

ESTRO

European Society
For Radiotherapy
& Oncology

Newsletter July - August 2019

Highlights of

#ESTRO
L38

BRACHYTHERAPY



Interview with Bradley Pieters,
chair of 7th GEC-ESTRO
workshop >>

PHYSICS















Interview with Núria Jornet,
chair of 3rd ESTRO physics
workshop >>

RTT



Philipp Scherer, chair of RTT
committee, discusses the RTT
workshop >>

CONTENTS

	Editorial	3
	Society life	5
	Read it before your patients	10
	Brachytherapy	29
	Physics	54
	RTT	72
	Radiobiology	93
	School	100
	Young ESTRO	112
	Health economics	136
	Conferences	140
	Calendar of events	176

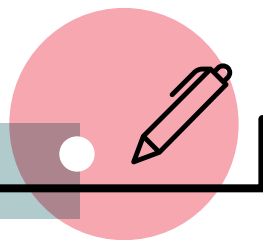
ESTRO

European Society
For Radiotherapy
& Oncology

Newsletter July - August 2019



EDITORIAL



“This is the right moment to keep an eye on the many more upcoming events.”

Dear friends and colleagues,

Time does fly! It is already two months since ESTRO 38. I am delighted to share with you the final attendance numbers for this year's annual meeting: it was our largest conference yet, with 6,633 participants.

ESTRO 38 also hosted a record number of exhibitors, both in terms of number of companies, 111, and number of square metres sold, 5,600 m². The figures are inclusive of the number of start-ups, which increased from eight in 2016 (the first year of the start-up corner) to 14 this year. The exhibition is an important part of the conference, both for the networking opportunities and for the updates on the latest technological developments from our partners in industry.

But ESTRO 38 was not only about numbers; it was also a qualitative success. I was very pleased to read the results of the evaluation survey, as a large majority of respondents rated the overall quality of the scientific sessions as very good. We realise that there is always room for improvement, but it was certainly motivating to



UMBERTO RICARDI

see that the ESTRO annual conference is fulfilling its role of being the main vehicle for dissemination of the best science available in our field.

ESTRO 38 saw national societies (NSs) come together at the annual meeting organised by the ESTRO national societies Committee (NSC). It was positively exciting to see how NSs took an active part in the programme for the day, presenting their views and experiences. During this annual meeting, the NSC presented the results of the survey that had been launched to investigate priorities for NSs. The NSC hopes the survey results can culminate in a publication presenting the main results and a roadmap for the four priority areas. This is a development to be watched as it will highlight the role of ESTRO together with the NSs in increasing awareness of radiation oncology.

We are now halfway through the year. This is the right moment to keep an eye on the many more upcoming events. There are the annual physics and GEC-ESTRO workshops, and registrations for these are already open. We are glad to announce that the RTTs have also launched a workshop this year. And it is also very nice to have the same city (Budapest) hosting these three different workshops. Also notable is the second 'ESTRO meets Asia' meeting in Singapore – a further opportunity to network and establish collaborations with professionals from this part of the world.

Finally, we also take this opportunity to thank all the Board members who completed their terms at ESTRO 38: Marianne Nordmark, Conchita Vens and Claudio Fiorino. We are grateful for the generosity in time and effort they dedicated to supporting the Society's activities during their assignment on the ESTRO Board. Their contribution and vision across the years was highly appreciated. We are confident that the Society can continue to rely on their active support in some other way. It is through the contributions of all its members that the Society can really become stronger.

This is all for now. I hope you enjoy the summer and a well-deserved break.

"Radiation Oncology. Optimal Health for All, Together"

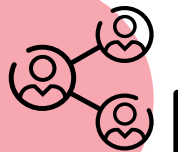


Umberto Ricardi
ESTRO President

Society life



Radiation Oncology.
Optimal Health **FOR ALL,**
Together.



“ESTRO signed a new memorandum of understanding (MoU) with the Brazilian Society of Radiotherapy (Sociedade Brasileira de Radioterapia).”

Welcome to the first newsletter after ESTRO 38 in Milan, Italy. I think we can all agree that it was a very successful and enjoyable meeting, and a privilege to have met and networked with colleagues and friends at both professional and social levels.

The congress is also an occasion at which members of the Society meet at the general assembly (GA) to hear about various activities at ESTRO, and to exercise our rights to vote on certain issues. In this Corner, we provide a brief report on what was discussed at the GA.

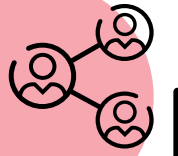
Finally, I am also delighted to announce that ESTRO signed a new memorandum of understanding (MoU) in Milan with the Brazilian Society of Radiotherapy (Sociedade Brasileira de Radioterapia). This is another demonstration of how ESTRO seeks to forge strategic links with radiation societies outside Europe. More information is available in this Corner.



Umberto Ricardi
ESTRO President



UMBERTO RICARDI




ESTRO general assembly



ESTRO General Assembly in session

The ESTRO General Assembly at ESTRO 38 on 29 April was well attended by ESTRO members.

ESTRO President, Umberto Ricardi, announced the results of the Board elections held in March, and thanked all candidates and Board members finishing their terms. For the clinician positions, Matthias Guckenberger was re-elected and Anna Kirby elected to start her first term. Núria Jornet is the new physicist representative, and Marc Vooijs is the new radiobiologist representative.

The President then went on to announce the names chosen by the Board and the Nominating Council to receive ESTRO Awards in 2020: Philip Poortmans for the Breur Award, and Michelle Leech for the Emmanuel van der Schueren Award. The Marie Curie Medal awarded every four years will go to Alvaro Martinez on the occasion of the World Brachytherapy Congress, which will be held back-to-back with ESTRO 39. Honorary members will be Paolo Casali, Rene Leemans, and Shyam K Shrivastava. The Lifetime 

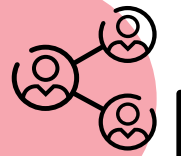
Achievement Awards will go to Jean-Marc Cosset, Wilfried De Neve, Roberto Orecchia and Pierre Scalliet.

The GA was also updated on ESTRO activities in 2018. The ESTRO treasurer, Dirk Verellen, presented the 2018 financial report. The GA approved the 2018 accounts and discharged the Board, executive management and external auditors for the daily administration of the Society in 2018. (Full details will be available in the minutes of the meeting.)

After this, the ESTRO President revealed to the GA the final participation statistics for ESTRO 38: a new record was broken with more than 6,600 participants registered for the event. The President also gave an update on the ongoing work of a governance task force; after the publication of the new ESTRO Vision for 2030 and a new Belgian code for associations that entered into force on 1 May 2019, the governance model of the Society will adapt to meet the new legal and strategic requirements.

Finally, Umberto Ricardi reminded all ESTRO members to save the date of next year's ESTRO annual congress, which will take place in Vienna, Austria, from 3-7 April 2020 (preceded by the World Brachytherapy Congress on 2-4 April 2020, also in Vienna).





MoU with Sociedad Brasileira de Radioterapia (SBRT)



SBRT President, Arthur A Rosa, and ESTRO President, Umberto Ricardi, shake hands after signing the MoU

ESTRO is happy to announce that the ESTRO President, Umberto Ricardi, signed a Memorandum of Understanding (MoU) with the SBRT President, Dr Arthur A Rosa. The MoU covers dual membership, scientific collaboration and the organisation of joint courses.

Read it before your patients

Too important to miss...
A digest of essential
reading for all radiation oncologists

BY PHILIPPE LAMBIN, DIRK DE RUYSSCHER AND HANS KAANDERS



PHILIPPE LAMBIN



DIRK DE RUYSSCHER



HANS KAANDERS



BREAST

Cancer outcomes in DCIS patients without locoregional treatment

Ryser MD, Weaver DL, Zhao F, Worni M, Grimm LJ, Gulati R, Etzioni R, Hyslop T, Lee SJ, Hwang ES.

J Natl Cancer Inst. 2019 Feb 13 [Epub ahead of print]

Background

The vast majority of women diagnosed with ductal carcinoma in situ (DCIS) undergo treatment. Therefore, the risks of invasive progression and competing death in the absence of locoregional therapy are uncertain.

Methods

We performed survival analyses of patient-level data from DCIS patients who did not receive definitive surgery or radiation therapy as recorded in the US National Cancer Institute's Surveillance, Epidemiology, and End Results programme (1992-2014). Kaplan-Meier curves were used to estimate the net risk of subsequent ipsilateral invasive cancer. The cumulative incidences of ipsilateral invasive cancer, contralateral breast cancer, and death were estimated using competing risk methods.

Results

A total of 1,286 DCIS patients who did not undergo locoregional therapy were identified. Median age at diagnosis was 60 years (inter-quartile range = 51-74 years), with median follow-up of 5.5 years (inter-quartile range = 2.3-10.6 years). Among patients with tumour grade I/II (n = 547), the ten-year net risk of ipsilateral invasive breast cancer was 12.2% (95% confidence interval [CI] = 8.6% to 17.1%) compared with 17.6% (95% CI = 12.1% to 25.2%) among patients with tumour grade III (n = 244) and 10.1% (95% CI = 7.4% to 13.8%) among patients with unknown grade (n = 495). Among all patients, the ten-year cumulative incidences of ipsilateral invasive

cancer, contralateral breast cancer, and all-cause mortality were 10.5% (95% CI = 8.5% to 12.4%), 3.9% (95% CI = 2.6% to 5.2%), and 24.1% (95% CI = 21.2% to 26.9%), respectively.

Conclusion

Despite limited data, our findings suggest that DCIS patients without locoregional treatment have a limited risk of invasive progression. Although the cohort is not representative of the general population of patients diagnosed with DCIS, the findings suggest that there may be overtreatment, especially among older patients and patients with elevated comorbidities.



BREAST

Effect of radiotherapy after breast-conserving surgery depending on the presence of tumour-infiltrating lymphocytes: a long-term follow-up of the SweBCG91RT randomised trial

Kovács A, Stenmark Tullberg A, Werner Rönnerman E, Holmberg E, Hartman L, Sjöström M, Lundstedt D, Malmström P, Fernö M, Karlsson P.

J Clin Oncol. 2019 Apr 2;JCO1802157. doi: 10.1200/JCO.18.02157. [Epub ahead of print]

Purpose

The effects of radiotherapy (RT) on the basis of the presence of stromal tumour infiltrating lymphocytes (TILs) have not been studied. The purpose of this study was to analyse the association of TILs with the effect of postoperative RT on ipsilateral breast tumour recurrence (IBTR) in a large randomised trial.

Methods

In the SweBCT91RT (Swedish Breast Cancer Group 91 Radiotherapy) trial, 1,178 patients with breast cancer stage I and II were randomly assigned to breast-conserving surgery plus postoperative RT or breast-conserving surgery only and followed for a median of 15.2 years. Tumour blocks were retrieved from 1,003 patients. Stromal TILs were assessed on whole-section hematoxylin-eosin-stained slides using a dichotomised cut-off of 10%. Subtypes were scored using immunohistochemistry on tissue microarray. In total, 936 patients were evaluated.

Results

Altogether, 670 (71%) of patients had TILs less than 10%. In a multivariable regression analysis with IBTR as dependent variable and RT, TILs, subtype, age, and grade as independent variables, RT (hazard ratio [HR], 0.42; 95% CI, 0.29 to 0.61; $P < .001$), high TILs (HR, 0.61; 95% CI, 0.39 to 0.96, $P = .033$) grade (3 v 1; HR, 2.17; 95% CI, 1.08 to 4.34; $P = .029$), and age (≥ 50 v < 50 years; HR, 0.55; 95% CI, 0.38 to 0.80; $P = .002$) were predictive of IBTR. RT was significantly beneficial in the low TILs group (HR, 0.37; 95%

CI, 0.24 to 0.58; $P < .001$), but not in the high TILs group (HR, 0.58; 95% CI, 0.28 to 1.19; $P = .138$). The test for interaction between RT and TILs was not statistically significant ($P = .317$).

Conclusion

This study shows that high values of TILs in the primary tumour independently seem to reduce the risk for an IBTR. Our findings further suggest that patients with breast cancer with low TILs may derive a larger benefit from RT regarding the risk of IBTR.



GYNAECOLOGIC

Phase III trial: adjuvant pelvic radiation therapy versus vaginal brachytherapy plus paclitaxel/carboplatin in high-intermediate and high-risk early stage endometrial cancer

Randall ME, Filiaci V, McMeekin DS, von Gruenigen V, Huang H, Yashar CM, Mannel RS, Kim JW, Salani R, DiSilvestro PA, Burke JJ, Rutherford T, Spirtos NM, Terada K, Anderson PR, Brewster WR, Small W, Aghajanian CA, Miller DS.

J Clin Oncol. 2019 Apr 17 [Epub ahead of print]

Purpose

The primary objective was to determine if vaginal cuff brachytherapy and chemotherapy (VCB/C) increases recurrence-free survival (RFS) compared with pelvic radiation therapy (RT) in high-intermediate and high-risk early-stage endometrial carcinoma.

Patients and methods

A randomised phase III trial was performed in eligible patients with endometrial cancer. Eligible patients had International Federation of Gynaecology and Obstetrics (2009) stage I endometrioid histology with Gynaecologic Oncology Group protocol 33-based high-intermediate-risk criteria, stage II disease, or stage I to II serous or clear cell tumours. Treatment was randomly assigned between RT (45 to 50.4 Gy over 5 weeks) or VCB followed by intravenous paclitaxel 175 mg/m² (3 hours) plus carboplatin (area under the curve, 6) every 21 days for three cycles.

Results

The median age of the 601 patients was 63 years, and 74% had stage I disease. Histologies included endometrioid (71%), serous (15%), and clear cell (5%). With a median follow-up of 53 months, the 60-month RFS was 0.76 (95% CI, 0.70 to 0.81) for RT and 0.76 (95% CI, 0.70 to 0.81) for VCB/C (hazard ratio, 0.92; 90% confidence limit, 0.69 to 1.23). The 60-month overall survival was 0.87 (95% CI, 0.83 to 0.91) for RT and 0.85 (95% CI, 0.81 to 0.90) for VCB/C (hazard ratio, 1.04; 90% confidence limit, 0.71 to 1.52). Vaginal and

distant recurrence rates were similar between arms. Pelvic or para-aortic nodal recurrences were more common with VCB/C (9% v 4%). There was no heterogeneity of treatment effect with respect to RFS or overall survival among clinical or pathologic variables evaluated.

Conclusion

Superiority of VCB/C compared with pelvic RT was not demonstrated. Acute toxicity was greater with VCB/C; late toxicity was similar. Pelvic RT alone remains an effective, well-tolerated, and appropriate adjuvant treatment in high-risk early-stage endometrial carcinomas of all histologies.



PROSTATE

Risk of subsequent primary cancers after carbon ion radiotherapy, photon radiotherapy, or surgery for localised prostate cancer: a propensity score-weighted, retrospective, cohort study

Mohamad O, Tabuchi T, Nitta Y, Nomoto A, Sato A, Kasuya G, Makishima H, Choy H, Yamada S, Morishima T, Tsuji H, Miyashiro I, Kamada T.

Lancet Oncol. 2019 Mar 15. pii: S1470-2045(18)30931-8. doi: 10.1016/S1470-2045(18)30931-8. [Epub ahead of print]

Background

The risk of subsequent primary cancers in patients with prostate cancer after treatment with photon radiotherapy is small in absolute numbers, but it is higher than that after surgical treatment. Carbon ion radiotherapy has a theoretically lower risk of inducing secondary malignancies than photon radiotherapy, but this risk has not been investigated in practice because of the low number of facilities offering such therapy worldwide and the limited data on long-term follow-up because the therapy have only been available since 1994. We aimed to analyse the risk of subsequent primary cancers after treatment with carbon ion radiotherapy in patients with localised prostate cancer and to compare it with that after photon radiotherapy or surgery in this setting.

Methods

In this retrospective cohort study, we reviewed records of patients who received carbon ion radiotherapy for prostate cancer between 27 June 1995 and 10 July 2012, at the National Institute of Radiological Sciences (NIRS) in Japan. We also retrieved the records of patients diagnosed and treated for prostate cancer between 1 January 1994 and 31 December 2012, from the Osaka Cancer Registry. Eligible patients had histologically confirmed localised prostate cancer and a minimum follow-up of at least three months; no age restrictions were applied. We excluded patients with metastasis, node-positive disease, or locally invasive (T4 stage) prostate cancer, those with previous

or synchronous malignancies, and those who received previous radiotherapy or chemotherapy. We did a multivariable analysis to estimate predictors of subsequent cancers after carbon ion radiotherapy treatment. We also used propensity score inverse probability weighting to retrospectively compare the incidence of subsequent cancers in patients with localised prostate cancer treated with carbon beams, photon radiotherapy, or surgery.

Findings

Of 1,580 patients who received carbon radiotherapy for prostate cancer at the NIRS, 1,455 (92%) patients met the eligibility criteria. Of 38,594 patients with prostate cancer identified in the Osaka registry, 1,983 (5%) patients treated with photon radiotherapy and 5,948 (15%) treated with surgery were included. Median follow-up durations were 7.9 years (IQR 5.9-10.0) for patients who received carbon ion radiotherapy (after limiting the database to ten-year maximum follow-up), 5.7 years (4.5-6.4) for patients who received photon radiotherapy, and six years (5.0-8.6) for those who received surgery. In total, 234 subsequent primary cancers were diagnosed in the carbon ion radiotherapy cohort; some patients developed several tumours. On multivariable analysis, age ($p=0.0021$ for 71-75 years vs ≤ 60 years; $p=0.012$ for >75 years vs ≤ 60 years) and smoking ($p=0.0005$) were associated with a higher risk of subsequent primary cancers in patients treated with carbon ion radiotherapy. In the propensity score-weighted analyses, carbon ion radiotherapy was associated \checkmark

with a lower risk of subsequent primary cancers than photon radiotherapy (hazard ratio [HR] 0.81 [95% CI 0.66-0.99]; p=0.038) or surgery (HR 0.80 [0.68-0.95]; p=0.0088), whereas photon radiotherapy was associated with a higher risk of subsequent primary cancers than surgery (HR 1.18 [1.02-1.36]; p=0.029).

Interpretation

Our analysis suggests that patients with localised prostate cancer treated with carbon ion radiotherapy appear to have a lower risk of subsequent primary cancers than those treated with photon radiotherapy. Although prospective evaluation with longer follow-up is warranted to support these results, our data support a wider adoption of carbon ion radiotherapy for patients with expected long-term overall survival or those with poor outcomes after receiving conventional treatments.





HEAD AND NECK

Association of oral human papillomavirus DNA persistence with cancer progression after primary treatment for oral cavity and oropharyngeal squamous cell carcinoma

Fakhry C, Blackford AL, Neuner G, Xiao W, Jiang B, Agrawal A, Gillison ML.

JAMA Oncol. 2019 May 2 [Epub ahead of print]

Importance

Detection of persistent oral human papillomavirus (HPV) DNA may be associated with recurrence of HPV-positive head and neck squamous cell carcinoma (HNSCC).

Objective

To evaluate the dynamics of oral HPV DNA detection and associations with disease outcomes in patients with HPV-positive and HPV-negative HNSCC.

Design, setting and participants

This prospective, two-institution, tertiary referral centre study of 396 patients with newly diagnosed oral cavity or oropharyngeal HNSCC was performed from 11 July 2011 to 7 May 2016. Oral rinse samples were prospectively collected at diagnosis and at completion of primary therapy. Weekly oral rinse samples were collected during radiotherapy. Purified tumour and oral rinse sample DNA were evaluated for 37 HPV types, and viral load was quantified by type-specific real-time polymerase chain reaction. Cancers were stratified by tumour HPV status, and HPV was classified as tumour type if identical to that detected in the tumour or non-tumour type.

Main outcomes and measures

Prevalence of HPV DNA before, during, and after therapy. Associations between tumour-type and non-tumour-type oral HPV DNA detection and recurrence-free and overall survival were evaluated.

Results

Of the 396 patients (median age, 59 years [range, 19-96 years]; 295 [74.5%] men; and 354 [89.4%] white race/ethnicity), 217 had oropharyngeal cancer; 170, oral cavity cancer; and 9, unknown primary HNSCC. The prevalence of oral HPV detection at diagnosis was higher among patients with HPV-positive compared with HPV-negative HNSCC (24 of 194 [84.2%] vs 170 of 202 [12.4%]; $P < .001$). Oral HPV-16 DNA had an 81% sensitivity and 100% specificity for HPV-16-positive HNSCC. The prevalence and load of tumour-type HPV decreased significantly during primary therapy with odds ratio for probability of infection with each increasing month after diagnosis (0.41; 95% CI, 0.33-0.52; $P < .001$), whereas those of non-tumour types did not (1.01; 95% CI, 0.97-1.06; $P = .62$). Current smoking was significantly associated with a reduced clearance of tumour-type HPV DNA (hazard ratio [HR], 0.54; 95% CI, 0.32-0.93). Two-year overall survival was significantly lower among the HPV-positive patients with persistent detection of tumour-type HPV after therapy than among those without detectable tumour-type DNA after therapy (68% vs 95%; adjusted HR, 6.61; 95% CI, 1.86-23.44; $P = .003$), as was recurrence-free survival (55% vs 88%; adjusted HR, 3.72; 95% CI, 1.71-8.09; $P < .001$). No associations were observed for non-tumour type HPV DNA among patients with HPV-positive or HPV-negative HNSCC.

Conclusions and relevance

Prevalence and viral load of tumour-type HPV DNA decreased rapidly with therapy, and persistent

detection was associated with increased risk of recurrence and death. Analysis of tumour type HPV DNA has considerable promise as a biomarker for treatment response and risk of progression.





RECTAL

Assessment of a watch-and-wait strategy for rectal cancer in patients with a complete response after neoadjuvant therapy

Smith JJ, Strombom P, Chow OS, Roxburgh CS, Lynn P, Eaton A, Widmar M, Ganesh K, Yaeger R, Cercek A, Weiser MR, Nash GM, Guillem JG, Temple LKF, Chalasani SB, Fuqua JL, Petkovska I, Wu AJ, Reyngold M, Vakiani E, Shia J, Segal NH, Smith JD, Crane C, Gollub MJ, Gonen M, Saltz LB, Garcia-Aguilar J, Paty PB.

JAMA Oncol. 2019 Jan 10 [Epub ahead of print]

Importance

The watch-and-wait (WW) strategy aims to spare patients with rectal cancer unnecessary resection.

Objective

To analyse the outcomes of WW among patients with rectal cancer who had a clinical complete response to neoadjuvant therapy.

Design, setting, and participants

This retrospective case series analysis conducted at a comprehensive cancer centre in New York included patients who received a diagnosis of rectal adenocarcinoma between 1 January 2006 and 31 January 2015. The median follow-up was 43 months. Data analyses were conducted from 1 June 2016 to 1 October 2018.

Exposures

Patients had a clinical complete response after completing neoadjuvant therapy and agreed to a WW strategy of active surveillance and possible salvage surgery (n = 113), or patients underwent total mesorectal excision and were found to have a pathologic complete response (pCR) at resection (n = 136).

Main outcomes and measures

Kaplan-Meier estimates were used for analyses of local regrowth and five-year rates of overall survival, disease-free survival, and disease-specific survival.

Results

Compared with the 136 patients in the pCR group, the 113 patients in the WW group were

older (median [range], 67.2 [32.1-90.9] vs 57.3 [25.0-87.9] years, $P < .001$) with cancers closer to the anal verge (median [range] height from anal verge, 5.5 [0.0-15.0] vs 7.0 [0.0-13.0] cm). All 22 local regrowths in the WW group were detected on routine surveillance and treated by salvage surgery (20 total mesorectal excisions plus 2 transanal excisions). Pelvic control after salvage surgery was maintained in 20 of 22 patients (91%). No pelvic recurrences occurred in the pCR group. Rectal preservation was achieved in 93 of 113 patients (82%) in the WW group (91 patients with no local regrowths plus two patients with local regrowths salvaged with transanal excision). At five years, overall survival was 73% (95% CI, 60%-89%) in the WW group and 94% (95% CI, 90%-99%) in the pCR group; disease-free survival was 75% (95% CI, 62%-90%) in the WW group and 92% (95% CI, 87%-98%) in the pCR group; and disease-specific survival was 90% (95% CI, 81%-99%) in the WW group and 98% (95% CI, 95%-100%) in the pCR group. A higher rate of distant metastasis was observed among patients in the WW group who had local regrowth versus those who did not have local regrowth (36% vs 1%, $P < .001$).

Conclusions and relevance

A WW strategy for select rectal cancer patients who had a clinical complete response after neoadjuvant therapy resulted in excellent rectal preservation and pelvic tumour control; however, in the WW group, worse survival was noted along with a higher incidence of distant progression in patients with local regrowth versus those without local regrowth.



LUNG

Safety and efficacy of a five-fraction stereotactic body radiotherapy schedule for centrally located non-small-cell lung cancer: NRG Oncology/RTOG 0813 Trial

Bezjak A, Paulus R, Gaspar LE, Timmerman RD, Straube WL, Ryan WF, Garces YI, Pu AT, Singh AK, Videtic GM, McGarry RC, Iyengar P, Pantarotto JR, Urbanic JJ, Sun AY, Daly ME, Grills IS, Sperduto P, Normolle DP, Bradley JD, Choy H.

J Clin Oncol. 2019 Apr 3;JCO1800622. doi: 10.1200/JCO.18.00622. [Epub ahead of print]

Purpose

Patients with centrally located early-stage non-small-cell lung cancer (NSCLC) are at a higher risk of toxicity from high-dose ablative radiotherapy. NRG Oncology/RTOG 0813 was a phase I/II study designed to determine the maximum tolerated dose (MTD), efficacy, and toxicity of stereotactic body radiotherapy (SBRT) for centrally located NSCLC.

Materials and methods

Medically inoperable patients with biopsy-proven, positron emission tomography-staged T1 to 2 (≤ 5 cm) N0M0 centrally located NSCLC were accrued into a dose-escalating, five-fraction SBRT schedule that ranged from 10 to 12 Gy/fraction (fx) delivered over 1.5 to 2 weeks. Dose-limiting toxicity (DLT) was defined as any treatment-related grade 3 or worse predefined toxicity that occurred within the first year. MTD was defined as the SBRT dose at which the probability of DLT was closest to 20% without exceeding it.

Results

In total, 120 patients were accrued between February 2009 and September 2013. Patients were elderly, there were slightly more females, and the majority had a performance status of 0 to 1. Most cancers were T1 (65%) and squamous cell (45%). Organs closest to planning target volume/most at risk were the main bronchus and large vessels. Median follow-up was 37.9 months. Five patients experienced DLTs; MTD was 12.0 Gy/fx, which had a probability of a DLT

of 7.2% (95% CI, 2.8% to 14.5%). Two-year rates for the 71 evaluable patients in the 11.5 and 12.0 Gy/fx cohorts were local control, 89.4% (90% CI, 81.6% to 97.4%) and 87.9% (90% CI, 78.8% to 97.0%); overall survival, 67.9% (95% CI, 50.4% to 80.3%) and 72.7% (95% CI, 54.1% to 84.8%); and progression-free survival, 52.2% (95% CI, 35.3% to 66.6%) and 54.5% (95% CI, 36.3% to 69.6%), respectively.

Conclusion

The MTD for this study was 12.0 Gy/fx; it was associated with 7.2% DLTs and high rates of tumour control. Outcomes in this medically inoperable group of mostly elderly patients with comorbidities were comparable with that of patients with peripheral early-stage tumours.



Bezjak A *et al.* Safety and efficacy of a five fraction SBRT schedule for centrally located NSCLC: NRG oncology / RTOG 0813 trial



URSULA NESTLE

Comment

RTOG 0813 is one of several prospective trials currently addressing stereotactic body radiation therapy (SBRT) for central non-small cell lung cancer (NSCLC) locations. Due to the fear of high toxicity, for example, fatal bleedings and bronchial strictures as published by the Timmerman group in 2006 [1], many colleagues are still reluctant to offer this treatment. So the question is, can we safely do so?

Within the first year, RTOG 0813 patients had 7.2% dose-limiting toxicities after a five-fraction SBRT with up to 12 Gy/fx. This trial included patients not only with tumours neighbouring the central bronchial tree, but also near to other parts of the mediastinum. In relation to events after one-year follow up, so far, four cases of grade 5 toxicities have been reported, mainly bronchopulmonary haemorrhages. In the Nordic Hilus trial on SBRT (56 Gy/8fx) of lung tumours which were all touching or neighbouring the central bronchi (so far published as an abstract only) 21/74 pts with grade 3 or higher toxicity were observed [2]. The European Organisation for Research and Treatment of Cancer (EORTC) Lungtech trial applying 60 Gy/8 fx to central tumours defined

in analogy to RTOG 0813, experienced two toxic deaths among the first 35 patients. This fact impaired recruitment so that the trial was closed prematurely [3].

Tumour location is an important predictor of toxicity. So far, despite the slowly growing body of prospective data, we have no clear view on tolerance doses for the critical group of serial organs in the central mediastinum. Unfortunately, even without high-grade normal-tissue damage, central tumours may cause defects in large bronchi or vessels close by (SBRT-related) tumour necrosis or complete remission. In other words: SBRT may be a knife, but it does not provide a suture.

On the other hand, these patients are medically inoperable and radiotherapy may provide their only chance of a cure. From this perspective, a 7-10% risk of severe complications does not appear too high. Without treatment, fatal bleedings can also result from locally progressive tumours and uncontrolled NSCLC, which would soon kill the patients through nodal and distant spread.

What should we do? First, the evaluation of treatment alternatives (including fractionated ✓

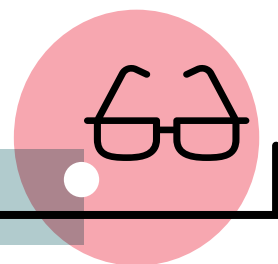
radiotherapy and systemic treatment) and thorough counselling is mandatory. After eventual SBRT for a central tumour, bronchoscopic and bioptic interventions should be kept to the absolute minimum. Second, due to the time course of radiation late effects, this question may not be solved by prospective clinical trials, but rather by registries collecting long-term follow-up data. The radiotherapy community should invest time and effort to feed these registries in order to get more solid insight on this topic.



Ursula Nestle
Department of Radiation Oncology
Kliniken Maria Hilf GmbH
Mönchengladbach, Germany

REFERENCES

1. Excessive toxicity when treating central tumours in a phase II study of stereotactic body radiation therapy for medically inoperable early-stage lung cancer. Timmerman R, McGarry R, Yiannoutsos C, Papiez L, Tudor K, DeLuca J, Ewing M, Abdulrahman R, DesRosiers C, Williams M, Fletcher J. *J Clin Oncol*. 2006 Oct 20;24(30): 4833-9.
2. The Nordic Hilus trial – first report of a phase II trial of centrally located lung tumours. Lindberg, K., Bergström, P., Brustugun, O., Engelholm, S., Grozman, V., Hoyer, M., Karlsson, K., Khalil, A., Kristiansen, C., Lax, I., Löden, B., Nyman, J., Persson, G., Rogg, L., Wersäll, P., Lewensohn, R. *JTO* 12, 2017, OA24.05 doi: <https://doi.org/10.1016/j.jtho.2016.11.369>
3. EORTC 221113-08113 Lungtech trial on SBRT of central lung tumours. Adebahr, S., Liu, Y, Colette, S., Faivre-Finn, C., Ahmad, S., Ahmed, M., Belderbos, J., Andratschke, N., Franks, K., Geets, X., Guckenberger, M., Konopa, C., Lambrecht, M., Lewitzki, V., Lievens, Y., Pourel, N., De Ruysscher, D., Dzsdiusko, R., Fortpied, C., McDonald, F., Peulen, H., Grosu, A., Hurkmans, C., LePechoux, C., Nestle, U. *Radiotherapy and Oncology*, V 133 (Suppl 1) 2019, P 524; OC0061



PAEDIATRIC

Management of vertebral radiotherapy dose in paediatric patients with cancer: consensus recommendations from the SIOPE radiotherapy working group

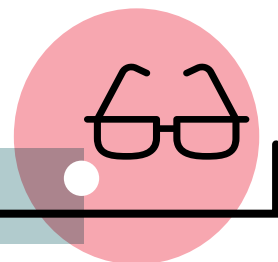
Hoeben BA, Carrie C, Timmermann B, Mandeville HC, Gandola L, Dieckmann K, Ramos Albiac M, Magelssen H, Lassen-Ramshad Y, Ondrová B, Ajithkumar T, Alapetite C, Balgobind BV, Bolle S, Cameron AL, Davila Fajardo R, Dietzsch S, Dumont Lecomte D, van den Heuvel-Eibrink MM, Kortmann RD, Laprie A, Melchior P, Padovani L, Rombi B, Scarzello G, Schwarz R, Seiersen K, Seravalli E, Thorp N, Whitfield GA, Boterberg T, Janssens GO.

Lancet Oncol. 2019 Mar;20(3):e155-e166. doi: 10.1016/S1470-2045(19)30034-8. Review.

Summary

Inhomogeneities in radiotherapy dose distributions covering the vertebrae in children can produce long-term spinal problems, including kyphosis, lordosis, scoliosis and hypoplasia. In the published literature, many often interrelated variables have been reported to affect the extent of potential radiotherapy damage to the spine. Articles published in the 2D and 3D radiotherapy-era instructed radiation oncologists to avoid dose inhomogeneity over growing vertebrae. However, in the present era of highly conformal radiotherapy, steep dose gradients over at-risk structures can be generated and thus less harm is caused to patients. In this report, paediatric radiation oncologists from leading centres in 11 European countries have produced recommendations on how to approach dose coverage for target volumes that are adjacent to vertebrae to minimise the risk of long-term spinal problems. Based on available information, it is advised that homogeneous vertebral radiotherapy doses should be delivered in children who have not yet finished the pubertal growth spurt. If dose fall-off within vertebrae cannot be avoided, acceptable dose gradients for different age groups are detailed here. Vertebral delineation should include all primary ossification centres and growth plates, and therefore include at least the vertebral body and arch. For partial spinal radiotherapy, the number of irradiated vertebrae should be restricted as much as achievable, particularly at the thoracic level in young children (less than six years old). There is a need for multicentre research on vertebral

radiotherapy dose distributions for children, but until more valid data become available, these recommendations can provide a basis for daily practice for radiation oncologists who have patients that require vertebral radiotherapy.



PALLIATION

Single-fraction stereotactic versus conventional multi-fraction radiotherapy for pain relief in patients with predominantly non-spine bone metastases: a randomised phase 2 trial

Nguyen QN, Chun SG, Chow E, Komaki R, Liao Z, Zacharia R, Szeto BK, Welsh JW, Hahn SM, Fuller CD, Moon BS, Bird JE, Satcher R, Lin PP, Jeter M, O'Reilly MS, Lewis VO.

JAMA Oncol. 2019 Apr 25. doi: 10.1001/jamaoncol.2019.0192. [Epub ahead of print]

Importance

Consensus is lacking as to the optimal radiotherapy dose and fractionation schedule for treating bone metastases.

Objective

To assess the relative efficacy of high-dose, single-fraction stereotactic body radiotherapy (SBRT) versus standard multi-fraction radiotherapy (MFRT) for alleviation of pain in patients with mostly non-spine bone metastases.

Design, setting, and participants

This prospective, randomised, single-institution phase 2 non-inferiority trial conducted at a tertiary cancer care centre enrolled 160 patients with radiologically confirmed painful bone metastases from 19 September 2014 through to 19 June 2018. Patients were randomly assigned in a 1:1 ratio to receive either single-fraction SBRT (12 Gy for ≥ 4 -cm lesions or 16 Gy for < 4 -cm lesions) or MFRT to 30 Gy in ten fractions.

Main outcomes and measures

The primary end point was pain response, defined by international consensus criteria as a combination of pain score and analgesic use (daily morphine-equivalent dose). Pain failure (i.e. lack of response) was defined as worsening pain score (≥ 2 points on a 0-to-10 scale), an increase in morphine-equivalent opioid dose of 50% or more, reirradiation, or pathologic fracture. We hypothesised that SBRT was non-inferior to MFRT.

Results

In this phase 2 non-inferiority trial of 96 men and 64 women (mean [SD] age, 62.4 [10.4] years), 81 patients received SBRT and 79 received MFRT. Among evaluable patients who received treatment per protocol, the single-fraction group had more pain responders than the MFRT group (complete response + partial response) at two weeks (34 of 55 [62%] vs 19 of 52 [36%]) ($P = .01$), three months (31 of 43 [72%] vs 17 of 35 [49%]) ($P = .03$), and nine months (17 of 22 [77%] vs 12 of 26 [46%]) ($P = .03$). No differences were found in treatment-related toxic effects or quality-of-life scores after SBRT versus MFRT; local control rates at one and two years were higher in patients receiving single-fraction SBRT.

Conclusions and relevance

Delivering high-dose, single-fraction SBRT seems to be an effective treatment option for patients with painful bone metastases. Among evaluable patients, SBRT had higher rates of pain response (complete response + partial response) than did MFRT and thus should be considered for patients expected to have relatively long survival.



SUPPORTIVE CARE

Effect of doxepin mouthwash or diphenhydramine-lidocaine-antacid mouthwash versus placebo on radiotherapy-related oral mucositis pain: the Alliance A221304 randomised clinical trial

Sio TT, Le-Rademacher JG, Leenstra JL, Loprinzi CL, Rine G, Curtis A, Singh AK, Martenson JA Jr, Novotny PJ, Tan AD, Qin R, Ko SJ, Reiter PL, Miller RC.

JAMA. 2019 Apr 16;321(15):1481-1490. doi: 10.1001/jama.2019.3504.

Importance

Oral mucositis causes substantial morbidity during head and neck radiotherapy. In a randomised study, doxepin mouthwash was shown to reduce oral mucositis-related pain. A common mouthwash comprising diphenhydramine-lidocaine-antacid is also widely used.

Objective

To evaluate the effect of doxepin mouthwash or diphenhydramine-lidocaine-antacid mouthwash for the treatment of oral mucositis-related pain.

Design, setting, and participants

A phase 3 randomised trial was conducted from 1 November 2014 to 16 May 2016, at 30 US institutions and included 275 patients who underwent definitive head and neck radiotherapy, had an oral mucositis pain score of 4 points or greater (scale, 0-10), and were followed up for a maximum of 28 days.

Interventions

In total, 92 patients were randomised to doxepin mouthwash (25 mg/5 mL water); 91 patients to diphenhydramine-lidocaine-antacid; and 92 patients to placebo.

Main outcome and measures

The primary end point was total oral mucositis pain reduction (defined by the area under the curve and adjusted for baseline pain score) during the four hours after a single dose of doxepin mouthwash or diphenhydramine-

lidocaine-antacid mouthwash compared with a single dose of placebo. The minimal clinically important difference was a 3.5-point change. The secondary end points included drowsiness, unpleasant taste, and stinging or burning. All scales ranged from 0 (best) to 10 (worst).

Results

Among the 275 patients randomised (median age, 61 years; 58 [21%] women), 227 (83%) completed treatment per protocol. Mucositis pain during the first four hours decreased by 11.6 points in the doxepin mouthwash group, by 11.7 points in the diphenhydramine-lidocaine-antacid mouthwash group, and by 8.7 points in the placebo group. The between-group difference was 2.9 points (95% CI, 0.2-6.0; $P = .02$) for doxepin mouthwash versus placebo and 3.0 points (95% CI, 0.1-5.9; $P = .004$) for diphenhydramine-lidocaine-antacid mouthwash versus placebo. More drowsiness was reported with doxepin mouthwash versus placebo (by 1.5 points [95% CI, 0-4.0]; $P = .03$), unpleasant taste (by 1.5 points [95% CI, 0-3.0]; $P = .002$), and stinging or burning (by 4.0 points [95% CI, 2.5-5.0]; $P < .001$). Maximum grade 3 adverse events for the doxepin mouthwash occurred in three patients (4%); diphenhydramine-lidocaine-antacid mouthwash, three (4%); and placebo, two (2%). Fatigue was reported by five patients (6%) in the doxepin mouthwash group and no patients in the diphenhydramine-lidocaine-antacid mouthwash group. ✕

Conclusions and relevance

Among patients undergoing head and neck radiotherapy, the use of doxepin mouthwash or diphenhydramine-lidocaine-antacid mouthwash versus placebo significantly reduced oral mucositis pain during the first four hours after administration; however, the effect size was less than the minimal clinically important difference. Further research is needed to assess longer-term efficacy and safety for both mouthwashes.





OLIGOMETASTASES

Stereotactic ablative radiotherapy versus standard of care palliative treatment in patients with oligometastatic cancers (SABR-COMET): a randomised, phase 2, open-label trial

Palma DA, Olson R, Harrow S, Gaede S, Louie AV, Haasbeek C, Mulroy L, Lock M, Rodrigues GB, Yaremko BP, Schellenberg D, Ahmad B, Griffioen G, Senthil S, Swaminath A, Kopec N, Liu M, Moore K, Currie S, Bauman GS, Warner A, Senan S.

Lancet. 2019 Apr 10. pii: S0140-6736(18)32487-5. doi: 10.1016/S0140-6736(18)32487-5. [Epub ahead of print]

Background

The oligometastatic paradigm suggests that some patients with a limited number of metastases might be cured if all lesions are eradicated. Evidence from randomised controlled trials to support this paradigm is scarce. We aimed to assess the effect of stereotactic ablative radiotherapy (SABR) on survival, oncological outcomes, toxicity, and quality of life in patients with a controlled primary tumour and one to five oligometastatic lesions.

Methods

This randomised, open-label phase 2 study was done at ten hospitals in Canada, The Netherlands, Scotland and Australia. Patients aged 18 or older with a controlled primary tumour and one to five metastatic lesions, Eastern Cooperative Oncology Group score of 0-1, and a life expectancy of at least six months were eligible. After stratifying by the number of metastases (1-3 vs 4-5), we randomly assigned patients (12) to receive either palliative standard of care treatments alone (control group), or standard of care plus SABR to all metastatic lesions (SABR group), using a computer-generated randomisation list with permuted blocks of nine. Neither patients nor physicians were masked to treatment allocation. The primary endpoint was overall survival. We used a randomised phase 2 screening design with a two-sided α of 0.20 (wherein $p < 0.20$ designates a positive trial). All analyses were intention to treat. This study is registered with ClinicalTrials.gov, number NCT01446744.

Findings

In total, 99 patients were randomised between 10 February 2012 and 30 August 2016. Of these 99 patients, 33 (33%) were assigned to the control group and 66 (67%) to the SABR group. Two (3%) patients in the SABR group did not receive allocated treatment and withdrew from the trial; two (6%) patients in the control group also withdrew from the trial. Median follow-up was 25 months (IQR 19-54) in the control group versus 26 months (23-37) in the SABR group. Median overall survival was 28 months (95% CI 19-33) in the control group versus 41 months (26-not reached) in the SABR group (hazard ratio 0.57, 95% CI 0.30-1.10; $p=0.090$). Adverse events of grade 2 or worse occurred in three (9%) of 33 controls and 19 (29%) of 66 patients in the SABR group ($p=0.026$), an absolute increase of 20% (95% CI 5-34). Treatment-related deaths occurred in three (4.5%) of 66 patients after SABR, compared with none in the control group.

Interpretation

SABR was associated with an improvement in overall survival, meeting the primary endpoint of this trial, but three (4.5%) of 66 patients in the SABR group had treatment-related death. Phase 3 trials are needed to conclusively show an overall survival benefit, and to determine the maximum number of metastatic lesions wherein SABR provides a benefit.



BILIARY TRACT

Capecitabine compared with observation in resected biliary tract cancer (BILCAP): a randomised, controlled, multicentre, phase 3 study

Primrose JN, Fox RP, Palmer DH, Malik HZ, Prasad R, Mirza D, Anthony A, Corrie P, Falk S, Finch-Jones M, Wasan H, Ross P, Wall L, Wadsley J, Evans JTR, Stocken D, Praseedom R, Ma YT, Davidson B, Neoptolemos JP, Iveson T, Raftery J, Zhu S, Cunningham D, Garden OJ, Stubbs C, Valle JW, Bridgewater J; BILCAP study group.

Lancet Oncol. 2019 Mar 25. pii: S1470-2045(18)30915-X. doi: 10.1016/S1470-2045(18)30915-X. [Epub ahead of print]

Background

Despite improvements in multidisciplinary management, patients with biliary tract cancer have a poor outcome. Only 20% of patients are eligible for surgical resection with curative intent, with five-year overall survival of less than 10% for all patients. To our knowledge, no studies have described a benefit of adjuvant therapy. We aimed to determine whether adjuvant capecitabine improved overall survival compared with observation following surgery for biliary tract cancer.

Methods

This randomised, controlled, multicentre, phase 3 study was done across 44 specialist hepatopancreatobiliary centres in the UK. Eligible patients were aged 18 years or older and had histologically confirmed cholangiocarcinoma or muscle-invasive gallbladder cancer who had undergone a macroscopically complete resection (which includes liver resection, pancreatic resection, or, less commonly, both) with curative intent, and an Eastern Cooperative Oncology Group performance status of less than 2. Patients who had not completely recovered from previous surgery or who had previous chemotherapy or radiotherapy for biliary tract cancer were also excluded. Patients were randomly assigned 1:1 to receive oral capecitabine (1,250 mg/m² twice daily on days 1–14 of a 21-day cycle, for eight cycles) or observation commencing within 16 weeks of surgery. Treatment was not masked, and allocation concealment was achieved with a computerised minimisation algorithm that

stratified patients by surgical centre, site of disease, resection status and performance status. The primary outcome was overall survival. As prespecified, analyses were done by intention to treat and per protocol. This study is registered with EudraCT, number 2005-003318-13.

Findings

Between 15 March 2006 and 4 December 2014, 447 patients were enrolled; 223 patients with biliary tract cancer resected with curative intent were randomly assigned to the capecitabine group and 224 to the observation group. The data cut-off for this analysis was 6 March 2017. The median follow-up for all patients was 60 months (IQR 37–60). In the intention-to-treat analysis, median overall survival was 51.1 months (95% CI 34.6–59.1) in the capecitabine group compared with 36.4 months (29.7–44.5) in the observation group (adjusted hazard ratio [HR] 0.81, 95% CI 0.63–1.04; p=0.097). In a protocol-specified sensitivity analysis, adjusting for minimisation factors and nodal status, grade, and gender, the overall survival HR was 0.71 (95% CI 0.55–0.92; p=0.010). In the prespecified per-protocol analysis (210 patients in the capecitabine group and 220 in the observation group), median overall survival was 53 months (95% CI 40 to not reached) in the capecitabine group and 36 months (30–44) in the observation group (adjusted HR 0.75, 95% CI 0.58–0.97; p=0.028). In the intention-to-treat analysis, median recurrence-free survival was 24.4 months (95% CI 18.6–35.9) in the capecitabine group and 17.5 months (12.0–23.8) in the observation group. ✕

In the per-protocol analysis, median recurrence-free survival was 25.9 months (95% CI 19.8–46.3) in the capecitabine group and 17.4 months (12.0–23.7) in the observation group. Adverse events were measured in the capecitabine group only, and of the 213 patients who received at least one cycle, 94 (44%) had at least one grade 3 toxicity, the most frequent of which were hand-foot syndrome in 43 (20%) patients, diarrhoea in 16 (8%) patients, and fatigue in 16 (8%) patients. One (<1%) patient had grade 4 cardiac ischaemia or infarction. Serious adverse events were observed in 47 (21%) of 223 patients in the capecitabine group and 22 (10%) of 224 patients in the observation group. No deaths were deemed to be treatment related.

Interpretation

Although this study did not meet its primary endpoint of improving overall survival in the intention-to-treat population, the prespecified sensitivity and per-protocol analyses suggest that capecitabine can improve overall survival in patients with resected biliary tract cancer when used as adjuvant chemotherapy following surgery and could be considered as standard of care. Furthermore, the safety profile is manageable, supporting the use of capecitabine in this setting.



Brachytherapy





In this Corner we draw your “attention to the coming 7th GEC-ESTRO workshop in Budapest. The theme is Adopt, Adapt, Advance.”

Welcome to the Brachytherapy Corner.

In this Corner we draw your attention to the coming 7th GEC-ESTRO workshop in Budapest. The theme is ‘Adopt, Adapt, Advance’. Bradley Pieters, GEC-ESTRO chair, tells us about the workshop and what you can expect.

We also include a report of the brachytherapy presentations at ESTRO 38. At the conference, brachytherapy was well represented in its own brachytherapy track, as well as in the interdisciplinary track. Several papers in the field of breast, gynaecology, prostate, and physics are summarised here for you.

Finally, the Corner concludes with the ‘Editors’ pick’ and an interview with Martin King on a publication comparing overall survival outcomes of low- and high-dose rate brachytherapy for unfavourable-risk prostate cancer.

We hope you enjoy this edition.



Peter Hoskin, Bradley Pieters, Åsa Carlsson Tedgren



PETER HOSKIN



BRADLEY PIETERS



ÅSA CARLSSON
TEDGREN



Interview with Bradley Pieters, chair of 7th Groupe Européen de Curiethérapie (GEC)-ESTRO GEC-ESTRO workshop

21-22 November 2019
Budapest, Hungary



BRADLEY PIETERS



21-22 November 2019
Budapest, Hungary

Adopt, Adapt, Advance

This year is the seventh annual GEC-ESTRO workshop. How do you feel about this?

I'm very proud that this is the seventh edition. It shows that the workshop is very highly valued by participants. In fact, every year about 90%, say they would like to attend again. Also, because of the workshop's success, other ESTRO committees, including physics and radiation therapy (RTT), are organising their own workshops.

Do you see tangible outcomes from the annual workshop?

An important aspect of the workshop, apart from the presentations, is networking. We usually see people during the workshop getting in contact with each other to discuss new ideas and starting to collaborate.

What is this year's theme and why did you choose it?

This year's theme is 'Adopt, Adapt, Advance'.

This theme emphasises the practical aspects of our work and fits with the workshop's spirit. There are new developments constantly being adopted by departments, and these need to be adapted to the local context. Ultimately, this leads to advances in our work practices and the quality of the treatment we offer.

How is the programme for the workshop developed?

Each year the GEC-ESTRO committee is responsible for the programme. Several discussions take place about the format and topics for the workshop. When an outline of the workshop has been developed, the working groups take it forward, proposing specific topics for the different sessions.

Is industry involved in the programme?

Industry is certainly involved in the programme, in terms of sponsoring it and exhibiting their products. This year, we have also introduced a session for companies to present their products. ✓

Who is the workshop's target audience?

The target audience is everyone with an interest in brachytherapy. Of course, we usually see radiation oncologists, physicists and technologists at the workshop, but other disciplines are very welcome. We would like to hear their views on brachytherapy.

For more information, visit:
www.estro.org/Workshops/2019/GEC-ESTRO/7th-GEC-ESTRO-Workshop

How would you advise a first-time participant to make the most of the workshop in Budapest?

As I said, everyone interested in brachytherapy can join. This year's programme features several parallel sessions and you can move between sessions. I would advise having a closer look at the final programme in advance to decide which sessions to attend. Because the sessions are repeated, it should be possible to attend the majority of topics.

Any final remarks?

I hope this year's edition will satisfy everyone again. I look forward to seeing many friends in the beautiful city of Budapest.



Bradley Pieters
Chair, 7th GEC-ESTRO Workshop





REPORTS FROM THE BRACHYTHERAPY TRACK AT ESTRO 38

Adam Chichel - Breast brachytherapy >>

Monica Serban - Gynaecological brachytherapy >>

Marieke van Son, Max Peters - Prostate-based brachytherapy >>

Georgina Fröhlich - Brachytherapy physics >>



Breast brachytherapy

ESTRO 38 had plenty on offer for those interested in breast brachytherapy. This year the main recurring themes were accelerated partial breast irradiation (APBI) and therapeutic techniques for conserving the second breast in ipsilateral breast cancer recurrences following previous irradiation.

The Sunday morning 'early bird' session started with a perfectly prepared teaching lecture on 'Re-irradiation for breast cancer' from Philip Poortmans¹, Paris, France. The lecture focused on a series of different clinical breast cancer scenarios. Among these there was a place for carefully selected patients that may be salvaged with second breast conserving therapy, even following earlier radiation. Most experience in this area is to be found in interstitial brachytherapy, which appears to be a safe and effective option for solitary ≤ 3 cm unifocal in-breast recurrences.

After this, there was a symposium on re-irradiation, which contained a comprehensive lecture from Christina Gutiérrez, Barcelona, Spain, on 'Brachytherapy in the re-irradiation situation – what are the benefits and limitations compared to modern external beam radiotherapy (EBRT)?'. Christina provided a summary of indications for re-irradiation with brachytherapy and of published results. She also presented her own experience

from ICO Barcelona, Spain². In her conclusion, Christina argued that second conservative treatment with second tumourectomy, followed by brachytherapy is feasible. The second local relapse and overall survival rates are similar to those of mastectomy and the cosmetic results are fair, but not excellent.

This year four of six abstracts selected for oral presentations investigated APBI in different settings. Jean-Michel Hannoun-Levi, Nice, France, presented the Groupe Européen de Curiethérapie (GEC)-ESTRO breast cancer working group's updated results on second conservative treatment for a second breast tumour event³. In total, 331 patients from 12 hospitals in seven countries underwent second conservative treatment between 2000-2014. After salvage lumpectomy APBI (reirradiation) was performed using either low- (30-55 Gy) or high-dose-rate brachytherapy (28-34 Gy). After a median follow-up of 72 months, six-year third ipsilateral breast tumour event (IBTE) free survival, regional, metastasis, specific and overall free survival were 92.9%, 96.4%, 87.4%, 90.1%, and 85.8% respectively. In terms of late toxicity, 194 patients (87%) had a G1-2 complications rate, while the G3 complication rate was 13%. It should be noted that patients assigned to low-risk group had third IBTE-free survival as high ✓



ADAM CHICHEL

as 99.3%. This approach, therefore, represents a valid option in terms of oncological outcome and toxicity profile in comparison with standard mutilating salvage mastectomy.

The results of a phase II trial on ten-year clinical and cosmetic outcomes of high-dose rate (HDR) brachytherapy for early breast cancer were presented by Fabio Arcidiacono, Terni, Italy. In total, 133 patients treated with post-breast-conserving surgery (BCS) 8 x 4 Gy APBI achieved 97% local recurrence-free survival, along with 93% excellent / good cosmetic outcomes.

Sylwia Kellas-Slecicka from Gliwice, Poland, shared the results of an interstitial multi-catheter brachytherapy APBI delivered to a large group of 481 women observed for a median of 55 months. Their five-year and ten-year overall survival (OS) was 94.4% and 83.5% respectively. Across the whole cohort, only seven out of 481 (1.45%) patients developed local recurrence; 2.7% and 0.8% had grade 2 and 3 late skin toxicity, respectively.

The fourth abstract was on 'Very accelerated partial breast irradiation (VAPBI): early effects of phase I-II multi-centre trial' and was presented by Jose-Luis Guinot, Valencia, Spain. This trial is endorsed by the GEC-ESTRO breast cancer ✂



Brachytherapy track in session

working group and is based on a HDR minimally invasive biopsy technique (MIBT) accelerated scheme of 4 x 6.25 Gy to decrease the total time of treatment to two to three days. The conclusion was that the treatment is feasible, with the first results similar to those of an APBI phase III trial. The acute effects after six months are similar as well.

‘Which is the best brachytherapy technique to deliver partial breast irradiation (PBI)? Pitfalls, results and current recommendations’ was the interesting Sunday afternoon debate. There were four speakers: Jean-Michel Hannoun-Levi, Nice, France, advocated for post-operative multi-catheter brachytherapy; Kristina Lössl, Bern, Switzerland, defended the intra-operative multi-catheter approach; Peter Niehoff, Offenbach am Main, Germany, shared his experience with single catheter balloon applicators like Mammosite or Contura; and Adam Chicheł, Poznań, Poland, presented results in patients treated with strut-adjusted single entry catheter (SAVI).

The conclusions? APBI is a standard for low-risk breast cancer patients. Depending on local conditions, the patient, surgeon and brachytherapist can work together to choose the best option for an individual’s case. All intra- and

post-operative settings, multi-catheter and single-entry devices, the patient’s comfort variabilities, clinical target volume (CTV) delineation methods, and post-operative histology decision changes have their advantages and limitations. The key thing is to implement the approach most suited to the local institutional environment to ensure that the patient has access to APBI with brachytherapy.

Which is the best technique for the delivery of APBI? This question was addressed by Charlotte Coles (in favour of external beam radiation therapy (EBRT), IMPORT LOW trial⁴), Vratislav Strnad (MIBT supported by level I randomised evidence⁵), Tibor Major (who provided a physicist’s point of view) and Jose-Luis Guinot (radiobiological aspects and limitations of APBI). Four constructive lectures were followed by an interesting debate on the pros and cons of each approach. It was stressed that no technique fits all. The data support accelerated treatment with various brachytherapy methods and EBRT as well. There is no question that for selected breast cancer patients, APBI has become the standard of care, not an option. For a more detailed assessment of its value, clinicians need the results of more EBRT partial-breast irradiation (PBI) trials, such as NSABP-B39. It is also desirable that we establish the safety

and oncological effectiveness of perioperative catheter implantation and administering the treatment in a few consecutive days.

There were three digital posters on brachytherapy in breast cancer that caught my attention. Fabrizio Piro *et al.* from Cosenza, Italy, presented ‘HDR BT boost in breast cancer: postoperative vs. intraoperative procedures, long-term outcomes’. The authors found no difference in terms of loco-regional recurrence, metastatic-free and overall survival in 75 patients with 8.2 years of follow-up. Andre Figueiredo *et al.* from Lisbon, Portugal, shared their results on ‘APBI with interstitial brachytherapy vs. whole-breast irradiation for early-stage breast cancer’. They compared 25 APBI patients with 260 whole-breast irradiation (WBI) patients and analysed them with a propensity-score matching methodology. The findings are in line with previously published randomised trials and confirm the non-inferiority of APBI results in comparison with WBI long-term oncological results and treatment toxicity profiles. The third abstract was from Kazunori Miyaura *et al.* from Tokyo, Japan. The authors of ‘Effects of interfraction uncertainty with strut-adjusted volume implant (SAVI) applicator’ analysed 50 cases. They found that a change in the dosimetric index of dose-volume histogram (DVH) occurs in the interfraction uncertainty ✍

of the SAVI applicator. This can be estimated to be about five per cent, which may mean that re-planning is necessary.



Adam Chicheł
Brachytherapy Department
Greater Poland Cancer Centre
Poznań, Poland

REFERENCES

- [1] 1Re-irradiation and hyperthermia in breast cancer. *Clin Oncol (R Coll Radiol)* 2018 Feb;30(2):73-84.
- [2] Second breast-conserving therapy with interstitial brachytherapy (APBI) as a salvage treatment in ipsilateral breast tumour recurrence: a retrospective study of 40 patients. *J Contemp Brachytherapy* 2019;11(2):101-107.
- [3] Accelerated partial breast irradiation with interstitial brachytherapy as second conservative treatment for ipsilateral breast tumour recurrence: multicentric study of the GEC-ESTRO Breast Cancer Working Group. *Radiother Oncol* 2013 Aug;108(2):226-31.
- [4] Partial-breast radiotherapy after breast conservation surgery for patients with early breast cancer (UK IMPORT LOW trial): five-year results from a multicentre, randomised, controlled, phase 2, non-inferiority trial. *Lancet* 2017 Sep 9;390(10099):1048-1060.
- [5] Five-year results of accelerated partial breast irradiation using sole interstitial multi-catheter brachytherapy versus whole-breast irradiation with boost after breast-conserving surgery for low-risk invasive and in-situ carcinoma of the female breast: a randomised, phase 3, non-inferiority trial. *Lancet* 2016 Jan 16;387(10015):229-38.





Gynaecological brachytherapy



MONICA SERBAN

At ESTRO 38, several gynaecological (GYN) brachytherapy topics were addressed, with a focus on adaptive MR-based brachytherapy in cervical and vagina cancers and optimal brachytherapy applicators and techniques. The sessions started with a very interesting symposium on image-guided adaptive brachytherapy (IGABT) for primary vaginal cancer in Europe and North America.

The first presentation was from Henrike Westerveld from Amsterdam, The Netherlands (SP-0025). Henrike gave a comprehensive overview of different treatment modalities and related patient outcomes. She went on to discuss the need for MR-IGABT in primary vaginal cancer (PVC). To date, there are only a limited number of studies, mostly mono-centre and retrospective, with patients treated with 2D radiography-based brachytherapy. Results from more recent, although very small, mono-centre studies using a 3D target concept are promising, showing better local control without additional morbidity. Recently, within the Groupe Européen de Curiethérapie (GEC)-ESTRO's GYN network, a retrospective multi-centre study was conducted to assess the outcome of patients treated for PVC with MR/CT IGABT. At a median follow-up of 29 months the three-year local control rate was 82%. Doses of > 80 Gy in large tumours T2-4 were found to result in better tumour

control. Henrike concluded that a prospective multi-centre IGABT study, preferably with MRI, is warranted to gain more knowledge about this rare disease.

Max Schmid from Vienna, Austria (SP-0026), continued the series of presentations by describing the target volume concept for PVC. A challenge in PVC, as described by Max, is the substantial tumour shrinkage during radio-chemotherapy, which leads to the question of what should be considered as target volume at the time of brachytherapy. To answer this question and to allow for improved comparability of treatment parameters, a task group was initiated within GYN GEC-ESTRO in December 2013. Its purpose was to introduce the IGABT target concept for PVC. The target concept was elaborated as a consensus agreement resulting from an iterative process, including target delineation exercises, retrospective analysis of clinical data and expert opinions. The target volume concept that was agreed consists of three target volumes: the residual gross tumour volume, a high-risk and an intermediate-risk clinical target volume. In his final remarks Max introduced an upcoming observational study, EMBRAVE, to be launched later this year. The study aims to prospectively evaluate and validate the proposed target volume concept in PVC. ✕

The next speaker, Mitchell Kamrava, from Los Angeles, USA (SP-0027), provided a comprehensive review of literature reporting the North American experience regarding IGABT for PVC with respect to dose, target / organ at risk (OAR) definitions, and clinical outcomes, and compared this with the experience from Europe. Currently, there is no consensus regarding the ideal dose, definition of the high-risk clinical target volume (CTV_{HR}), or definition of OAR, such as the vagina. Local control is high with IGABT. In the future there will be a need for strategies to identify patients at higher risk of distant metastases. Future work, through multi-institutional collaboration, will also have to include consensus on CTV_{HR} definition as well as a better understanding of vaginal tolerance.

The concluding presentation at this symposium was from Nicole Nesvacil, from Vienna, Austria (SP-0028). Nicole presented a multi-centre brachytherapy treatment planning comparison of three different patient cases, with pre-contoured target and OAR structures, using a multi-channel cylinder with/without interstitial needles. Five centres, all members of the GEC-ESTRO vagina brachytherapy task group, had to plan these cases according to their departmental practice, with no uniform planning aims or dose constraints. The objective was to investigate

the impact of loading strategies quantified by variations of Total Reference Air Kerma (TRAK) coming from the central/peripheral catheters in the cylinder or from interstitial needles. They also investigated the impact of the planning aims for target and OARs on total dose variation between centres. The planning study showed differences between centres, mainly in planning aim to the CTV_{HR} (ranging 70 – 86 Gy EQD2₁₀), in catheter/needle loading and in the systematic inclusion of the vagina as a target by one of the centres. The reported OAR doses were similar. In the future, a prospective multi-centre study will be needed to improve on methodology for dose reporting.

The proffered papers session started with a presentation by Monica Serban from Aarhus, Denmark (OC-0172), the abstract of which features in the ESTRO 38 conference report. Her contribution was on the effect of brachytherapy applicators (tandem and ovoid (T&O) versus tandem and ring (T&R)) and technique (intracavitary (IC) versus intracavitary / interstitial (IC/IS)) on target doses, isodose surface volumes and OARs doses. The analysis was conducted on a large cohort of 902 locally advanced cervical cancer (LACC) patients treated with IGABT as part of the EMBRACE I study. For intracavitary implants, the results showed

increased target dose (by ~ 3 Gy EQD2₁₀) for target volumes < 45 cm³ and reduced V85 Gy EQD2₁₀ (23% lower at target volumes of 30 cm³) with T&R IC applicator. Bladder and rectum doses were generally higher with T&O applicator (by 3 to 8 Gy EQD2₃) while the vaginal doses were lower with the T&O applicator (by 20 Gy EQD2₃). Routine application of IC/IS improved target coverage and dose conformity, and better spared the bladder and rectum (by 3 to 5 Gy EQD2₃ lower). With the addition of needles, the differences seen in target / OAR doses and in V85 Gy between the IC applicators was reduced.

In the next presentation, Mario Federico, from Las Palmas de Gran Canaria, Spain (OC-0173), investigated the benefit for a wider use of IC/IS technique in small tumours (International Federation of Gynaecology and Obstetrics (FIGO I-II). These are tumours that could otherwise be treated with the IC technique. The results came from a prospective clinical trial of 200 patients. In total, 79 of these patients treated with the IC/IS technique were in fact patients that would have been suitable for the IC technique alone (target coverage³ 86 Gy EQD2₁₀ and acceptable OARs doses achieved on re-planning with the IC technique) and were therefore included in the analysis. The plans were evaluated based on target doses (CTV_{HR} D_{90%}) and √

OARs doses ($D2\text{cm}^3$ and $D0.1\text{cm}^3$). Furthermore, to compare competing plans (IC versus IC/IS) when all constraints were met, a cost function, used as a plan quality index, was introduced to express the dosimetric performance of the entire treatment plan in a single numerical value. The results showed that IC/IS plans achieved significant dosimetric gain in a larger proportion of the patients than expected. The investigators concluded that, given the comparable costs and complication rates between IC and IC/IS, a more extensive use of an IS component in small tumours seems justified.

The two subsequent presentations were both from Aarhus University Hospital (AUH), Denmark. Jacob Lindegaard (OC-0174) discussed the impact of the collaboration with the GYN GEC-ESTRO international network, in terms of developments of brachytherapy techniques and dose-volume parameters. Between 2005-2018, 400 patients treated with MR-IGABT were analysed. The data showed an increase in the use of the IC/IS technique from approximately 40% (2005) to 65% (2018). The constraints and planning aims obtained through the GEC-ESTRO collaboration greatly impacted AUH's clinical practice. Significant improvement in dose-volume parameters was observed; this was primarily achieved by decreasing the dose

contribution from external beam radiotherapy (EBRT) by 7 Gy, while increasing the contribution from IGABT by 11 Gy, leading to an overall improvement in $CTV_{HR} D_{90\%}$ from 83 to 93 Gy ($EQD2_{10}$). The $D2\text{cm}^3$ of bladder, rectum and sigmoid were reduced by 3 to 10 Gy, while the ICRU rectovaginal point was reduced by 8 Gy ($EQD2_3$). In his presentation Jacob also described a new approach for estimating the probability of the need to use the IC/IS technique or for reaching a certain level of target coverage, by using the so-called 'tumour score'. The tumour score, described at length in poster PO-0826 by the same author, is calculated by scoring points (from 0 to 3) to different degrees of involvement of eight anatomical locations (cervix, left parametrium, right parametrium, vagina, bladder, ureter, rectum and uterine corpus) and summing them up to obtain a final T-score. The use of the tumour score, derived from both clinical examination and MR imaging, appears capable of intra-FIGO-stage prognostication by using information on local tumour extension, which is not incorporated in the FIGO stage alone.

The next presentation from Aarhus was by Primoz Petric (OC-0175) describing the use of novel 3D-printed vaginal tandem-needle templates (TNT) for insertion of needles in the

parallel (P) or parallel and oblique (P&O) direction in LACC patients with narrow vagina and / or extensive local disease. The researchers were able to distinguish two types of TNTs: standard TNT (12 P or 8 P plus 7 O needles) or personalised TNT (individualised needle insertion points and angles), depending on the case. In total, 50 patients treated with TNT and 56 treated with the commercial T&R applicator (with/without needles) from 2015 to 2018 were included. TNT was fitted over the commercially available uterine tandem, while dwell-positions in P needles were used to simulate the ring channel. ✍



Read a report on the '3rd ESTRO-AROI Gynaecological Teaching' course in the School Corner, p: 105

Predictors for the use of P&O needles versus P needles or for the use of 3D-printed TNTs versus commercial applicators were tumour size, parametrial extension and bladder/rectum invasion, while vaginal and uterine involvement were not. Comparable dosimetric parameters were achieved in cases treated with 3D-printed TNTs relative to those treated with commercially available applicators.

Another topic addressed in this session was on quality assurance (QA) of physician delineation performance in LACC patients as part of the EMBRACE II study, by Simon Duke from Cambridge, UK (OC-0176). Among other evaluations, the radiotherapy QA process included the contouring of two benchmark \checkmark cases by the principal investigator (PI). In total, 49 clinicians submitted contours for evaluation, using a bespoke online contouring tool for delineation. The regions of interest (ROIs) evaluated were: the residual GTV (GTV_{res}), high-risk CTV (CTV_{HR}), intermediate-risk CTV (CTV_{IR}), bladder, sigmoid, rectum and bowel. Each ROI was scored on a range 0-10 by two assessors, with a score ≥ 6 required to pass. The first-time pass rate was low (8%) and most submissions required revision of more than one ROI. The most common ROIs requiring revision were the GTV_{res} (65%), CTV_{IR} (61%), sigmoid (49%) and

bowel (63%). Qualitative analysis showed that errors were due to conceptual difficulties, as well as image interpretation and variation in case selection. The individualised feedback improved contouring; however, these interventions should be repeated over time for PIs as well as non-PIs. In the future, we need improved tools that will allow rapid contouring across a large number of cases with automated assessments.

Noha Jastaniyah from Riyadh, Saudi Arabia (OC-0177) presented her group's results on intra-fraction variation of OARs dose using a kV-CBCT scanner and the role this technology could have in adaptive cervical cancer HDR brachytherapy. Data from 19 patients and 57 brachytherapy fractions were retrospectively analysed. Bladder, rectum and sigmoid were contoured on planning CT and CBCT images by the same observer. OAR dose intra-fraction variations in HDR brachytherapy were small on average, but some large random variations were observed in individual patients. Data showed that without adaptive planning, 21% of patients will have a chance that at least one OAR would exceed the recommended limits, though a variation in equivalent dose in 2 Gy (EQD2) higher than 10% would occur in only 10% of them. Noha concluded that kV-CBCT scans provide reasonable image quality for

delineating OARs in cervical cancer and a kV-CBCT acquired before dose delivery can detect unfavourable anatomical changes, which might warrant further dose optimisation based on pre-treatment imaging.

Tissana Prasartseree from Bangkok, Thailand (OC-0178), concluded the proffered papers session with a presentation on a late GI/GU toxicity predictors in cervical cancer image-guided brachytherapy (IGBT). To this end, isodose surface volumes (ISVs) of intermediate to high doses were used to quantify the excess dose outside the so-called 'toxicity-negligible' region V_{neg} (including the CTV_{HR} and part of the uterus/vagina within the 60 Gy EQD2₁₀ isodose line). Since this excess dose region represents the movable space of pelvic organs, it could be thought to correlate to toxicity. The ratio $iRex = ISV/V_{neg}$, with ISV calculated for different EQD2 dose levels of 60, 70, 80 and 90 Gy, was studied for correlation with late GI and/or GU toxicities. In total, 149 cervical cancer patients treated with EBRT and HDR-IGBT were retrospectively reviewed. GI and combined GI/GU toxicity established a statistically significant difference in $iRex$ (for all EQD2 dose levels investigated) between grade 0-1 to grade 2-4. However, only $iRex$ of 60 and 70 Gy established a dose-response relationship with grade \checkmark

2-4 GI and combined GI/GU late toxicity. Tissana concluded that, with further investigation, the proposed concepts of excess dose volume and iRex could be used as novel IGBT dose constraints in addition to D2cm³ and D0.1cm³.



Monica Serban
Aarhus University
Aarhus, Denmark





Prostate-based brachytherapy

This year, at ESTRO 38, a full day was devoted to high-dose-rate (HDR) prostate brachytherapy. This technique has several advantages over external beam radiotherapy, including the opportunity to 'dose-paint' by adjusting source dwell times and positions. The steep dose decline of brachytherapy makes it possible to escalate the dose to the tumour, without compromising dose constraints for the organs at risk. The increasing amount of research on this topic shows that this technique is being used more widely around the world.

During the day, two randomised comparative studies were discussed. A group from the Charles-Le Moyne hospital in Canada presented a randomised trial of 1 x 19.5 Gy (arm one) versus 2 x 14.5 Gy (arm two) HDR-brachytherapy (Jolicoeur *et al*, OC-0282). Focusing on early acute toxicity (at one, three, six weeks and three months after treatment), 170 patients were analysed using the common terminology criteria for adverse events (CTCAE) score, international prostate symptom score (IPSS) and international index of erectile function (IIEF-5).

The pre-treatment median prostate-specific antigen (PSA) levels were 6.6 (arm one) and 6.7 (arm two). T stages ranged from T1c (55% and 57%) to T2c (5% and 2%). Gleason grades

were mostly seven: 3+4 in 52% and 57%, 4+3 in 28% and 30%, respectively. CTCAE-graded acute genitourinary (GU) or gastro-intestinal (GI) toxicity was not significantly different between the arms. IPSS was mild at baseline (median 6.3 and 6.7), with a small increase after one week (to 11.5 and 12.6). It then returned to baseline level after three months in both groups. Urinary retention occurred in 6.7% of patients in arm one and 2.1% in arm two. IIEF-5 scores were also very similar, with baseline scores of 13 and 15.2, with a small decline to 12.9 and 12.2 at 12 weeks. On this basis, the Charles-Le Moyne group concluded that both schedules are well tolerated in the early setting after treatment.

The BC Cancer Agency in Canada presented another comparative study (Crook *et al*, OC-0287). They reported dosimetric results from a randomised study comparing low-dose-rate (LDR) brachytherapy (n=31, 145 Gy) with HDR-brachytherapy (n=29, 2x13.5 Gy) using dose escalation to the dominant intraprostatic lesion (DIL) as assessed on multiparametric MRI. Intraoperative transrectal ultrasound scans (TRUS) were fused with pre-treatment MRIs to target the DILs. Patients had up to three DILs (100 DILs in total were targeted), located either peripherally (n=74), anteriorly (n=20) or centrally (n=6). For LDR and HDR, a median DIL D90% \geq



MARIEKE VAN SON



MAX PETERS

of 151% and 132% was achieved, with higher doses for peripheral tumours versus anterior and central DILs. Using LDR, differences were 159% versus 122% and 124%, respectively. Using HDR, D90% was 137% versus 123% and 118%, respectively ($p < 0.001$). These lower doses to central and anterior lesions reflect the planning algorithm, which was bounded by urethral dose constraints of a maximum of 130%. For central and anterior lesions, HDR DIL D90% values were significantly closer to the desired dose prescription than with LDR, giving an indication that HDR is better for dose escalation when lesions are at an unfavourable position, such as close to the urethra.

Cohort-based results of HDR-monotherapy were presented by two other groups. The Mount Vernon Cancer Centre in the UK (Tsang *et al*, OC-0284) presented an analysis of urethral strictures after HDR-brachytherapy (1x19 Gy). Using urethra dose constraints of D10% <22Gy, D30% <20.8Gy and maximum dose <28.5Gy, they only reported five CTCAE grade ≥ 2 strictures in a group of 178 patients. They performed a 1:1 matched case-control analysis, matching on pre-treatment IPSS, number of needles used and clinical target volume (CTV) size. In this small group, no association was found between post-treatment stricture and urethral dosimetry. The

group suggested that in the future, radiomic features of pre-treatment T2-weighted MRI image, such as homogeneity and contrast of the prostate gland, might identify patients who will develop urethral strictures.

The Cruces University Hospital in Spain (Gomez-Iturriaga *et al*, OC-0283) analysed the pattern of relapse within the prostate after HDR treatment with 1x19 Gy. They treated a total of 44 patients with low (44%) and intermediate (56%) risk disease, of which 42 underwent pre-treatment MRI, which was used to contour DILs (visible in 25 patients), as assessed by T2W and DWI sequences. Median CTV dosimetry was V100 96.5%, V150 20.5% and V200 5.3%. After a median follow-up of 37 months, 14 patients (32%) experienced biochemical failure. Local relapse was seen on MRI in 12 patients and 11/12 patients underwent MRI-TRUS fusion biopsy. This confirmed local relapse in ten patients. DVH analysis revealed that patients with biochemical failure had received significantly lower doses in terms of V100, V125 and D90% ($p = 0.032$, $p = 0.018$ and $p = 0.018$ respectively). Furthermore, mean DIL D90% and D98% were a little lower for patients with biochemical failure. It was concluded that patients with 'cooler' implants have a higher incidence of biochemical and local failure, with predominantly in-field recurrences

with respect to the initial tumour volume on MRI. This adds to the rationale for further dose escalation to dominant intraprostatic nodules.

The group from Sunnybrook Odette Cancer Centre in Canada (Mendez *et al*, OC-0288) presented results of a single 15Gy HDR-brachytherapy boost in 545 patients with intermediate-risk prostate cancer followed by external beam radiation therapy (EBRT). This consisted of 37.5 Gy in 15 fractions in the majority of patients (93%). The median age of the cohort was 67 years with a median PSA of 7.4 ng/ml. A little over half (55%) of all patients had cT1 and the rest (45%) had cT2 disease. The International Society of Urological Pathology (ISUP) Gleason grade for the group was 1 in 9 (2%), 2 in 346 (67%) and 3 in 164 patients (32%). Neoadjuvant androgen deprivation therapy (ADT) was given in 90 patients (18%) for a median duration of six months. The HDR-brachytherapy boost achieved a good coverage (median V100 of 97%). Median (biochemical) follow-up was 4.9 years, with 44 patients (8%) experiencing biochemical failure. Biochemical control was 91% and 82% at five and seven years. The cumulative incidence of ADT was 7% at seven years.

A group from the University Medical Centre Utrecht, The Netherlands, touched on a different

realm of HDR-brachytherapy: focal treatment of the prostate tumour instead of whole-gland treatment. They reported outcomes of MRI-guided focal HDR-brachytherapy (1x19 Gy), in both the radio-recurrent setting (Peters *et al*, OC-0285) and the primary setting (van Son *et al*, OC-0286). Patients with radio-recurrent disease (n=125) had tumour characteristics ranging from low-risk to higher-risk disease. One third of patients had stage T3 tumours, where the median PSA was 4.8 ng/ml (range 0.9-39) and the median PSA doubling time (PSADT) was 16 months (range 3-73). Staging was done using multiparametric MRI and PET/CT (Choline- and later PSMA-PET/CT). After inserting the catheter, MRI-based catheter reconstruction was performed and contours were adjusted according to anatomy changes. A total of four patients experienced grade 3 GU toxicity, which were three urethral strictures (two at six months and one at 24 months) and one urinary retention at six months. There was no grade 2 or higher GI toxicity. IPSS and IIEF scores were relatively stable during the longer term follow-up. Patient-reported quality of life (QoL) questionnaires only revealed urinary complaints in the first month, which stabilised afterwards. After two years, biochemical failure-free survival (BFFS) and metastases-free survival (MFS) were 64% and 83% for the entire group, and 84% and 91% for

the 30 phase I study patients (all with low-risk disease). In the future, it will be necessary to identify which patients benefit most from this treatment using statistical modelling.

In the primary setting, focal HDR-brachytherapy was performed in a phase I study (n=30). Patients were staged with multiparametric MRI and systematic biopsies. The median PSA was 7 ng/ml (range 1-10), and the median PSADT was 4.5 years (range 0.5-38). The Gleason grade was 4+3=7 in two patients and 3+4=7 in 12 patients. Almost half of all patients had T2c disease. No grade 3 GU or GI toxicity was seen. New-onset grade 3 erectile dysfunction (ED) was present in 12 patients.

Accordingly, the IIEF showed a clear downward trend. Clinically relevant (≥ 10 points) patient-reported QoL deterioration was seen in relation to sexual activity and tiredness. However, patients' emotional and cognitive functioning improved. At four years, BFFS was 70%, MFS 93% and overall survival 100%. Most recurrences (7/9) were out-of-field. Salvage treatment with whole-gland or focal treatment (both n=2) did not result in increased toxicity or deterioration of QoL. Although BFFS of focal treatment is sub-optimal in this setting (most likely due to inadequate selection without full template biopsy mapping

or PET / CT), re-salvage treatment offers the potential to increase BFFS to an acceptable rate, while keeping toxicity and QoL stable.

The results from these studies show that there is great potential in HDR-brachytherapy, offering the opportunity to further escalate the dose to the tumour, and also in unfavourable tumour locations. This can be used in both the primary and the salvage setting, using monotherapy HDR treatment in either a single session or divided over two sessions, and HDR as a focal boost concomitant to EBRT, or in focal approaches. The popularity of this topic was reflected in the well-attended prostate brachytherapy session, which will undoubtedly require a bigger lecture room during next year's ESTRO 39.

┐ Marieke van Son, PhD candidate
Department of Radiation Oncology
University Medical Centre Utrecht,
The Netherlands

Max Peters, resident in training
Department of Radiation Oncology
University Medical Centre Utrecht,
The Netherlands



Brachytherapy physics

There were a number of very interesting presentations in the brachytherapy track at ESTRO 38. The topic was well represented with a large number of posters, even more e-posters, and a wide range of symposia, debates and proffered papers sessions.

The track opened with a symposium session dedicated to image-guided adaptive brachytherapy (IGABT) for primary vaginal cancer in Europe and North America. The surprising conclusion was that the approach to contouring the planning target volume (PTV) in vaginal cancer is not unified. In some centres the remainder vagina is also part of the PTV, while elsewhere it is an organ at risk (OAR). As vaginal cancer is a rare disease, only a limited number of studies have been published on the topic. Where the vagina has been investigated as an OAR, no correlations were found between vaginal dose and side effects.

The second part of the track was about real-time navigation technologies in brachytherapy. There were exciting presentations about real-time source tracking in high-dose-rate (HDR) pelvic brachytherapy using electromagnetic devices. The type and degree of errors of the source dwells were also evaluated. The next talk featured the *in vivo* dosimetry of brachytherapy

with metal-oxide-semiconductor field-effect transistors (MOSFET). The second part of this session was about the challenge of introducing interstitial needles with 3D-printed vaginal templates into the standard procedures for brachytherapy of cervix cancer.

The proffered papers session on cervix brachytherapy started with presentations about the intracavitary and interstitial ring-type versus Fletcher-type applicators, followed by 3D-printed tandem-needle templates. Authors concluded that, generally, dose to the rectum and bladder can be reduced using a ring applicator. However, larger tumours can be irradiated with appropriate dose coverage only with the ovoid shape of the Fletcher-type applicator. The EMBRACE study also came into prominence in this session, with the delineation performance evaluated through MRI images. In spite of the fact that MRI is the gold standard in cervix brachytherapy because of the good soft tissue contrast, the research team found many errors due to conceptual difficulties and variation in case selection.

For me as a medical physicist, the symposium about inverse planning in brachytherapy was the most interesting. The question discussed was whether inverse planning is a one-click ✓



GEORGINA FRÖHLICH

solution or not? Several different points of view were explained, but the final conclusion was that it can be a one – or a two to four – click solution, but only in cases where the density of dwell positions is large enough, for example, in breast or prostate brachytherapy. In cervix brachytherapy, inverse optimisation methods can work only in the interstitial aspects of implantations. In intracavitary situations, manual or graphical optimisation is recommended.

Accelerated partial breast irradiation (APBI) was the most popular topic across the brachytherapy track, with three sessions dedicated to it. The first question was about the best brachytherapy technique to deliver APBI. The answer was that a single catheter balloon can be used only in large breasts where the tumour is in the middle of the entire breast tissue. However, clinical evidence exists only for multi-catheter HDR brachytherapy. The second question was about the best technique to deliver APBI, including teletherapy. The answer was that both tele- and brachytherapy have an essential place in APBI, with all methods being clinically feasible. There is no one size fits all technique. The most appropriate technique for delivering APBI is dependent on the individual's anatomy.



Brachytherapy track in session

In a really diverse session on optimising dose distribution, the audience heard three interesting presentations. They covered:

- a bi-objective optimisation method of dosimetric indices;
- a platinum shielding inside the needles, which can reduce the dose to urethra to a tenth in prostate brachytherapy;
- the evaluation of the inter-observer variation in prostate contouring and a robust treatment planning method to mitigate this.

The last proffered papers session was dedicated to prostate HDR brachytherapy. The first study in this session demonstrated acute toxicity of a single fraction of 19 Gy versus two times 14.5 Gy brachytherapy. The next topics were focal salvage brachytherapy, boost brachytherapy and using radiomics in the delineation of dominant intraprostatic lesions (DIL) for dose escalation. Dose to DIL was compared in HDR versus low-dose-rate brachytherapy. The presenters concluded that the HDR technique may dose escalate better when the target DIL is close to critical organs.



Georgina Fröhlich
Medical physicist
National Institute of Oncology
Centre of Radiotherapy
Budapest, Hungary





Editors' picks

A comparative analysis of overall survival between high-dose-rate and low-dose-rate brachytherapy boosts for unfavourable-risk prostate cancer >>



A comparative analysis of overall survival between high-dose-rate and low-dose-rate brachytherapy boosts for unfavourable-risk prostate cancer

King MT, Yang DD, Muralidhar V, Mahal B, Butler S, Devlin PM, Lee LJ, Mouw KW², Martin NM, D'Amico AV, Nguyen PL, Orio PF

Brachytherapy. 2019 Mar - Apr;18(2):186-191. doi: 10.1016/j.brachy.2018.12.007. Epub 2019 Jan 10.



MARTIN KING

What was your motivation for initiating this study?

Many patients are interested in high-dose-rate (HDR) brachytherapy boost, because of potentially fewer short-term side effects compared with low-dose-rate (LDR) brachytherapy boost, as well as better biochemical progression-free survival compared with dose-escalated external beam radiation therapy (DE-EBRT). However, there are no prospective data about whether survival outcomes between HDR boost and LDR brachytherapy boost are comparable. Since we had access to the National Cancer Database (NCDB), which provides specific coding for radiation therapy modalities, we wanted to determine whether survival outcomes from HDR brachytherapy were comparable to LDR brachytherapy, and improved compared with DE-EBRT.

What were the main challenges during the work?

The main challenge that we encountered was accounting for selection bias inherent in the large retrospective NCDB database. Selection bias often complicates the interpretation of results, because physicians may favour certain treatments based on patient-specific factors, such as age, co-morbidity, as well as disease

burden. For example, in our study, patients who underwent brachytherapy were significantly younger than patients who underwent DE-EBRT, and younger patients would be expected to have better survival outcomes than older patients irrespective of the treatment received. As a result, many of the baseline characteristics between brachytherapy and DE-EBRT were not as well balanced as they would be in a prospective randomised controlled trial. In order to account for selection bias, we implemented a propensity weighting method, which attempted to balance these characteristics before analysis. However, propensity weighting is still not able to control for unmeasured confounders, which could influence treatment selection and lead to bias. Another challenge was that there were no other important clinical endpoints (e.g. distant metastasis, prostate cancer-specific mortality) available to validate our findings.

What are the most important findings of your study?

The most important findings of the study were that HDR brachytherapy boost was associated with comparable survival outcomes to LDR brachytherapy boost (adjusted hazard ratio (AHR) 1.03 [0.96, 1.11]; $p = 0.38$), but improved survival outcomes compared with dose-escalated

external beam radiation therapy (AHR 1.36 [1.29, 1.44]; $p < 0.001$). Similar results were obtained for the intermediate-risk and high-risk subgroups. Furthermore, our results were consistent with those published in a recent large multi-institutional retrospective analysis of men with Gleason 9-10 prostate cancers, in which there was no difference in distant metastasis or prostate-cancer specific mortality between LDR and HDR brachytherapy boost[1].

What is the implication of this research?

The implication of this research is that HDR brachytherapy boost may yield similar survival outcomes as LDR brachytherapy boost. Based on this research, I feel more confident in offering men, especially those with baseline moderate urinary symptoms, HDR brachytherapy boost for definitive control of aggressive prostate cancer. However, only an adequately powered randomised controlled trial would actually prove that important oncologic outcomes between LDR and HDR brachytherapy boost are, in fact, comparable.

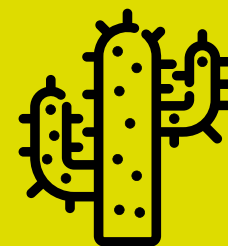
Martin King
Department of Radiation Oncology
Dana-Farber Cancer Institute
Brigham and Women's Hospital
Harvard Medical School
Boston, USA

REFERENCE

- [1] Kishan AU, Cook RR, Ciezki JP, Ross AE, Pomerantz MM, Nguyen PL, Shaikh T, Tran PT, Sandler KA, Stock RG, Merrick GS, Demanes DJ, Spratt DE, Abu-Isa EI, Wedde TB, Lilleby W, Krauss DJ, Shaw GK, Alam R, Reddy CA, Stephenson AJ, Klein EA, Song DY, Tosoian JJ, Hegde JV, Yoo SM, Fiano R, D'Amico AV, Nickols NG, Aronson WJ, Sadeghi A, Greco S, Deville C, McNutt T, DeWeese TL, Reiter RE, Said JW, Steinberg ML, Horwitz EM, Kupelian PA, King CR. 'Radical prostatectomy, external beam radiotherapy, or external beam radiotherapy with brachytherapy boost and disease progression and mortality in patients with Gleason score 9-10 prostate cancer'. *JAMA*. 2018;319(9):896-905. doi:10.1001/jama.2018.0587.

7th GEC- ESTRO Workshop

**Adopt, Adapt,
Advance**



21-22 November 2019
Budapest, Hungary

www.estro.org

WCB 
2020

World Congress of Brachytherapy

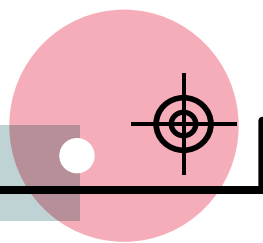
2-4 April 2020
Vienna, Austria

Follow us on    
www.estro.org



Physics





“In this issue we look back at the ESTRO 38 conference and introduce our next important event: the ESTRO physics workshop.”

Dear colleagues,

Welcome to the latest edition of the Physics Corner.

This year's ESTRO conference is already history. We hope you returned with a lot of new insights and inspirations from the conference presentations and from discussions with your peers. In this newsletter, we look back at the conference. There are different reports, e.g. from the physics committee chair, Catharine Clark, and from our Twitter ambassadors. You will also find short summaries of the physics poster awardees (best young poster, best poster). Finally, we have reports from three mini workshops that took place during the conference. These were 1.5-hour roundtable discussions on topics of special interest. Authors of the best abstracts about these topics were invited to participate. In the future, we intend to have informal updates and to bring the different groups closer together.

Our next important event is the ESTRO physics workshop, 'Science in Development'. In its third edition, this very special workshop format has become well established within ESTRO. Read an interview with Núria Jornet, one of the main initiators of this interactive format. She outlines plans for the workshop, which is intended to improve the interaction between researchers, end users and industrial partners and, therefore, is very much focused on discussions and interaction. It is not actually a single workshop, but five running in parallel, with different topics. Curious? Read the interview to see if there is something for you. We hope to see you in Budapest, Hungary, this October.

We wish you a wonderful summer.



Christian Richter (christian.richter@oncoray.de)
Mischa Hoogeman (m.hoogeman@erasmusmc.nl)
Brendan McClean (Brendan.McClean@slh.ie)



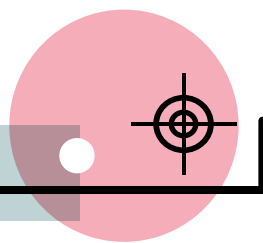
MISCHA HOOGEMAN



BRENDAN MCCLEAN



CHRISTIAN RICHTER



Interview with the Chair of the 3rd physics workshop: 'Science in development'

25-26 October 2019
Budapest, Hungary



NÚRIA JORNET

3rd ESTRO Physics Workshop Science in Development

25-26 October 2019
Budapest, Hungary

Now in its third year, the ESTRO physics workshop, 'Science in Development', is quite well established. Are the objectives the same or do they change with each edition?

The objectives are essentially the same: to create platforms for networking around topics of interest for our medical physics community, both in research and in clinical practice. In particular, we want to improve the interaction between researchers, end users and industrial partners.

What kind of tangible outcomes have resulted from the previous two workshops?

The atmosphere in the previous workshops enabled a number of new collaborations between individuals and institutions to get off the ground. Outcomes from the first workshop included: a grant proposal; an idea for a new course on dosimetry audits, which is due to start at the ESTRO School in 2020; and two white papers on in vivo dosimetry, which are being drafted.

Following the second workshop, two surveys were prepared, one on the use of adaptive radiotherapy (POPART) and another on the use of in vivo dosimetry. The predictive modelling group has already set up a group on Mendeley called 'Toxicity modelling in radiotherapy working group', and has started to draft a guideline on model validation.

You are getting ready for the third workshop in Budapest. Has anything changed in terms of the overall concept or organisation of the workshop?

The concept remains the same. However, as this is the third edition it has matured, and topic leaders, ESTRO staff and participants know what to expect. This helps with the organisation. We have fine-tuned the programme to allow plenty of time for discussion. We have also set aside a slot to agree potential outcomes. The template that participants complete ahead of the course has been improved so that topic leaders can be better prepared. ✍

How were the topics for this third workshop selected?

The ESTRO physics committee is very happy to announce that for this edition all the topics were selected from suggestions from the call to our membership. In Budapest we will have a good balance between research-orientated and clinical topics. We expect the broad range of topics will interest many of our members.

The topics include:

1. Computational methods for clinical target volume definition
2. Multi-source data fusion for decision-support systems in radiation oncology: opportunities, methodologies, standardisations and clinical translation
3. Implementation / commissioning / quality assurance (QA) of artificial intelligence techniques
4. Clinical applications and quality assurance of surface guided radiation therapy (in collaboration with the American Association of Physicists in Medicine (AAPM))
5. Plan quality assessment: dose distribution and robustness metrics.
This year we will open the workshop with a provocative talk by Robert Jeraj entitled "Medical physics got stuck in a box - how to get out?".

Who is the target audience?

The target audience is mainly medical physicists who have a special interest in any of the proposed topics and who are willing to contribute to discussions and to advance the field.

What should first-time participants expect from the workshop? What about those who have previously attended and who might be thinking about taking part again?

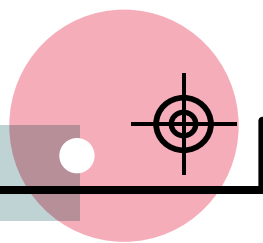
Both newcomers and those that have attended previous workshops should expect to meet colleagues with the same interests, who are willing to network, have discussions on how to harmonise practice, drive technological advances together with industrial partners, and also stimulate new medical physics research.

Those coming for a second and third time are key players in the success of the workshop as they already know what to expect, the dynamics involved and therefore can keep the spirit alive.



Núria Jornet
Chair, 3rd physics workshop

For more information, visit:
<https://www.estro.org/Workshops/2019/Physics/3rd-ESTRO-Physics-Workshop-Science-in-Development>



REPORTS FROM THE PHYSICS TRACK AT ESTRO 38

Catharine Clark - Physics track >>

Luise A Künzel - phiRO awardee for best poster >>

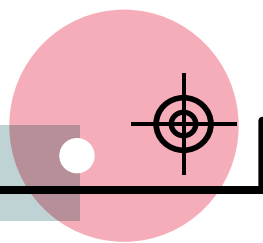
Aurora Rosvoll Grøndahl - Best poster physics >>

Daniela Thorwarth - Physics mini-workshop >>

Kathrine Røe Redalen - Physics mini-workshop >>

Francesca Albertini - Physics mini-workshop >>

View from the Twitter ambassadors >>



Physics track

The two physics tracks at ESTRO 38 consisted of eight teaching lectures, 13 symposia, one debate and 14 proffered paper sessions. Overall, the conference attracted 6,633 delegates of which 1,784 (26.9%) were physicists.

The physics tracks highlighted the major current trends in radiotherapy physics with a large number of proffered papers on predictive modelling, radiomics and adaptive radiotherapy. There were a very high number of presentations on protons across all the different topics, but especially in planning, measurement and toxicity. There were also a large number of presentations on MRI in pre-treatment planning, intra-fraction motion management and in radiomics. Overall, the work presented was extremely varied, taking in fundamental dosimetry, radiobiological modelling and advanced imaging techniques.

The physics debate involved a discussion around what training will be needed in ten years' time, including imaging, automation, modelling, leadership and maintaining a focus on traditional physics skills. All the debaters presented very strong cases. However, the opinion from the floor was that we must maintain our physics skills and learn to apply them to a range of different problems and solutions within radiation oncology.

There was also an inaugural meeting of women working in medical physics, which saw 57 participants gather at eight o'clock in the morning for an introduction to physics activities in ESTRO and an opportunity to meet other women.

In the following pages you will be able to read about the two poster winners: best poster and best young poster. We also hear from our physics Twitter ambassadors about what they thought were the conference highlights.

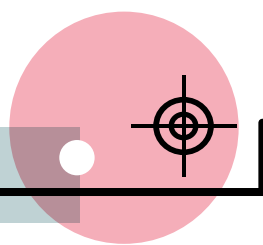


Catharine Clark
Chair of the Radiation Physics Scientific
Advisory Group
ESTRO 38

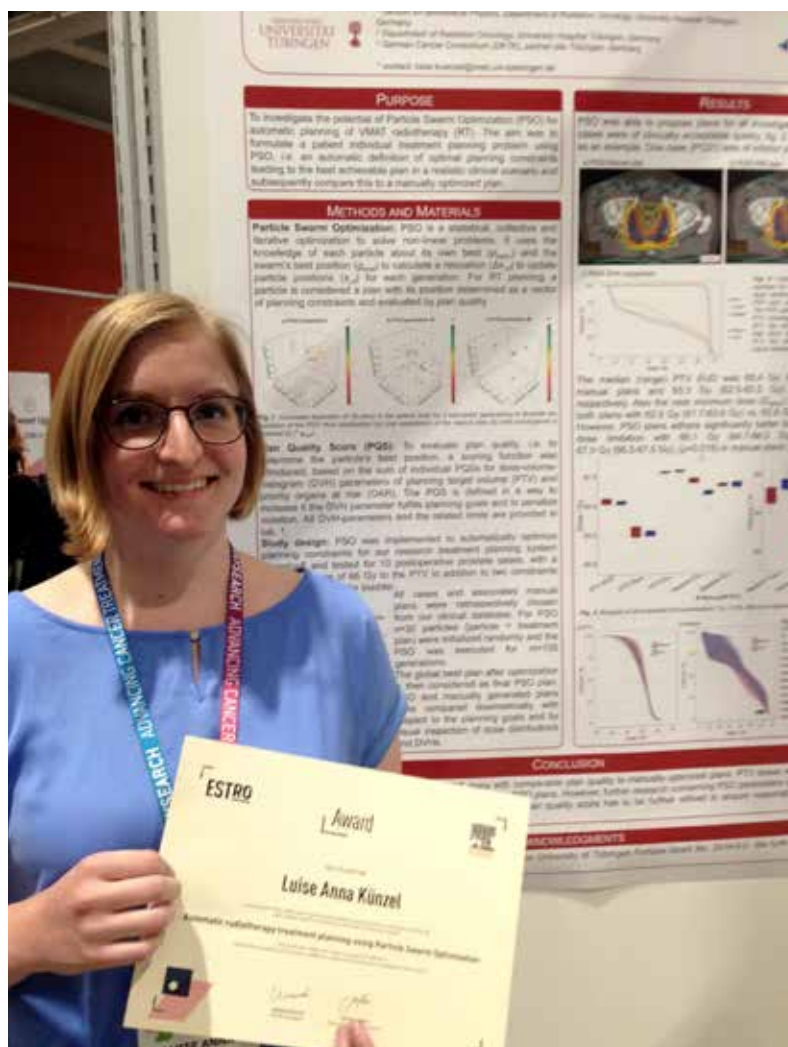


CATHARINE CLARK





phiRO awardee for best poster



Luise Kunzel next to her winning poster



LUISE A KÜNZEL

Manual planning is often formulated as an inverse optimisation problem. Therefore, objectives and constraints concerning targets and organs at risk (OAR) need to be balanced to ensure prescribed tumour dose and OAR

dose sparing at the same time. But this process is often time-consuming and ineffective. In this context, automatic planning seems to offer a very promising alternative.

In our poster, presented at ESTRO 38 in Milan, we proposed to treat the balancing of constraints as a second optimisation and solve it automatically by applying particle swarm optimisation (PSO). PSO is an iterative, statistical and collective optimisation suitable for high-dimensional, non-linear problems. It is inspired by the behaviour of species which form swarms to solve complex problems. These species do this by sharing and combining the information gathered by individuals in the swarm. This information is called 'particles'. In treatment planning, a particle equals a plan, represented as a vector of planning constraints. A dedicated plan quality score (PQS) is used to evaluate the particle positions in the search space. Each particle compares its best position reached so far to the global best position and tries to approximate them by an iterative alteration of the planning constraints.

We presented a PQS dedicated to post-operative prostate treatments with two constraints referring to the rectum and one to the bladder. The PSO was implemented and executed for ten cases and the proposed plans were compared to the ✓



From left: Ludvig Muren (editor-in chief phiRO), Luise Kunzel, and Pierfrancesco Franco (chair, Young ESTRO committee)

related manual plans. PSO plans offered similar target dose, while reaching significantly better rectum high-dose sparing. An additional advantage is that automatic PSO planning reduced inter-patient plan variation.

Further research is needed concerning the PSO parameters and dedicated PQS need to be developed for different treatment purposes to fully explore the potential of particle swarm optimisation for automatic planning.

┌
Luise A Kunzel
Section for Biomedical Physics
University Hospital for Radiation Oncology
Tübingen, Germany

Best poster physics awardee



From left: Eirik Malinen, Cecilia Futsaether, Aurora Groendahl and Ingerid Knudtsen



AURORA
ROSVOLL GRØNDAHL

The Healthcare Data Modelling Group at the Norwegian University of Life Sciences is working closely with the Oslo University Hospital and the University of Oslo, Norway, to develop computational tools for outcome prediction and automatic tumour segmentation.

Delineation of gross tumour volume (GTV), various target volumes and organs at risk is

a vital part of radiotherapy planning. Today, these delineations are performed manually, which is time-consuming and labour-intensive for clinicians. In addition, manual delineations are prone to significant inter- and intra-observer variations. Finding fast, robust and accurate automatic delineation methods could bypass many of these issues and therefore is of great importance. ✍

In the poster presented at ESTRO 38, *“Comparison of automatic tumour segmentation approaches for head and neck cancers in PET/CT images”* by Aurora R. Groendahl, Martine Mulstad, Yngve M. Moe, Ingerid S. Knudtsen, Turid Torheim, Oliver Tomic, Ulf G. Indahl, Eirik Malinen, Einar Dale and Cecilia M. Futsaether, we assessed different methods for automatic delineation of head and neck cancers (HNC) in baseline FDG-PET/CT images. The approaches spanned several levels of complexity, from PET thresholding via shallow machine learning to deep learning using convolutional neural networks. Our results show that a deep learning segmentation approach provide GTV delineations close to those made by experienced radiation oncologists.

A total of 197 HNC patients planned for radiotherapy at Oslo University Hospital between 2007 and 2013 were included in the study. The automatic delineations resulting from the three different segmentation approaches were compared to oncologist-delineated GTVs using internal validation data. We found that all methods based on PET images performed satisfactorily, due to the high standardised uptake value (SUV) of the tumour relative to other tissues. Using the Dice similarity coefficient, measuring the agreement between automatic delineations and the oncologist, deep learning

outperformed the other methods. In addition, deep learning was the only approach that, with acceptable accuracy, could discern the tumour based solely on CT images. The deep learning approach resulted in Dice coefficients of up to 0.73. These results are comparable to inter-observer variabilities given in the literature, where reported Dice coefficients are around 0.6 to 0.7.

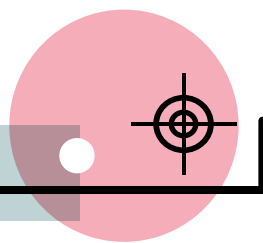
Based on these promising results, current research efforts are directed at external validation of the HNC deep learning model, as well as exploring the use of deep learning approaches for automatic tumour segmentation in other cancer diagnoses examined with different image modalities.



Aurora Rosvoll Groendahl
Healthcare Data Modelling Group
Faculty of Science and Technology
Norwegian University of Life Sciences
Ås, Norway



Read a report on the ‘Dose modelling and verification for external beam radiotherapy’ course in the School Corner, p: 109



Physics mini-workshop on “The use of diffusion- weighted MRI for radiotherapy”



DANIELA THORWARTH

On the last day of ESTRO 38 in Milan, six researchers who had each submitted physics abstracts related to the topic ‘Diffusion-weighted magnetic resonance imaging (DW-MRI) for radiotherapy’ came together for a 90-minute workshop. During the workshop, each participant had the opportunity to present their research topic. After this introduction there was a lively discussion about various aspects related to this field of research, including the selection of b-values, parameter extraction (fitting) from b-value MR images, handling of older data sets, the comparability of data acquired with different scanners and varying field strengths, and data analysis strategies.

The workshop was chaired by Marielle Philippens, Utrecht, The Netherlands, and Daniela Thorwarth, Tübingen, Denmark. The following participants took part:

- Boris Peltenburg, Utrecht, The Netherlands
- Kine Bakke, Oslo, Norway
- Giulia Buizza, Milan, Italy
- Sara Leibfarth, Tübingen, Denmark
- Alberto Traverso, Maastricht, The Netherlands, and Toronto, Canada
- Nicole Wiedenmann, Freiburg, Germany.

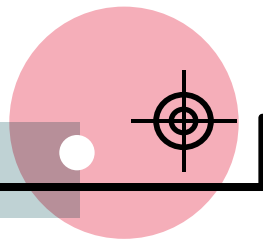
The aim of the workshop was to bring researchers working in the same field closer together

to facilitate interaction and discussion. The workshop was a great success and we hope further scientific exchange will stem from it. Thanks to all the participants for making it a success.



Daniela Thorwarth
Department of Radiation Oncology
University of Tübingen
Tübingen, Germany





Physics mini-workshop on “Image-based machine learning for automatic tumour segmentation”



Participants in the mini-workshop on “Image-based machine learning for automatic tumour segmentation”. From left: John Lee, Umair Javaid, William H. Nailon, Michelle Rooney, Aurora Rosvoll Grøndahl, Franziska Knuth, Cecilia M. Futsæther.

Participants for this mini-workshop were selected based on abstracts submitted related to automatic tumour segmentation through the use of different machine learning methods.

Machine learning and big data were themes running through ESTRO 38 and as such this workshop fitted nicely into the conference. The workshop started with presentations of

the research projects behind the selected abstracts. It was good to see how the abstracts complemented each other, but also how each of them contributed unique aspects based on different imaging modalities, data sets and methodology.

Among the topics explored at the workshop were performance measures to evaluate how



KATHRINE
RØE REDALEN

well segmentation methods are working, different kinds of input images, methods for pre-processing images, contour augmentation methods and how to handle different voxel sizes, when several image series are combined. Importantly, everyone agreed that in order to facilitate validation at other sites, researchers should provide better descriptions of what they did to the data in their publications.

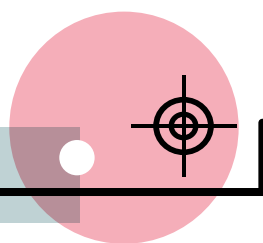
The immediate feedback from the participants was that the mini-workshop was a useful initiative for scientific exchange at an informal level in which everyone can interact, and that it provided new contacts for people working on related topics as well as new ideas. The participants said that they hoped that the mini-workshops would be continued next year.

The participants in the workshop were: Michelle Rooney (Edinburgh, UK), William H. Nailon (Edinburgh, UK), Franziska Knuth (Trondheim, Norway), Aurora Rosvoll Grøndahl (Ås, Norway), Umair Javaid (Brussels, Belgium) and John Lee (Brussels, Belgium). The workshop was chaired by Cecilia M. Futsæther (Ås, Norway) and Kathrine Røe Redalen (Trondheim, Norway).



Kathrine Røe Redalen
Department of Physics
Faculty of Natural Science
Norwegian University of Science
and Technology (NTNU)
Trondheim, Norway





Physics mini-workshop on “Adaptive proton therapy: from the research lab into clinical reality”

For this workshop, participants were selected based on abstracts relating to the topic of adaptive proton therapy. As you would expect for a broad topic such as this, there were participants who were experts in different fields, ranging from imaging experts to fast optimisation algorithm experts. It was very satisfying to see everybody in one room to discuss the adaptive proton therapy workflow.

The workshop started with participants introducing themselves, and then outlining what they saw as the main challenges and the most promising innovations for implementing an adaptive proton therapy approach clinically.

It was recognised that although for an ‘off-line’ adaptation strategy the technology is there, for an ‘online’ process there are still some critical aspects that need to be addressed. In particular, a reliable and fast automatic segmentation algorithm is still lacking, as well as a common agreement on how to perform the clinical and physical plan approval. Nevertheless, it was highlighted that the use of log-file-based quality-assurance (QA), probably in combination with machine-file QA, is a promising solution to replace the pre-treatment patient-specific QA. It was also recognised that before any clinical application, it is necessary for each centre to

perform a comprehensive QA of the used log-file system, which might be vendor-specific.

Additionally, it was acknowledged that until the clinical implementation of the online adaptive workflow, the use of intermediate solutions, such as dose restoration, could simplify the adaptive process. The use of alternative solutions, such as anatomical robust optimisation, could also reduce the need of adaptation.

Participants questioned whether it was necessary to establish a clinical evidence base before the application of a proton adaptive therapy. The consensus was that probably it was not, as in general it was difficult to find clinical evidence for this kind of technological development. In addition, there was not much clinical evidence to prove the value of intensity-modulated radiation therapy (IMRT) or image-guided radiotherapy (IGRT), both of which are now established treatment methods.

Participants said that it would be necessary (and interesting) to define the acceptable level of inaccuracy in the different steps of the workflow (e.g. in the segmentation, in the daily stopping power definition) to still benefit from the adaptive proton therapy approach. ✕



FRANCESCA ALBERTINI

Finally, it was widely acknowledged that the use of artificial intelligence is expected to have a major impact in automatising several aspects of the adaptive workflow, thus favouring clinical integration.

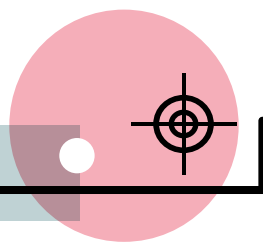
The participants in the workshop were Macarena Cubillos Mesias (OncoRay Dresden, Germany), Mohamed Elmahdy (LUMC Leiden, The Netherlands), Elena Borderias Villarroel (UC Louvain, Belgium), Thyrza Jagd (Erasmus Rotterdam, The Netherlands), Guillaume Landry (LMU Munich, Germany), Christopher Kurz (LMU Munich, Germany) and Lena Nenoff (PSI, Switzerland). The workshop was chaired by Mischa Hoogeman (Erasmus Rotterdam, The Netherlands) and Francesca Albertini (PSI, Switzerland).



Francesca Albertini
Centre for Proton Therapy
PSI, Switzerland



Read a report on the 'Particle therapy' course in the School Corner, p: 107



View from the Twitter ambassadors taking part in the ESTRO 38 physics track



Physics Twitter ambassadors at work



PHYSICS TWITTER AMBASSADORS

This year's physics track at ESTRO 38 kicked off with an engaging overview of the world of machine learning in radiotherapy with the pre-meeting course on 'Machine learning for physicists'. This set the stage for the popular radiomics and automation themes of the track. There were many inspiring talks on topics such as the applications of artificial intelligence (AI) in radiation oncology and the acceptance of AI in the work of the medical physicist. These talks

highlighted the importance of using quality data to avoid 'garbage in, garbage out' and improve radiomic models. This theme was rounded off nicely with some brilliant arguments in the closing debate: 'Data farming versus data mining?'.

Adaptive and advanced radiotherapy techniques also featured widely across the physics track with sessions covering recent developments in radiotherapy, including MR guidance, proton

therapy and probabilistic planning. These topics featured many interesting discussions on motion management, quantitative imaging and new developments for existing hardware such as improved cone beam computed tomography (CBCT) reconstruction and correction. A particular highlight was the debate: 'In ten years physicists will need different training to include more...'. The speakers were invited to put forward their arguments for what will be the most important skills needed for future medical physicists to work in the growing field of personalised and adaptive radiotherapy treatments.

This year's ESTRO congress introduced a new platform called 'The Stage', where networking events could take place. This space was used for lots of informal sessions. A highlight was the first ESTRO coffee meeting for 'Women in medical physics', which created a network to encourage collaboration and support for women working in radiotherapy. The University of Manchester team from the UK was proud to act as Twitter ambassadors for ESTRO 38, with many of our researchers and students at the conference enjoying sharing thoughts and engaging in discussion with other delegates online. We thoroughly enjoyed the ESTRO 38 physics track, returning to Manchester with notepads full of ideas and inspiration. We are already looking

forward to travelling to Vienna, Austria, for next year's congress.

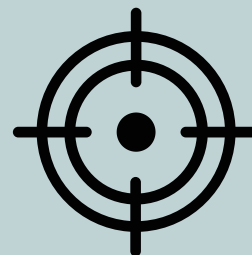


Abigail Bryce-Atkinson, Josh Lindsay,
Jane Shortall and Angela Davey
on behalf of @RT_Physics



3rd ESTRO Physics Workshop

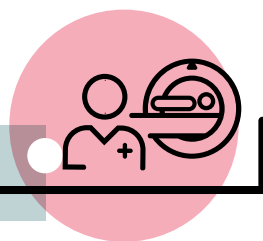
Science in Development



25-26 October 2019
Budapest, Hungary

RTT





“We hope the Corner is useful for anyone who participated in ESTRO 38 and had trouble deciding which session to attend.”

Dear colleagues,

For those of you who couldn't make ESTRO 38, this RTT Corner features a number of articles about people's experiences at the conference and feedback from sessions they attended. We hope this will also be useful for anyone who participated in the conference and had trouble deciding which session to attend.

I would like to take this opportunity to thank Bartos Bak, chair of the ESTRO 38 RTT track, who worked hard to lead the scientific advisory group in developing such a fantastic programme for us all to enjoy. I was fortunate to assist Bart as co-chair, and look forward to taking on the role of chair for next year in Vienna.

We hope you enjoy the contributions from your fellow RTTs and we all appreciate their time spent writing them.

As always, we would be very happy to hear more about the experiences of RTTs in your department, so please get in touch with us if you'd like to write an article for this Corner. We are fortunate to have such a variety of exciting developments happening in different institutions and countries and would enjoy reading about them.



Aileen Duffton (aileen.duffton@ggc.scot.nhs.uk)

Isabel Lobato (isabelloba@gmail.com)

Ilija Čurić (iccurici@gmail.com)



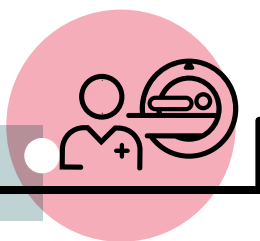
AILEEN DUFFTON



ISABEL LOBATO



ILIJA ČURIĆ



ESTRO RTT workshop – ‘Adaptation in a dynamic environment – RTTs taking the future in own hands’

8 November 2019
Budapest, Hungary



PHILIPP SCHERER



Radiotherapy is a steadily evolving discipline as we aim to secure the highest quality treatment for our patients, and it has strong links to medical technologies, imaging technologies and computer science. Several new developments, such as image-guided radiotherapy (IGRT), intensity-modulated radiotherapy (IMRT) and particle therapy, have dramatically changed radiotherapy – both in general and in terms of the multi-professional team working in radiotherapy. Current technical developments, such as the MR-linac, and emerging technologies, such as artificial intelligence (AI) or machine learning, have the potential to change radiotherapy significantly in the near future.

We need to address the topic of how to use the possibilities offered by all the emerging developments effectively and safely to augment our professional practice. We also need to discuss the question of how to ensure that errors made, for example, by software algorithms can be detected by a professional checking the results. All of this has an impact on our education and training, including continuing professional

development (CPD), to ensure that we all have the necessary skills for future practice.

As radiation therapists (RTTs) we have already adapted our scope of practice several times; for example, when taking over patient follow-up, moving to dosimetrist positions, introducing image-guided and adaptive treatment workflows into practice, or moving into advanced practice roles – all while keeping our focus on what is the best and safest care for our patients. In relation to particle therapy, we still need to address specific issues relating to RTTs, and to better incorporate these topics into our professional education.

To address all this, ESTRO is organising a new RTT workshop that will offer a space to brainstorm topics and questions such as these, and to consider the implications for practice and education. This workshop will help to create new networks with colleagues from across Europe and potentially to build collaborations with professionals and researchers in these emerging fields. We also want to create a space ✓

for exchanging ideas with the suppliers and manufacturers of oncology information systems, treatment planning systems, and treatment and imaging systems. This type of dialogue between medical professionals and industry is vital – especially for a young profession and field of expertise that is rapidly incorporating new technical possibilities to optimise workflows.

In our view, it is time to come together to discuss our professional future, and our roles and responsibilities in this steadily evolving field of expertise. We want to actively consider current and future challenges. We hope that the workshop will provide you with an opportunity to discuss these issues and to network with colleagues and potential collaborators and friends. So please join us for this workshop in the beautiful city of Budapest, Hungary, on 8 November 2019.

Philipp Scherer, MSc

Leitender RT (Geräteteam) UK für Radiotherapie und Radioonkologie der PMU an den SALK MuellnerHauptstr
Salzburg, Austria

For more information, visit:

www.estro.org/Workshops/2019/Physics/3rd-ESTRO-Physics-Workshop-Science-in-Development



Mary Coffey, Trinity College Dublin, summarises the workshop:

"This workshop is an exciting opportunity for all RTTs to help to define our role in the dynamic environment evolving over the coming decades and take control of our own destiny. Through lectures, discussion and networking we can take a 'blue skies' approach to where we want to be and what we need to do to achieve it. How can education support us to enable achieving our vision for our own profession? How can we use artificial intelligence to our benefit rather than our detriment, and be prepared when it is a reality in our everyday practice?"

Join us in Budapest for the start of our journey into a new era for RTTs across Europe."



Harald Hentschel provides a synopsis of the 'particle' workshop:

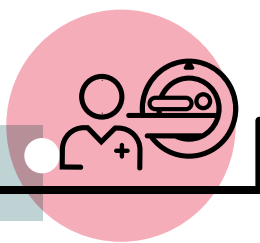
"In this workshop we will present and discuss the challenges that RTTs are facing in the particle world. What is needed in our educational programmes to prepare students for this specific working environment? With the worldwide increase in the number of particle centres, we will see new concepts of cooperation between photon and proton facilities; we will give a comprehensive overview of differences and similarities between photon and particle treatment techniques, technology and workflow to help understand each other's needs. We look forward

to exchanging experiences with our participants and invite them to discuss unique and common challenges, possible workflows as well as concepts of how particle and photon therapy can cooperate to provide the best care for our patients."



Martijn Kamphuis on the IGRT/ adaptive radiation therapy (ART) workshop:

"IGRT, and more recently ART, has become one of the most challenging and important parts of the role of the RTT and a major pillar in daily practice. Even though IGRT and ART have matured, there is still much room for development. New technical possibilities such as MR-guided treatment delivery and improved software algorithms offer interesting opportunities. In this workshop, we will try to explore different aspects of current and future image-guided and adaptive radiotherapy, as well as the role of the RTT in them. Where is there still room for development? Is there a need for standardisation and guidelines, for instance, to be able to audit each other's departments? This workshop will provide an excellent opportunity to network with your peers and to build potentially long-lasting and fruitful collaborations. We look forward to meeting you there."



REPORTS FROM THE RTT TRACK AT ESTRO 38

Ingrid Kristensen - A patient-centred approach to follow-up >>

Lisa Hay - Improving accuracy in patient positioning >>

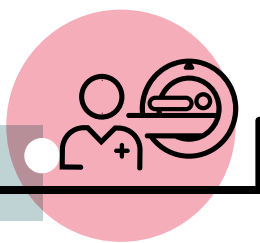
Laura Mullaney - Report from teaching lecture 'MR-guided radiotherapy in the pelvic region' >>

Maddalena Rossi - Quality in image-guided radiation therapy >>

Bernd Wisgrill - Basic course brachytherapy >>

Ana Rita Simões - My experience teaching at the head and neck OAR contouring workshop at ESTRO 38 >>

Joanne Mitchell - My first visit to an ESTRO annual congress >>



A patient-centred approach to follow-up

Chairs: Ingrid Kristensen, Sweden, and Simon Goldsworthy, UK



INGRID KRISTENSEN

There were seven very interesting talks in this session on a patient-centred approach to follow-up.

Jarkko Kauppinen from Kuopio, Finland, presented a mobile app that enables patients to keep track of their treatment times, instead of using a paper schedule. The app also includes daily alerts and reminders about how to prepare for treatment. So far it has just been tested in Finland, with a high degree of satisfaction from patients. Hopefully we will see it used in other countries as well.

Severine Cucchiaro from Liège, Belgium, presented methods to compare three different sources of patient information with the aim of improving their service. They compared information from individual complaints, satisfaction surveys and adverse events. From these sources they identified ways to improve parking facilities, provide more welcoming waiting areas and to improve communication.

Andrea Shessel from Toronto, Canada, presented a pilot study in which a group of radiation therapists (RTTs) were organised in a new way. Each RTT was partnered with a patient, becoming the patient's 'primary' RTT. The results from the pilot suggest improved continuity of care,

higher quality and safety, and improved patient experience. The pilot has been extended to include a larger group of patients and RTTs.

A study concerning radiation-induced oesophagitis in breast cancer patients was presented by Katrina West from Wentworthville, Australia. The researchers at the Westmead Hospital treated their breast cancer patients (including nodes in the supraclavicular (SCF) and/or the internal mammary chain (IMC)) with intensity-modulated radiation therapy (IMRT). Looking at 77 patients in total, they found that oesophagitis grade 2 were present in 24 patients. They found a difference in patients receiving >31 Gy (mean) if the irradiated oesophagus volume was greater than 1 cm.

Heather Nisbet from Oxford, UK, presented a study concerning skin care practice in the UK for breast cancer patients. In a guideline from 2015, only general guidance is given. The purpose of this study was to conduct a survey across the UK about which skincare products were recommended and to see if any one product was associated with fewer skin reactions. In total, 542 responses were analysed. No statistical difference between skin products was found. Weight, cup size, diabetes, cardiovascular disease, mastectomy and beam energy ✓

were all found to have statistically higher Radiation Therapy Oncology Group (RTOG) grades. The study confirms the guideline that any sodium lauryl sulphate (SLS)-free product can be used.

From Sydney, Australia, Hanh Nguyen presented a study on how healthcare professionals perceive the use of patient-reported outcomes (PROs) and patient-reported outcome measures (PROMs) in head and neck cancer care. Of participants, 58% were RTTs, of whom 59% had never even heard of PROs. The study identified barriers and enablers to routine use of PROs and PROMS. This will guide future interventions on the implementation of routine PRO collection.

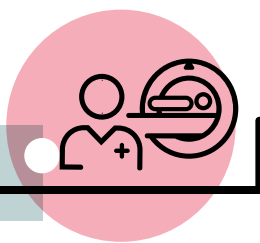
Lastly, Lotte van der Weijst from Ghent, Belgium, presented the Lung PLUS study. This study reports PROs for patients undergoing stereotactic body radiation therapy (SBRT) for early stage non-small cell lung cancer. The initial report indicates that there are no significant differences in overall toxicity, health-related quality of life and fatigue over time.

The session was very interesting with new techniques presented as well as patient-related data that will help us to improve our patients' experience during their time in our departments.



Ingrid Kristensen
Radiation Physics, Skåne University Hospital,
Sweden, RTT and PhD
Skåne, Sweden





Improving accuracy in patient positioning

Chairs: Lynsey Devlin, UK, and Sophie Perryck, Switzerland



LISA HAY

At this, my first ESTRO conference, I was excited to attend the radiation therapist (RTT) tracks and find out how other RTTs are improving patient care throughout Europe. The exhibition area was very impressive and to have the opportunity to observe and learn about the potential benefits of new equipment and technology available for future advances was very motivating.

The session on improving accuracy in patient positioning was interesting as the speakers were discussing work intended to assess the efficiency of technology and equipment designed to improve patient treatment experiences, while maximising patient comfort and set-up accuracy, prior to and during treatment delivery. I am sure all RTTs would agree that this is an extremely relevant topic, as optimising patient comfort and providing a positive treatment experience increases patient compliance with instructions given during their treatment preparation and positioning.

There were six speakers in the session discussing a number of innovative topics. The first speaker was Vincent Hamming from The Netherlands presenting an evaluation of AlignRT for deep inspiration breath hold (DIBH) positioning and intrafraction monitoring. Vincent reported that AlignRT can improve accuracy in positioning left-

sided breast cancer patients treated with DIBH compared to cone-beam computed tomography (CBCT). The active breathing, coordinator-guided breath holds minimised intrafraction variability and delivered good stability.

Next Leonard Mesch from The Netherlands described a clinical evaluation of the stability, patient comfort and ease in use of the new Nanor mask. The comparison of the Nanor, Efficast micro and Efficast maxi masks was undertaken to determine stability and patient comfort measurements between the mask types. The Nanor mask was reported by patients as feeling more comfortable and softer than the Efficast micro mask and appeared to marginally improve stability. RTTs using the different types of masks during completion of study questionnaires also agreed with these findings.

The third speaker of the session was Aoife Williamson from the UK, who gave an evaluation of the potential treatment delivery benefits of Varian HyperArc for brain metastases. Aoife evaluated the benefits of Varian Hyperarc for treatment delivery of brain metastases using the Encompass shell. Aoife stated that the accuracy of Encompass is comparable to the previous system, BrainLab. They found that the treatment position with Encompass is maintained ✓

during the delivery of the non-co-planar beams used for HyperArc, delivering the Linac-based stereotactic radiosurgery (SRS) with greater efficiency than 10XFFF volumetric modulated arc therapy (VMAT). The significant reduction in delivery time using Hyperarc could result in a clinically significant reduction of intrafraction motion.

Isabelle Gagne from Canada then presented on improving organs at risk (OAR) volumes during prostate radiation therapy using daily patient feedback and standardised protocols. Isabelle described the implementation of a standardised hydration and bowel preparation protocol (SHBPP), which resulted in meaningful reductions in variability of rectal volumes and slightly smaller bladder volumes at CTsim. Inconsistency of bladder volumes and rectal distensions >10mm was lowered by 3% at treatment using daily feedback recorded by the RTTs.

Nienke Weitkamp from Switzerland was next to present on the topic of whether surface-guided radiotherapy (SGRT) can be used with open masks to set-up head and neck cancer (HNC) patients and reduce intrafractional motion. Nienke presented an evaluation of the set up and treatment of head and neck cancer patients in an open mask with the aid of SGRT. The

initial set-up accuracy of an open mask (OM) with SGRT versus traditional closed mask (CM) system was investigated. Data from the SGRT system was used to evaluate intrafractional motion. The study demonstrated that SGRT allows for HNC treatment in an open mask with clinically acceptable set-up accuracy of less than 2mm in each direction. An open mask creates a better treatment experience for patients with claustrophobia. Additionally, OM allows monitoring and, if necessary, gating of radiotherapy delivery for swallowing motion, which could influence future planning target volume (PTV) definition.

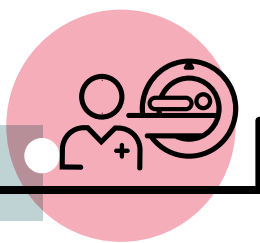
Finally, Genevieve Van Ooteghem from Belgium described the use of virtual reality animations (VRA), a new strategy to reduce patients' anxiety induced by radiotherapy. Genevieve reported the experience recorded when using the hypnotising VRA proposed by Oncomfort® in patients included in a trial assessing mechanically-assisted non-invasive ventilation (MANIV). This trial aimed to demonstrate the safety and the efficacy of MANIV to stabilise and modulate the breathing pattern without any sedation. Patients were connected to a mechanical ventilator and asked to give up control of their breathing, which caused some patients to experience anxiety. VRA was a good support for some very anxious

patients. However, other patients did not feel the benefit of this strategy, highlighting the need to adapt stress management strategies to individual patients.

As an RTT with a specialist interest in head and neck cancer, I found the discussions on immobilisation of the head and neck particularly interesting, generating ideas for future projects within my own department.



Lisa Hay
Research and development RTT
The Beatson West of Scotland Cancer Centre
Glasgow, UK



Report from teaching lecture 'MR-guided radiotherapy in the pelvic region'

Lecture given by: Dr Alison Tree,
The Royal Marsden Hospital Trust
and Institute of Cancer Research,
Uro-Oncology, London, UK



LAURA MULLANEY

Dr Alison Tree discussed her experiences and that of the radiation therapy team at The Royal Marsden, following the introduction into clinical practice of the Elekta Unity MR-Linac last year. She highlighted the clinical benefits of using the MR-Linac for prostate, rectum and gynaecological cancers.

The advantages of this system are many, including the superior soft tissue definition allowing for improved contouring and target delineation; the ability to tract intrafraction motion using cine MRI during dose delivery and, arguably the most important, allowing for daily adaptive re-planning treatment.

Dr Tree provided valuable insights in the workflow management for magnetic resonance-guided radiation therapy (MRgRT) using daily adaptive re-planning at the Linac. Currently, there are two radiation therapists (RTTs), two physicists and one doctor present at the console area at each fraction. Imaging is acquired, which is then fused with the image on which the reference plan was acquired. The doctor completes the contouring. The plan is then re-optimised on the MR scan of the day by the physicist, which is then accepted/or not by the doctor. Concurrently the initial plan checks are done and verification imaging is acquired by

the RTT to ensure no prostate motion during planning. If the verification image is consistent with the initial image, then the patient motion is monitored while the plan is approved. During planning a secondary independent dose check occurs for quality assurance. The patient is then treated with a cine-MRI monitoring the target and organs at risk (OAR) position during treatment delivery.

One of the current disadvantages with MRgRT is the vast workforce resources and multidisciplinary requirements for effective workflow. As the team becomes more experienced with MRgRT there may be a move towards fewer staff at the Linac, with the RTTs potentially taking over the contouring and planning roles and other staff members working remotely.

Another challenge with the constant MR imaging and the ability to change the plan daily, is a risk of over-intervention. Dr Tree gave an example of the small bowel lying close to the prostate on the daily image, with the plan adapted accordingly with reduced planning target volume (PTV) coverage; but on the verification imaging, the bowel had moved away due to bladder filling. This may have resulted in unnecessary under-dose to the target. ✕

Another challenge is to identify those patients who will receive the greatest clinical benefit from daily adaptive re-planning and ensure that they are prioritised for this new technology.

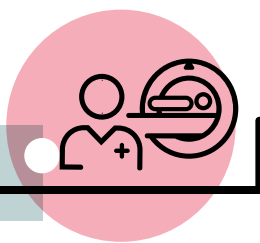
Dr Tree finished by touching on what the future might hold for MRgRT for prostate, including increased toxicity sparing, focusing on structures such as the penile bulb, urethra, neuro-vascular bundles and corpus cavernosum. This modality could also aid a move towards more extreme hypofractionated radiation therapy for prostate patients.

The teaching lecture provided the audience with a concise overview of the opportunities that MRgRT provides in the pelvic area and the associated specific complexities of MR-Linac implementation.



Laura Mullaney
Assistant Professor
Discipline of Radiation Therapy
School of Medicine
Trinity College Dublin
University of Dublin
Dublin, Ireland





Quality in image-guided radiation therapy (IGRT)



MADDALENA ROSSI

This first radiation therapist (RTT) symposium of the congress featured three excellent speakers.

The first speaker was Winnie Li, an associate professor and RTT from the University of Toronto and Princess Margaret Hospital, Toronto, Canada. Winnie provided an overview of what is needed when the workflow for image-guided radiation therapy (IGRT) is continuously changing. Not only are strategies required to train RTTs to register images, but RTTs must be aware of and trained to recognise anatomical changes that occur and be able to react to them. As information can change when it is passed on, Toronto have set up a number of methods to standardise and maintain the accuracy and precision of treatment delivery. These include annual refresher courses, multidisciplinary meetings and also reviewing registrations as a teaching aid. The RTTs have developed and implemented IGRT-led patient rounds, where challenging cases can be shared and discussed. All RTTs in the departments are also required to pass a new e-learning module.

The second speaker was Hans de Boer, a physicist from UMC Utrecht, The Netherlands. Hans spoke about developing standardised image guidance registration for the MR-linac. This relatively new treatment option delivers

diagnostic-quality soft-tissue contrast, which generates information that can be used to create an adaptive plan on the machine. He described the workflow of patient treatment on the MR-linac, where such an adaptive plan is in place. The patient can be scanned, and the plan adapted to the anatomical situation. Delineations can be adjusted as required, the dose optimised and then treatment can be delivered in one session on the treatment machine. This process requires very close collaboration between RTTs, physicists and radiation oncologists. Cine images can be acquired (e.g. of the prostate) and action can be taken if needed. The whole treatment procedure must be quick and efficient so that the adaptive plan delivers accurate treatment in a relatively short period of time. In the future, structured quality assurance items for treatment plans could result in an RTT-led adaptive treatment session, with support from a physicist and a radiation oncologist.

The third and final speaker was Leila Shelley, a physicist from the Edinburgh Cancer Centre, UK. She presented her PhD work for the VoxTox group. Her hypothesis was that delivered dose is a better predictor for toxicity than planned dose. The rectum was automatically segmented in patients treated for prostate cancer. The accumulated delivered dose and the planned ✓

dose metrics were assessed and compared with prospectively collected toxicity data and various clinical endpoints. Equivalent uniform dose (EUD) was the strongest predictor of toxicity. Delivered dose was more predictive of proctitis, and dose to some sub-regions was found to be significant for toxicity prediction. Leila also presented data from a colleague on head and neck toxicity. These showed that delivered dose to the swallowing organ at risk (OAR), although higher than the planned dose, had no effect on weight loss and was only borderline significant. In general, differences in head and neck patients between planned and delivered dose were smaller, but may be more significant. There were also three posters on this work presented at ESTRO (PO 0983, PO 0984 and EP 1922). Future work will include the use of radiomics and biomarkers to predict toxicity.

These three speakers demonstrated that IGRT is important in daily clinical practice. A structured approach by RTTs to training and teaching is achievable and will maintain accuracy and precision in treatment delivery.

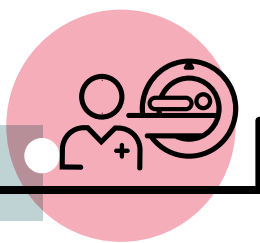
With the introduction of the MR-linac, there are new aspects to clinical practice that require a different approach to IGRT. Using IGRT can assist in the prediction of toxicity. This is because

delivered dose is a better predictor for toxicity than planned dose.



Maddalena Rossi
Senior research radiation therapy technologist
Radiation Oncology Department
The Netherlands Cancer Institute
Amsterdam, The Netherlands





RTT pre-meeting course: Basic course brachytherapy

The aim of this pre-meeting course at ESTRO 38 was to bring together brachytherapy radiation therapists (RTTs), nurses and dosimetrists from across Europe to share knowledge and experiences, and to arrive at a more uniform level of knowledge.

The topic of basic course brachytherapy was chosen because the field is rapidly evolving, with new imaging modalities and adaptive strategies emerging. This has led to new and changed roles in the brachytherapy team, including RTTs, nurses and dosimetrists. As the responsibilities of these three roles overlap, we decided to make them our target groups for this course. In addition, physicists and physicians who like to share aspects of their work with RTTs, nurses or dosimetrists were also welcome.

The day started with a session refreshing our knowledge of the topic, providing an overview of the principles of brachytherapy and safety issues in its modern form. In the second part of the course the focus moved to the roles of the RTT, nurse and dosimetrist in a modern brachytherapy setting. Although different in name, it seemed the three professions were doing many of the same tasks – providing patient care, assisting in the operation room, and assisting with imaging and treatment planning.

We also discussed the necessity for good education and new possibilities in this area. All the lectures prompted questions and discussions, which sometimes had to be postponed until the end of the afternoon. There was very good interaction between participants and course teachers.

In the afternoon, the group split into two, in order to share experiences and challenges from our own departments. The big issues that arose were lack of time and budget for education. In many departments, the brachytherapy team is small, so if an RTT joins a course, the department is left with a shortage of staff. In addition, financial resources are often limited.

This discussion resulted in a call to ESTRO to seek further financial resources to support the education of RTTs. There were also some great ideas for online knowledge sharing between RTTs working in the field.

The day ended with a light-hearted debate on the topic: “Only with an RTT, nurse and/or dosimetrist, is the brachytherapy team complete”. Sara Abdollahi, a physicist from Iran, was very brave in agreeing to argue against the motion. In fact, she provided a couple of valid arguments against involvement, particularly ✓



BERND WISGRILL

around how you establish responsibility for patient care with these different overlapping roles in a single team. This highlighted a need for legal embedding of the profession of RTTs, nurses and dosimetrists within the team. Out of this, a proposal arose to develop a pan-European certificate for brachytherapy RTTs, nurses, and dosimetrists.

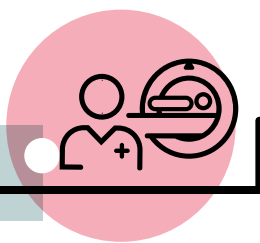
All in all, it was a good pre-meeting, which provided plenty of ideas for the future.



Bernd Wisgrill
Department of Radiation Oncology
Medical University of Vienna
Vienna, Austria



**Read a report by a research RTT on the
'Particle therapy' course in the School
Corner, p: 107**



My experience teaching at the head and neck OAR contouring workshop at ESTRO 38

It is a pleasure to write about my first experience teaching in the 'Fellowship in anatomic delineation and CONtouring (FALCON) head and neck organs at risk (OAR)' workshops at ESTRO 38. To introduce myself, I am a radiation therapist (RTT) who qualified in 2008 at Escola Superior de Tecnologia da Saude (ESTeSL) in Lisbon, Portugal. I worked in Portugal for about five years and after completing my MSc I moved to the UK in 2012. I have been working in the UK Radiotherapy Trials Quality Assurance (RTTQA) Group for the last four years. I also started a PhD fellowship this year, funded by the National Institute for Health Research (NIHR).

What is FALCON and how did I become a tutor?

FALCON is a radiotherapy outlining teaching programme organised by ESTRO. It contributes to reducing inter-observer variability in contouring and, ultimately, aims to equip clinicians with the skills to adequately interpret and follow outlining guidelines. Most importantly, it has the potential to impact on consistency across different institutions, allowing outcomes and toxicity results from clinical trials to be comparable so that we are all talking the same language. Online and live delineation workshops are hosted in which a panel of experts in the

field teach target and / or OAR outlining using the EDUCASE contouring platform.

My FALCON story started in 2014, when I was appointed as a tutor to provide support to students on the platform (EDUCASE) and to ensure good communication between students and teachers. I have contributed to several online and live target outlining workshops, including breast, lung stereotactic radiation therapy (SBRT), and head and neck. I have also contributed to the head and neck OAR contouring workshop.

This year, however, I was pleased to be invited to join Dr Jon Cacicedo at ESTRO 38 to teach at the head and neck OAR workshop. It was a fantastic opportunity. Although head and neck OAR outlining is one of my specialisms within my role at RTTQA, I was slightly nervous about being the first radiation therapist (RTT) to have a teaching position at a FALCON workshop.

The head and neck OAR workshop at ESTRO 38

Two workshops were held this year at ESTRO 38. The first, a pre-conference workshop, and the second, hosted on the first day of the main conference. ✓



ANA RITA SIMÕES

The structure of the workshop at ESTRO varies from the online workshops for which I have been a tutor over the past two years. The students were provided with a clinical case for OAR outlining in advance of the workshop. The first thing we discussed in the workshop was where most disagreement between participants was observed. This was followed by a presentation of the 2015 ESTRO guidelines, published by Brouwer and colleagues, where important anatomical landmarks were debated. Finally, participants were invited to modify their outlines as per the recommendations presented. After the second delineation, we saw significant improvements in outlining consistency with guidelines and inter-student homogeneity.

The role of an RTT in outlining

The vast majority of students in these workshops are clinicians. However, recently, there has been a noticeable increase in the number of RTTs enrolling. RTTs play a crucial role in delineating OARs in many centres and I think that it is very likely that this participation is going to increase. In the UK, OAR delineation is RTT-led for many tumour groups and, in some centres, we also contribute to target volume outlining, particularly for prostate and breast cancer. My own outlining competency was achieved

at Mount Vernon Hospital in the UK, where I completed a comprehensive competency framework, which was complementary to my undergraduate anatomy and outlining training. This training has provided me with the knowledge and expertise to be able to quality assure, against a protocol, outlining in a multicentre radiotherapy clinical trial setting, an integral part of my current UK RTTQA group role.

How can RTTs use these FALCON workshops?

As RTTs become more involved in clinical outlining, I expect to see increasing numbers of RTT students in these workshops. During FALCON workshops, we discuss with students OAR dose-volume constraints and how they relate to accurate delineations. This can support training of RTTs working in treatment planning and dosimetry. There is also the potential for the training to be applicable in other RTT roles, for example, anatomy training for imaging interpretation. RTTs can improve their skills in radiological anatomy, which can be directly transferred to treatment imaging assessment. This can help in identifying anatomy on cone beam computed tomography (CBCT), which are used by RTTs on a daily basis, and support decision-making. This is vital as centres move

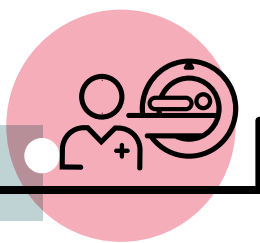
towards live planning and CBCT dose calculation.

Finally, if and when automated algorithms for delineation become a reality, and are more widely used for planning and adaptive online planning, it will be important to have RTTs trained to critically review software-based outlining and correct inaccuracies where required.

Overall, my first experience as a FALCON teacher was fantastic and I am proud to be the first RTT teaching OAR outlining at an ESTRO workshop. It was also great to catch up with students and FALCON friends and colleagues during ESTRO 38 in Milan. As our profession adapts to changes in radiotherapy, I hope that more of my RTT colleagues across Europe consider attending FALCON workshops.



Ana Rita Simões
UK Radiotherapy Trials Quality Assurance (RTTQA) Group,
Mount Vernon Hospital
Institute of Cancer Research
The Royal Marsden Hospital
London, UK



My first visit to an ESTRO annual congress

Although I've heard a great deal about the ESTRO congress, I have, until now, never had the pleasure of a visit. In this article, I tell you what ESTRO 38 was like for a first-timer.

About me

I am an RTT working at the Edinburgh Cancer Centre in the UK. I have experience of the treatment side of the patient pathway, but my main area of expertise, and the majority of my professional career has been concerned with pre-treatment imaging in the department. Just over a year ago I took up a brand-new role of 'research radiographer', a new position not only for me but also for my department.

The congress

By the time I arrived in Milan and checked in at my hotel, which was incidentally very conveniently located beside a metro stop, I had unfortunately missed the majority of the opening ceremony. Nevertheless, feeling slightly apprehensive, I decided to head down to the Mico centre to see what the networking session was all about and get a feel of the layout for the days ahead.

Up bright and early the next morning, I headed to the venue for the first day. First impressions: it's huge! Yes, it's an international conference,

as the 'European' in ESTRO would suggest, but nothing prepared me for the scale of the event.

As soon as I had confirmed my attendance, I started my prep. I read and re-read the programme booklet, studied abstracts that I felt were applicable to my area of expertise and interest, attempted to understand the floor plan and even considered (for a moment) taking part in the five kilometre Super Run taking place on the Sunday, so I thought I was fairly well prepared.

Even though I had visited the centre the previous evening, I felt slightly overwhelmed as I walked in on that first morning. I was struck by the enormity of the event, not just in terms of the size of the venue itself, but in the amount of people attending, with everyone seeming very focused on getting to their chosen presentations. I have attended national and international conferences before, but nothing on this scale. With a combination of the ESTRO app, a map of the floor plan, and some very helpful staff, I made my way to the conference rooms.

With such a huge choice of topics related to the field of radiation oncology, you could find yourself torn between sessions, especially if you have an area of special interest. ✍



JOANNE MITCHELL

As the only radiation therapist (RTT) attending from my department, I was aware how fortunate I was to be there, and I really wanted to be able to feedback to my colleagues as much as I could. I decided to mostly follow the RTT track. In doing so, I hoped I would gain an awareness of a broad spectrum of the current work that is being undertaken by my RTT colleagues around the globe.

With such a big programme and with an audience spanning so many different countries, each with its own unique healthcare system, it would be understandable if some of the talks were not relevant to your current practice. In fact, maybe I expected this to be the case. However, each and every one of the sessions I attended was relevant to my department's current practice, and possibly even future plans. The delivery, quality and content were first class too. The extremely high quality and diverse posters, either on display or stored electronically, served as a reminder, should anyone need it, of the vast amount of research that is continuously taking place in the world of radiation oncology. I was very fortunate to be invited to co-chair a poster viewing session, an amazing opportunity at such a conference. I found myself in awe of the work that had gone into the topics being reported and the actual posters themselves.

What is my advice to a first timer at a future ESTRO conference?

- Accommodation – take in to account wherever possible the distance from the venue and the local public transport when booking your stay. My hotel was perfectly situated about a 30-minute walk from the venue and was also on a metro line, making travelling to and from the conference or social events very easy, which, when travelling alone, could be a concern.
- Really do study the programme before you go, make a timetable, but expect to deviate somewhat. If you have more than one person attending from your department and you really want to take back as much information as possible, divide the sessions between you.
- Take the time to browse the exhibition hall. Initially I was so focused on absorbing as much as I could of all the sessions and posters on offer, that I didn't spend a great deal of time browsing the vendors. Prior to attending, ask in your department if there is anything anyone would like you to see so you can book a demo, if necessary. I was able to gain some valuable knowledge from a CT apps specialist one afternoon, along with a very good coffee!
- Enjoy and take part in the networking

opportunities. You may be tired at the end of a day, but they are an important part of the conference experience. Radiotherapy is a small world, and you have no idea who you may need to contact or visit throughout your professional career. In my view, it's always easier if you know a name and a face. In a conference of 6,500 people I managed to bump into an RTT colleague from The Netherlands who had very kindly taken me under her wing when I and a fellow student undertook an elective placement many years ago.

- Networking again: take part in speed dating. I joined the RTT session and thoroughly enjoyed it. It's a fantastic, quite amusing opportunity to see how your fellow professionals work around the globe.
- Wear comfortable shoes. Clocking up over 10,000 steps every day, there's a lot of walking involved.

What did I take home from ESTRO 38? A huge amount of information on image-guidance methods, procedures and protocols, new technologies and modalities, adaptive radiotherapy and motion management, MRI and its role in radiotherapy, quality assurance not only in the workplace, but also with clinical trials. I could go on and on. By embracing ✍

opportunities offered to me, I have been able to build my knowledge, skills and confidence when critiquing academic work, which can only benefit me in my current role.

The overriding message is that it was absolutely fantastic. I feel very proud to be a part of the workforce that contributes to this area of healthcare. Most importantly of all, I really want to go again next year.

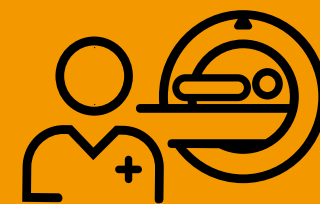


Joanne Mitchell
Research radiographer, radiotherapy
Edinburgh Cancer Centre
Edinburgh, UK



2019 **ESTRO** **RTT** Workshop

**Adaptation in a dynamic
environment – RTTs taking
the future in own hands**



8 November 2019
Budapest, Hungary

www.estro.org

Radiobiology





Sex bias in radiobiology research

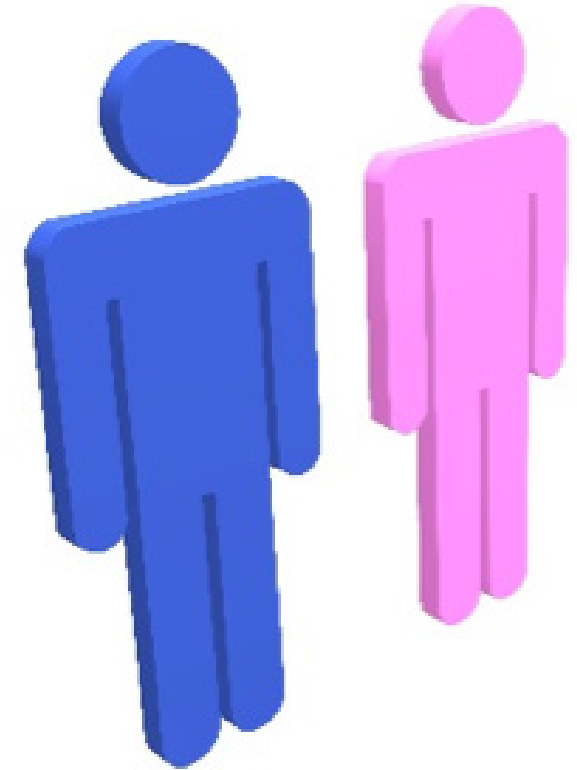
In a society that strives to offer men and women the same opportunities, rights and obligations, sex equality appears assumed in medicine. But in recent years genetic, cellular, biochemical and physiological differences between males and females are increasingly being reported. Sex was shown to matter when it comes to drug responses,¹⁻³ tissue regeneration,^{4,5} plaque formation,⁶ neuronal cell starvation⁷ and a variety of medical conditions, including cancer.^{8,9}

The issue of sex bias or sex dimorphism in science is real. This bias may be the result of earlier policies, such as the 1977 US Food and Drug Administration (FDA) guidelines, advising that women of childbearing potential should be excluded from drug trials. This exclusion was justified by the need to control for the variability in women's hormonal status. Although the 1990s saw a change towards medical research more inclusive of females in clinical trial enrolments, specific analysis of potential sex effects has been lacking from both pre-clinical and clinical studies. An analysis of basic and translational research in surgical biomedical research highlighted that 76% of cell lines studies did not specify the sex. Of those that did, only 21% included female and 1% reported sex-based results.¹⁰ Similar sex bias exist in otolaryngology¹¹ and orthopaedic¹² research.

So what is the situation in basic and translational radiobiological research and should sex matter too in radiation oncology?



Laure Marignol



Royalty-free image obtained from Dreamstime.com

The Case for Immunotherapy and radiation therapy combination protocols

The combination of immunotherapy with radiation therapy is increasingly gaining momentum. But sex is a variable that affects the functions of both the innate and adaptive immune systems.¹³ In their review, Klein et al.¹³ elegantly explain the sex-specific subtleties of the immune system. The authors highlight that while sex-based differences in immune responses are increasingly reported, less than 10% of articles in the field analyse data by sex¹⁴.

With regards to innate immunity, Klein et al. explain that the literature attributes some sex differences directly to sex steroids due to the presence of putative androgen and/or oestrogen response elements in the promoter



region of a number of critical genes.¹⁵ But the author also highlight that a role for the Toll-like receptor pathways and the induction of type I interferon responses is also likely. This follows from the observation that women appear to overexpress Toll-like receptor 7 (TLR7) when compared to men, leading to a higher production of Interferon alpha following TLR7 ligand stimulation¹⁶. Sex however also influences adaptive immunity, with several reports showing that females mice produce higher levels of T helper1-type cytokines¹⁷ such as interferon-gamma and harbour reduced numbers of regulatory T cells¹⁸, when compared to males.

Ultimately the authors outlines a number genetic, hormonal and environmental factors that can also be associated with the regulation of sex differences in immunity: differences in the type of regulatory response genes,¹⁹ as well as the amount of miRNAs present between the X and Y chromosomes,²⁰ genetic polymorphism linked to sex-specific antibody responses,²¹ and the microbiome²² to name a few.

These reports have implication in the use of immunotherapy in cancer patients. When compared to chemotherapy, a recent meta-analysis published in The Lancet Oncology concluded that immunotherapy is more likely to be more effective in men²³, and biomarkers predictive of immunotherapy outcomes may need to be developed in a sex-specific manner.⁸ This raises some questions regarding a possible impact of patient sex in radiation therapy studies.

The inclusion of both male and female cellular and animal models was made mandatory by the US National Institute of Health in 2014.²⁴ Taking lung cancer as an example, access to these models is possible, but not easily facilitated. A search for available models (human AND non-small cell lung cancer) identifies 41 available cell lines on one of the vendor's site, but with no option available to filter for sex, retrieval of this information requires the manual review of each product sheet. Of these 41 lines, 17 (41%) are female, 23 (56%) are male and 1 (2%) is non-specified. Researchers may alternatively choose to avail of a lung cancer pack consisting of 7 cell lines with varying degrees of genetic complexity, 5 of which are male. Yet the most commonly used cells include A549 and H460 cells, both male.

Although women are involved in clinical trials, with several studies carefully matching their patient population for sex, male dominance and avoidance of sex-related reporting is extremely high. Taking the example of lung cancer, a recent Cochrane review²⁵ reports that 74.8% of the participants included in the analysis were men, with one study failing to report the number of men and women included. A thorough analysis is required, but the rapid analysis of the 18 clinical studies included in a recent systematic review of the combination Stereotactic Ablative Radiotherapy with Immune checkpoint inhibitors²⁶ identifies that 12 studies report the number of males and female patients included in their patient baseline clinical and treatment characteristics. The numbers could not be determined in 3 studies and one did not provide this information. Four of the twelve studies included more women than men

(Female-to-male ratio ranging from 1.25 to 1.7). Only one study had balanced the number of men and women. Overall, these 12 studies collectively accounted for 20,212 women and 25,120 men.

None of these studies provide a sex-specific analysis of the study outcomes. A different picture may potentially arise from such an analysis. Especially in those trials that monitored the level of interferon -gamma associated genes as a measure of favourable immunologic changes in the tumor microenvironment.²⁷ In their study, Luke et al.²⁷ concluded that SBRT did not consistently increase IFN-γ-associated gene expression across patients. With a female-to-male ratio of 1.5, one might speculate whether the change could be attributed to patient's sex, and furthermore whether the high control rates reported are dominated by the response of one sex.

In light of these reports, the careful analysis of clinical trials testing the benefit of the combination of radiation therapy with any form of immunotherapy according to sex seems warranted, and future studies should adhere to The Sex and Gender Equity in Research (SAGER) guidelines.²⁸

The Sex As a Biological Variable policy

The National Institute of Health, through a new policy, requires researchers to factor sex into the design, analysis and reporting of vertebrate animal and human studies, in an attempt to enhance the reproducibility but ultimately address the lack of attention to the influence of sex in biomedical research. The latter may



be of particular importance in light of the 2001 report of the US Government Accountability Office highlighting that eight out of the ten drugs removed from the market between 1997 and 2001 posed greater health risk to women than men (Available from <http://www.gao.gov/products/GAO-01-286R>).

In her article, “Applying the new SABV (sex as a biological variable) policy to research and clinical care”,²⁹ Janine Austin Clayton of the Office of Research on Women’s health at the National Institute of Health in Bethesda, USA recognises that accounting for sex as a biological variable (SABV) is key to personalized medicine.

The first step requires researchers to distinguish between “sex”, a term related to the presence of XX or XY chromosomes in humans, from “gender”, a term associated with the social, cultural and psychological traits of human males and females.

In practical terms, Clayton recommends that Researchers include the terms “sex”, “gender”, “male” and “female” to their literature search to determine whether sex differences are known in their field of study, possibly expanding their search to the GenderMED database.³⁰

Studies are designed to include balance and randomization of the sexes, and where applicable sufficiently powered to detect sex differences.

Researchers systematically un-pool male and female data and repeat their analysis in a sex-specific manner.

Researchers specify the sex of any cells, animals or human participants included in their study, report and discuss study outcomes in a sex-specific manner when preparing their manuscript.

Ultimately, the adherence to these principles will expand our knowledge base of male and female biology and improve clinical care.

Sex and radiation responses

Sex-specific studies have highlighted that drugs may affect males and females differently. For instance, aspirin does not provide the same cardiovascular protective effect between men and women.³¹ But the impact of sex on the radiation response remains largely unstudied.

Studies in mice have identified that cell death programs are differentially regulated in males and females, in a process likely mediated by Poly-(ADP-Ribose) Polymerase-1 (PARP-1) and estrogens.³² Experimental data suggests that males are prone to PARP-1 necrosis, whereas in females, cell death is PARP-1 independent and dominated by caspase-dependent apoptosis.³³ These findings are supported by report of sex differences in basal redox state,³⁴ response to oxidative stress,³⁵ sensitivity to both apoptosis and autophagy.³⁶ Considering the importance of all these processes in the radiation response of cells, radiobiological differences between male and female cells can be hypothesised.

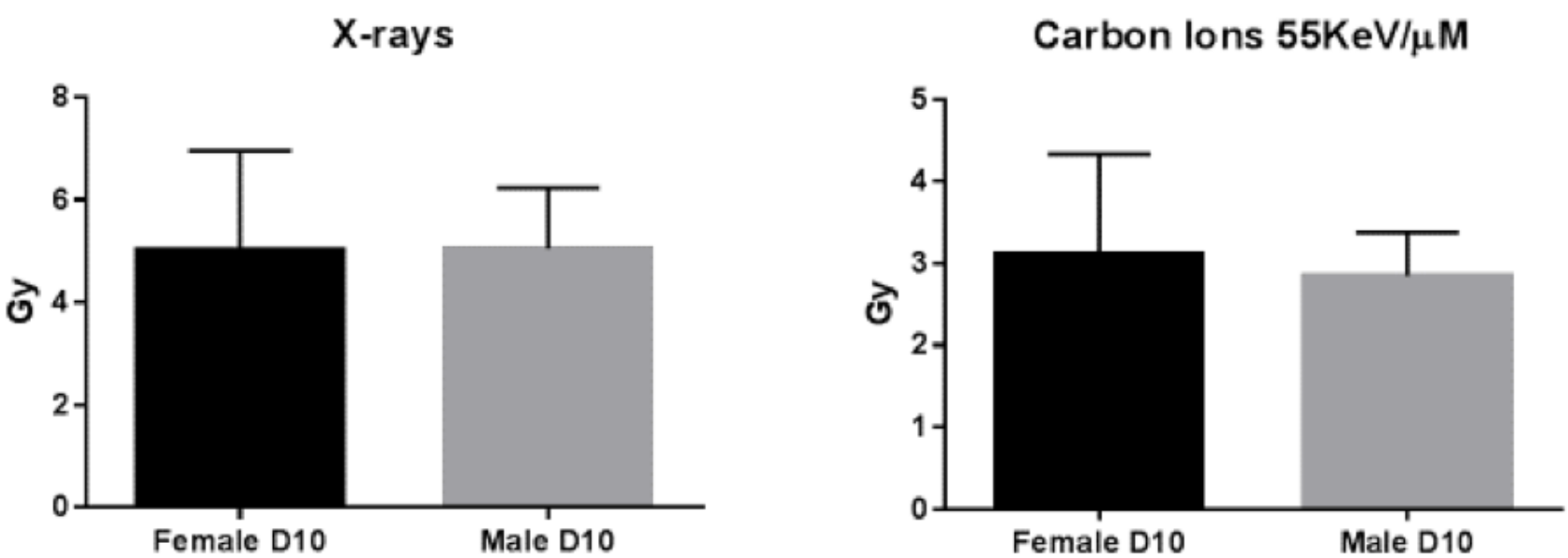


Figure 1: Mean and standard deviation of the D₁₀ values reported for a panel of nine melanoma cancer cell lines irradiated with either x-rays or carbon ions according to cell line’s sex. Adapted from Aldo et al. 2016. N=5 female cell lines (92-1, HMV-I, HMV-II, Colo679, GAK) and N= 4 male cell lines (MeWo, C32TG, G361, OMM-1)

The mathematical modelling of the radiation survival curve, both through the use of the multi-target and the linear-quadratic model, has helped elucidate the radiosensitivity of cells and perhaps these parameters could begin to help test this hypothesis. In 1983, Carney et al. investigated the radio-sensitivity of a panel of lung cancer cell lines and reported a large variability in D_0 values.³⁷ Unfortunately all five small cell lung cancer cell lines used were male. But interestingly, of the two large cell cell lines, one was female and exhibits a lower D_0 value (80 rad / 0.8Gy) than the male cell line (91 rad / 0.91Gy). Similarly, Ando et al. reviewed the radiosensitivity of a panel of melanoma cell lines in response to x-rays and carbon-ions (55keV/ μ m).³⁸ Although the authors did not report on the sex of the lines used, 5 were female and 4 were male. However no difference can be seen between the D_{10} values reported under both irradiation conditions (Figure 1).

Some reports of sex differences in radiation responses do exist. Exposure to low dose radiation was associated with sex-specific modifications in the expression of Ras superfamily members, protein kinase C isoforms and AP-1 factor components.³⁹ In female glioma patients, concomitant AIB1 and HER2 amplification were closely related to shorter survival time and radiotherapy resistance,⁴⁰ and the analysis of MR scans identified higher cell proliferative rate, inflammation and vasogenic oedema in glioma-bearing male rats.⁴¹

Perhaps sex differences might have a greater impact in patient care. Do male and female patients require different supporting care? And importantly should radiotherapy be monitored



Royalty-free image obtained from Dreamstime.com

differently? With regards to clinical care, Clayton highlights that providers should be concerned with the chief complaint and symptoms of men and women; the sex-specific norms of standard lab values, and susceptibility to disease. For instance, women are more prone to dry eye disease and cataracts.⁴² In irradiated mice, the induction of cataract was accelerated by estrogens.⁴³ Sex-specific analysis of cataract incidence and dose-response modelling in patients treated with radiotherapy may thus be warranted.

However the biggest consideration may come from the increased recognition of sex differences in the perception of pain.^{44, 45} Sensitivity to pain seems to be mediated by microglia in males and T-lymphocytes in females.⁴⁶ Analysis of

the quality of life of male and female patients NCIC CTG Sc.23 randomized trial revealed that within the good responders to that palliative radiotherapy regimen, men were more likely to report a change in the psychological aspect of the QLQ-BM22 questionnaire, whereas women reported improvement in the emotional aspect of the QLQ-C15-PAL questionnaire.⁴⁷

Conclusion

If sex matters in science, it is likely to matter in radiation oncology. Like other fields of medicine, the careful review of the literature is highly likely to identify a lack of inclusion of sex as a biological variable. What the literature to date tells us is that sex needs to be not to be only controlled for but also analysed against. The consequences on the sample sizes in both our pre-clinical and clinical studies will not be trivial, but the gains could be huge.

Laure Marignol
Trinity College Dublin
Dublin, Republic of Ireland



REFERENCES

- [1] Jager, U. et al. Rituximab serum concentrations during immuno-chemotherapy of follicular lymphoma correlate with patient gender, bone marrow infiltration and clinical response. *Haematologica* **97**, 1431-8 (2012).
- [2] Cristina, V. et al. Association of Patient Sex With Chemotherapy-Related Toxic Effects: A Retrospective Analysis of the PETACC-3 Trial Conducted by the EORTC Gastrointestinal Group. *JAMA Oncol* **4**, 1003-1006 (2018).
- [3] Rose, T.L., Deal, A.M., Nielsen, M.E., Smith, A.B. & Milowsky, M.I. Sex disparities in use of chemotherapy and survival in patients with advanced bladder cancer. *Cancer* **122**, 2012-20 (2016).
- [4] Sutti, S. & Tacke, F. Liver inflammation and regeneration in drug-induced liver injury: sex matters! *Clin Sci (Lond)* **132**, 609-613 (2018).
- [5] Deasy, B.M. et al. A role for cell sex in stem cell-mediated skeletal muscle regeneration: female cells have higher muscle regeneration efficiency. *J Cell Biol* **177**, 73-86 (2007).
- [6] Nelson, W.D. et al. Sex-dependent attenuation of plaque growth after treatment with bone marrow mononuclear cells. *Circ Res* **101**, 1319-27 (2007).
- [7] Du, L. et al. Starving neurons show sex difference in autophagy. *J Biol Chem* **284**, 2383-96 (2009).
- [8] Wang, S., Zhang, J., He, Z., Wu, K. & Liu, X.S. The predictive power of tumor mutational burden in lung cancer immunotherapy response is influenced by patients' sex. *Int J Cancer* (2019).
- [9] Frega, S. et al. Heterogeneous tumor features and treatment outcome between males and females with lung cancer (LC): Do gender and sex matter? *Crit Rev Oncol Hematol* **138**, 87-103 (2019).
- [10] Yoon, D.Y. et al. Sex bias exists in basic science and translational surgical research. *Surgery* **156**, 508-16 (2014).
- [11] Stephenson, E.D., Farzal, Z., Kilpatrick, L.A., Senior, B.A. & Zanation, A.M. Sex bias in basic science and translational otolaryngology research. *Laryngoscope* **129**, 613-618 (2019).
- [12] Bryant, J., Yi, P., Miller, L., Peek, K. & Lee, D. Potential Sex Bias Exists in Orthopaedic Basic Science and Translational Research. *J Bone Joint Surg Am* **100**, 124-130 (2018).
- [13] Klein, S.L. & Flanagan, K.L. Sex differences in immune responses. *Nat Rev Immunol* **16**, 626-38 (2016).
- [14] Beery, A.K. & Zucker, I. Sex bias in neuroscience and biomedical research. *Neurosci Biobehav Rev* **35**, 565-72 (2011).
- [15] Hannah, M.F., Bajic, V.B. & Klein, S.L. Sex differences in the recognition of and innate antiviral responses to Seoul virus in Norway rats. *Brain Behav Immun* **22**, 503-16 (2008).
- [16] Berghofer, B. et al. TLR7 ligands induce higher IFN-alpha production in females. *J Immunol* **177**, 2088-96 (2006).
- [17] Roberts, C.W., Walker, W. & Alexander, J. Sex-associated hormones and immunity to protozoan parasites. *Clin Microbiol Rev* **14**, 476-88 (2001).
- [18] Ziegler, S.M. et al. Human pDCs display sex-specific differences in type I interferon subtypes and interferon alpha/beta receptor expression. *Eur J Immunol* **47**, 251-256 (2017).
- [19] Libert, C., Dejager, L. & Pinheiro, I. The X chromosome in immune functions: when a chromosome makes the difference. *Nat Rev Immunol* **10**, 594-604 (2010).
- [20] Pinheiro, I., Dejager, L. & Libert, C. X-chromosome-located microRNAs in immunity: might they explain male/female differences? The X chromosome-genomic context may affect X-located miRNAs and downstream signaling, thereby contributing to the enhanced immune response of females. *Bioessays* **33**, 791-802 (2011).
- [21] Scepanovic, P. et al. Human genetic variants and age are the strongest predictors of humoral immune responses to common pathogens and vaccines. *Genome Med* **10**, 59 (2018).
- [22] Rizzetto, L., Fava, F., Tuohy, K.M. & Selmi, C. Connecting the immune system, systemic chronic inflammation and the gut microbiome: The role of sex. *J Autoimmun* **92**, 12-34 (2018).
- [23] Conforti, F. et al. Cancer immunotherapy efficacy and patients' sex: a systematic review and meta-analysis. *Lancet Oncol* **19**, 737-746 (2018).
- [24] Clayton, J.A. & Collins, F.S. Policy: NIH to balance sex in cell and animal studies. *Nature* **509**, 282-3 (2014).
- [25] Zhu, J. et al. Immunotherapy (excluding checkpoint inhibitors) for stage I to III non-small cell lung cancer treated with surgery or radiotherapy with curative intent. *Cochrane Database Syst Rev* **12**, CD011300 (2017).
- [26] Chicas-Sett, R. et al. Stereotactic Ablative Radiotherapy Combined with Immune Checkpoint Inhibitors Reboots the Immune Response Assisted by Immunotherapy in Metastatic Lung Cancer: A Systematic Review. *Int J Mol Sci* **20** (2019).
- [27] Luke, J.J. et al. Safety and Clinical Activity of Pembrolizumab and Multisite Stereotactic Body Radiotherapy in Patients With Advanced Solid Tumors. *J Clin Oncol* **36**, 1611-1618 (2018).
- [28] Heidari, S., Babor, T.F., De Castro, P., Tort, S. & Curno, M. Sex and Gender Equity in Research: rationale for the SAGER guidelines and recommended use. *Res Integr Peer Rev* **1**, 2 (2016).
- [29] Clayton, J.A. Applying the new SABV (sex as a biological variable) policy to research and clinical care. *Physiol Behav* **187**, 2-5 (2018).
- [30] Oertelt-Prigione, S., Gohlke, B.O., Dunkel, M., Preissner, R. & Regitz-Zagrosek, V. GenderMedDB: an interactive database of sex and gender-specific medical literature. *Biol Sex Differ* **5**, 7 (2014).
- [31] Berger, J.S. et al. Aspirin for the primary prevention of cardiovascular events in women and men: a sex-specific meta-analysis of randomized controlled trials. *JAMA* **295**, 306-13 (2006).
- [32] Ortona, E., Matarrese, P. & Malorni, W. Taking into account the gender issue in cell death studies. *Cell Death Dis* **5**, e1121 (2014).
- [33] Jog, N.R. & Caricchio, R. Differential regulation of cell death programs in males and females by Poly (ADP-Ribose) Polymerase-1 and 17beta estradiol. *Cell Death Dis* **4**, e758 (2013).

- [34] Malorni, W., Campesi, I., Straface, E., Vella, S. & Franconi, F. Redox features of the cell: a gender perspective. *Antioxid Redox Signal* **9**, 1779-801 (2007).
- [35] Penaloza, C. et al. Sex of the cell dictates its response: differential gene expression and sensitivity to cell death inducing stress in male and female cells. *FASEB J* **23**, 1869-79 (2009).
- [36] Lista, P., Straface, E., Brunelleschi, S., Franconi, F. & Malorni, W. On the role of autophagy in human diseases: a gender perspective. *J Cell Mol Med* **15**, 1443-57 (2011).
- [37] Carney, D.N., Mitchell, J.B. & Kinsella, T.J. In vitro radiation and chemotherapy sensitivity of established cell lines of human small cell lung cancer and its large cell morphological variants. *Cancer Res* **43**, 2806-11 (1983).
- [38] Ando, K. & Goodhead, D.T. Dependence and independence of survival parameters on linear energy transfer in cells and tissues. *J Radiat Res* **57**, 596-606 (2016).
- [39] Besplug, J. et al. Sex and tissue-specific differences in low-dose radiation-induced oncogenic signaling. *Int J Radiat Biol* **81**, 157-68 (2005).
- [40] Sui, F. et al. Gender-related differences in the association between concomitant amplification of AIB1 and HER2 and clinical outcomes in glioma patients. *Pathol Res Pract* **214**, 1253-1259 (2018).
- [41] Perez-Carro, R., Cauli, O. & Lopez-Larrubia, P. Multiparametric magnetic resonance in the assessment of the gender differences in a high-grade glioma rat model. *EJNMMI Res* **4**, 44 (2014).
- [42] Clayton, J.A. & Davis, A.F. Sex/gender disparities and women's eye health. *Curr Eye Res* **40**, 102-9 (2015).
- [43] Dynlacht, J.R. et al. Effect of estrogen on radiation-induced cataractogenesis. *Radiat Res* **165**, 9-15 (2006).
- [44] Mogil, J.S. & Bailey, A.L. Sex and gender differences in pain and analgesia. *Prog Brain Res* **186**, 141-57 (2010).
- [45] Rosen, S.F. et al. Increased pain sensitivity and decreased opioid analgesia in T-cell-deficient mice and implications for sex differences. *Pain* **160**, 358-366 (2019).
- [46] Sorge, R.E. et al. Different immune cells mediate mechanical pain hypersensitivity in male and female mice. *Nat Neurosci* **18**, 1081-3 (2015).
- [47] Chow, S. et al. Gender differences in pain and patient reported outcomes: a secondary analysis of the NCIC CTG SC. 23 randomized trial. *Ann Palliat Med* **6**, S185-S194 (2017).



School





“This year, the ESTRO School is hosting over 50 educational activities.”

We are halfway through 2019 and already more than 1,900 participants have taken part in our ESTRO educational activities. More than 800 attended a live course in Europe; more than 400 attended a course outside Europe; more than 500 attended one of the courses preceding ESTRO 38; and more than 100 took part in a blended contouring workshop.

This year, the ESTRO School is hosting over 50 educational activities. Offering such an extensive educational portfolio year after year would not be possible without more than 50 course directors and their faculties. They are crucial to the success of the ESTRO School as they selflessly volunteer their time and energy to share their expertise with their peers.

To support and strengthen these faculties, the ESTRO Education Council organised its fifth retreat for ESTRO teachers, prior to the annual congress in Milan. More than 60 participants were wildly enthusiastic about the thought-provoking workshop by Jean-Luc Doumont. They were inspired by his creative approach to teaching and very practical ideas to improve teaching presentations and, consequently, learning. Equipped with extra knowledge and skills, these teachers will continue to provide excellent courses in 2019 and 2020.

Next year, two new courses are planned: ‘In-room MRI guided radiotherapy’ and ‘Dosimetric auditing’. Keep an eye on the new ESTRO website from September to find out all about next year’s educational programme. From now on we are going green and digital and will no longer provide a printed ESTRO School guide.

We wish you a wonderful summer and hope to meet you very soon in the School.



Jesper Eriksen, Marie-Catherine Vozenin and Christine Verfaillie



JESPER ERIKSEN
Member and chair of the
education council



MARIE-CATHERINE
VOZENIN
Member of the education
council



CHRISTINE VERFAILLIE
Managing director
Head Education and Science



FALCON: 2019 online workshops programme

Mark your calendar >>



Mark your calendar

ESTRO members can benefit from a discount on the registration fee to attend an online workshop.

2019 ONLINE CONTOURING WORKSHOPS

Each online workshop includes two sessions

Anal cancer	25 September 2019	2 October 2019
OAR - abdomen	8 October 2019	15 October 2019
Head and neck cancer	12 November 2019	19 November 2019
Liver SBRT	2 December 2019	9 December 2019



Course reports

3rd ESTRO-AROI Gynaecological Teaching Course >>

14-17 March 2019 | Rishikesh, India

ESTRO particle therapy course >>

18-22 March 2019 | Groningen, The Netherlands

Dose modelling and verification for external beam
radiotherapy >>

19-23 May 2019 | Lisbon, Portugal



3rd ESTRO-AROI Gynaecological Teaching Course

14 -17 March 2019

Rishikesh, India

ESTRO course directors:

- Richard Pötter, Radiation Oncologist, Medical University Hospital, Vienna, Austria
- Kari Tanderup, Medical Physicist, University Hospital, Aarhus, Denmark

AROI course directors:

- Umesh Mahantshetty, Radiation Oncologist, Tata Memorial Hospital, Mumbai, India
- Jamema Swamidas, Medical Physicist, ACTREC, Tata Memorial Centre, Mumbai, India



DEBOLEENA
MUKHERJEE

The third ESTRO-Association of Radiation Oncologists in India (AROI) Gynaecological Teaching Course was held in the beautiful city of Rishikesh, Uttarakhand, India.

The theme of the teaching programme was '3D radiotherapy, with a special emphasis on the implementation of MRI / CT-based brachytherapy in cervical cancer'. In total, there were 105 participants, mainly from India and a number of south-east Asian countries. The participants enjoyed systematic and structured scientific sessions, and warm hospitality from the prestigious host institute, the All India Institute of Medical Sciences (AIIMS) hospital, located in the foothills of the Himalayas.

During the course, emphasis was placed on the role of clinical gynaecological examination (eyes and fingers) and staging using the tumour, node, metastasis (TNM) system, the new Federation of Gynaecology and Obstetrics (FIGO) system and the American Joint Committee on Cancer (AJCC) system. Imaging protocols for radiation planning were also discussed, including fluoroscopic simulation, virtual CT simulation, ultrasound, PET-CT, MRI, and the delineation of gross, clinical and internal target volumes (GTV-CTV-ITV) in external beam radiotherapy (EBRT), including the EMBRACE studies. We also discussed the

management and treatment planning of the para-aortic nodal region, dose-volume histogram (DVH) analysis and use of the EQD2 spreadsheet.

Medical physicists were divided into three groups for carrying out practical hands-on training on treatment planning systems using various applicators, including M/s Elekta, Varian and Bebig systems. There was a panel discussion, feedback and evaluation of homework on EBRT and brachytherapy cases from various hospitals in India, using Varian Cloud and CITRIX systems in the computer lab. We were shown an outstanding audio-video presentation on patient preparation and commissioning, and reconstruction of applicators. We were also able to observe auto radiography using Gafchromic films of applicators on a high-dose-rate brachytherapy machine in the radiotherapy department at AIIMS.

We discussed the physics aspects of treatment planning of intracavity brachytherapy (Fletcher / Manchester, Tandem / Ring), the Moulage technique and the limitations of using standard loading patterns +/- interstitial techniques in cervix cancer. The highlight of the course was the high degree of audience engagement and interaction using smart phones to vote on questions asked during lectures, and the

multiple choice question sessions at the end of the course.

The central message of the course was to refine the concepts of brachytherapy and emphasise the dose reporting parameters, as well as to form a gynaecological network to share experiences through brachytherapy videos and to help each other achieve the best treatment outcomes.

The course came to an end with closing remarks from the ESTRO course directors, Dr Richard Pötter and Dr Kari Tanderup, the AROI course directors, Dr Umesh Mahantshetty and Dr Jamema Swamidas, the teachers, Dr Christine Haie Meder and Dr Daya Nand Sharma, and the course organiser, Dr Manoj Gupta. The eminent speakers and the course coordinator, Ms Melissa Vanderijst, aptly supported all the enthusiastic participants and made this event a great success.

A special thanks to my family and my radiation oncologist, Dr Sachin Taneja, for encouraging me to attend this excellent teaching course. I look forward to joining similar courses in the future.



Deboleena Mukherjee
Medical physicist and RSO
Radiation Oncology Centre
Indian Naval Hospital Ship Asvini,
Mumbai, India





ESTRO particle therapy course

18-22 March 2019

Groningen, The Netherlands

Course directors:

- Oliver Jäkel, Medical Physicist, German Cancer Research Centre (DKFZ) and Heidelberg Ion Beam Therapy Centre, Heidelberg, Germany
- Marco Krengli, Radiation Oncologist, University of Piemonte Orientale & Centro Nazionale Adroterapia Oncologica (CNAO), Pavia, Italy



Participants at the particle therapy course



KOEN CRAMA

I was one of 100 participants that took part in the recent ESTRO particle therapy course in Groningen, The Netherlands. The group was surprisingly diverse. The radiation therapists (RTTs) were in the minority, and I wasn't expecting so many radiation oncologists (almost 50% of the group). There were participants from 24 different countries, some with a lot of experience in particle therapy and others with very little.

This made for an interesting and enjoyable group to spend the week with. There was lots of interaction with between participants and the faculty, and also some very good discussion among the faculty themselves. This goes to show that although particle therapy is not a new technique, there is still a lot to learn, especially in relation to carbon ion therapy. ✍

There were refresher lectures at the beginning of days one and two for RTTs, and anyone else who wanted to join them. These covered some basic physics and clinical aspects of particle therapy on day one and basic radiobiology on day two. The first day provided a really effective overview of the basics. There were good presentations on particle generation, accelerator technology, and the radiation biology of particles. At times it felt a bit rushed and I think it would be easy to fill three whole days with the basic principles of particle therapy. We closed the day with a city walk through the ancient city of Groningen. Even I, as someone who is from The Netherlands, learned a lot about the history of Groningen. This was followed by an enjoyable social event in a former residence of the King.

Days two, three and four involved a mixture of clinical talks, which covered the indications and evidence in the literature for all kinds of tumour groups. The rest of the time was filled with more practical topics, such as image guidance, organ motion management and cost effectiveness. As an RTT, I really liked the more practical sides of the course. We discussed some common techniques, and also some research projects being undertaken at the participating institutions. At the end of the second day we were able to visit the new proton therapy centre

at University Medical Centre Groningen (UMCG), which has been open for a year now. The facility is able to offer all the latest techniques and is dedicated to irradiation treatment for children. In The Netherlands, only UMCG is allowed to treat patients with protons. The last day was reserved for discussion as a group.

One of the things that I really liked about the week, was that the faculty were prepared to be critical of the evidence and utility of particle therapy. Of course, they promoted particle therapy, but on many occasions, they also warned – with substantiation – that poorly designed research projects would show no benefits associated with proton therapy.

I was really happy with the quality of the course. I would recommend it to other people, but especially medical physicists and radiation oncologists. For RTTs, I do think the course is a bit too clinically focused and not practical enough, but that's my opinion. You can see what you think in 2020.



Koen Crama
Research RTT / dosimetrist
Amsterdam Academic Medical Centre
Amsterdam, The Netherlands
k.f.crama@amc.nl



Dose modelling and verification for external beam radiotherapy

19-23 May 2019
Lisbon, Portugal

Course directors:

- Tommy Knöös, Medical Physicist, Skåne University Hospital and Lund University, Lund, Sweden
- Brendan McClean, Medical Physicist, St Luke's Radiation Oncology Network, Dublin, Ireland



ISAK WAHLSTEDT



Whether you are a medical physicist working with external beam radiotherapy (EBRT) or an experienced dosimetrist performing treatment planning, this dose modelling and verification for EBRT course is useful in giving you a fundamental understanding of your treatment planning system (TPS). For me, this course was a link between theoretical dosimetry and the colourful isodose lines produced by your TPS. Whether you are commissioning a new TPS, implementing a new Linac, or just looking for a better understanding of the physics and mathematics behind your TPS, this course would be of great value.

Apart from general theory behind, for example, fluence, radiation transport, Linac head design,

and dose calculation, the course provides specific insight into the functionality of commercially available treatment planning systems. In addition, you can get specific advice tailored to your clinic; for example, on what detectors to use for small field dosimetry, whether you should use dose to medium or dose to water and the consequences of this, or how to decide upon useful action limits for patient-specific quality assurance.

The lectures were excellent, each building on knowledge from previous lectures. Most days started with recap multiple-choice questions (MCQ) and ended with practical exercises. The MCQ sessions were fun and a useful aid for memorising the most important take-home ✓



Course group picture

messages of the previous day. The practical exercises gave us the opportunity of using our knowledge and applying it to specific problems. Some of these problems were given as part of the course preparation material and some during the course.

The course venue was the Sana Metropolitan Hotel in the beautiful and charming city of Lisbon. The city was at its best, with lovely sunny weather and the beautiful lavender-coloured blossom of the jacaranda trees decorating

the streets. The social event was an enjoyable walking tour of the city centre, that took in the thousands of football fans celebrating the Lisbon team Benfica's victory in the top Portuguese football league. The walking tour took us to spots such as Rossio Square, Santa Justa Lift, and the viewpoint of São Pedro de Alcântara. It ended with a meal at a lovely traditional Portuguese restaurant.

I congratulate the course directors, project manager, teachers and local organisers for

putting together a course that gave participants a better theoretical understanding of our TPS and useful advice for our clinics.

Isak Wahlstedt
Medical physicist
Rigshospitalet, Copenhagen, Denmark
isak.hannes.wahlstedt@regionh.dk



POSTGRADUATE COURSES IN EUROPE

Image-Guided Radiotherapy in Clinical Practice

17-21 February 2019 | Porto, Portugal

Basic Clinical Radiobiology

3-7 March 2019 | Brussels, Belgium

Comprehensive and Practical Brachytherapy

3-7 March 2019 | Athens, Greece

Particle Therapy

18-22 March 2019 | Groningen, The Netherlands

Lower GI – Technical and Clinical Challenges for Radiation Oncologists

20-22 March 2019 | Amsterdam, The Netherlands

Upper GI – Technical and Clinical Challenges for Radiation Oncologists

23-26 March 2019 | Amsterdam, The Netherlands

Foundation of Leadership in Radiation Oncology

26 April 2019 | Milan, Italy

Advanced Skills in Modern Radiotherapy

19-23 May 2019 | Brussels, Belgium

Multidisciplinary Management of Prostate Cancer

19-23 May 2019 | Pisa, Italy

Dose Modelling and Verification for External Beam Radiotherapy

19-23 May 2019 | Lisbon, Portugal

Target Volume Determination – From Imaging to Margins

2-5 June 2019 | Athens, Greece

IMRT and Other Highly Conformal Techniques in Practice

2-6 June 2019 | Budapest, Hungary

Evidence Based Radiation Oncology

24-29 June 2019 | Montpellier, France

Clinical Practice and Implementation of Image-Guided Stereotactic Body Radiotherapy

1-5 September 2019 | Florence, Italy

Physics for Modern Radiotherapy

A joint course for clinicians and physicists

8-12 September 2019 | Riga, Latvia

Advanced Treatment Planning

22-26 September 2019 | Budapest, Hungary

Imaging for Physicists

29 September - 3 October 2019 | Manchester, UK

Image-Guided Radiotherapy and Chemotherapy in Gynaecological Cancer: Focus on MRI Based Adaptive Brachytherapy

12-16 October 2019 | Cluj, Romania

Comprehensive Quality Management in Radiotherapy – Quality Assessment and Improvement

13-16 October 2019 | Dublin, Ireland

Best Practice in Radiation Oncology

Train the RTT (Radiation Therapists) Trainers - Part II

14-16 October 2019 | Vienna, Austria

Positioning and Immobilisation for Radiation Therapy

19-20 October 2019 | Brussels, Belgium

Multidisciplinary Management of Breast Cancer

27-30 October 2019 | Budapest, Hungary

Research Course in Radiation Oncology

How to develop research/validation programmes when implementing new technology?

Edition 1: MRI Linac

3-6 November 2019 | Madrid, Spain



Research Course in Radiotherapy Physics

3-6 November 2019 | Madrid, Spain

ESTRO/ESOR Multidisciplinary Approach of Cancer Imaging

4-5 November 2019 | Amsterdam, The Netherlands

Multidisciplinary Management of Non-Melanoma Skin Cancer

7-9 November 2019 | Brussels, Belgium

Palliative Care and Radiotherapy

A course on prognosis, symptom control, re-irradiation, oligometastases

26-28 November 2019 | Brussels, Belgium

Paediatric Malignancies

1-3 December 2019 | Utrecht, The Netherlands

Multidisciplinary Management of Brain Tumours

1-3 December 2019 | Brussels, Belgium

PRE-MEETING COURSES

Eight Pre-Meeting Courses at ESTRO 38

26 April 2019 | Milan, Italy

POSTGRADUATE COURSES OUTSIDE EUROPE

3D Radiotherapy with a Special Emphasis on Implementation of MRI/CT Based Brachytherapy in Cervical Cancer

14-17 March 2019 | Rishikesh, India

Palliative Care and Radiotherapy

A course on prognosis, symptom control, re-irradiation, oligometastases

26-28 March 2019 | Manila, Philippines

Combined Drug-Radiation Treatment: Biological Basis, Current Applications and Perspectives

7-9 June 2019 | Seoul, South Korea

Multidisciplinary Management of Head and Neck Oncology

28-31 October 2019 | Mexico City, Mexico

Advanced Technologies

9-12 November 2019 | India, venue to be announced

Advanced Technologies

24-27 November 2019 | Beijing, China

UNDERGRADUATE COURSES

Medical Science Summer School Oncology for Medical Students

15-27 July 2019 | Vienna, Austria

ESO-ESSO-ESTRO Multidisciplinary Course in Oncology for Medical Students

26 August - 6 September 2019 | Turin, Italy

Young ESTR0





“ESTRO 38: an overview of all the sessions, topics and a glimpse of the three prize-winning abstracts for the Young Poster Award.”

Dear readers,

In this issue of the Young Corner we feature a report from Pierfrancesco Franco on ESTRO 38. He discusses both the Young Track, with an overview of all the sessions and topics, and the Young Poster Award, offering a glimpse of the three prize-winning abstracts. You can also find, thanks to Ludwig Dubois, the complete list of the questions delivered during the quiz, the traditional conclusion for the Young Track at the annual congress. This year's lucky winner received a free registration for an ESTRO School course.

This Corner also includes two mobility grant reports. Finally, we have the pleasure of welcoming Elisabet Gonzalez, third-year resident in the Radiation Oncology Department in Hospital Clínico Universitario de Salamanca in Spain, as a guest editor for this issue. She presents a whole set of interesting contributions. We hope you enjoy it.



Kathrine Røe Redalen and Pierfrancesco Franco



KATHRINE
RØE REDALEN



PIERFRANCESCO
FRANCO



“Several colleagues who attended the ESTRO 38 congress share with us their thoughts on some of the topics raised and to tell us about their experiences.”



ELISABET GONZALEZ

Welcome to the Young Corner. We hope you enjoyed ESTRO 38 in Milan.

As guest editor, I have invited several colleagues who attended the congress to share with us their thoughts on some of the topics raised and to tell us about their experiences. This includes: the experience of a young radiation oncologist during her residence and how it changed her views; the experience of attending a pre-meeting course; and a description of the situation for residents in Spain and the relationships between the different radiation oncology societies there.

We also hear about the importance of mobility grants in this issue, and how they provide a tremendous opportunity for in-training members to improve their knowledge, skills and abilities. This type of experience allows you to meet colleagues from different disciplines and departments, including radiation oncology, physics, medical oncology, radiology and nuclear medicine, and to learn how they work, how they develop workflows and how they make decisions as a multidisciplinary team. In this context, Rajesh Pasricha, from Aiims in Rishikesh, India, describes his visit to the University of Applied Sciences (UAS) in Switzerland.

We hope you enjoy this issue.



Elisabet Gonzalez





REPORTS FROM THE YOUNG TRACK AT ESTRO 38

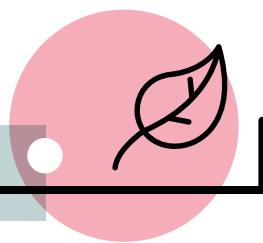
Pierfrancesco Franco - Report on the Young Track and Young Poster Award >>

Elisabet Gonzalez - Basic course brachytherapy treatment >>

Ángela Matías Pérez - First oral presentation at an ESTRO meeting >>

Elisabet Gonzalez - Young professionals and clinical research >>

Ludwig Dubois - Quiz and networking session >>



Report on the Young Track and Young Poster Award



At the Young ESTRO session day

Young Track

The Young Track is a well-established part of the scientific programme at the ESTRO congress. This year, the track was held on Sunday 28 April, and was organised by Martin-Immanuel Bittner and Cyrus Chagari, both members of the Young ESTRO committee. Professor Walter Kolch, Director of Systems Biology Ireland at University College Dublin, opened the day with a lecture entitled 'Precision medicine and systems

biology – transforming cancer research in the 21st century'. The lecture provided the audience with a detailed overview of how to unlock and integrate the different information contained within 'omics' data (radiomic, genomic, radio-genomic, proteomic, metabolomic) with the clinical data, in order to obtain a relevant and actionable view of an individual patient's cancer so as to properly target precision diagnosis and therapy. Despite the complexity of the topic, Prof Kolch gave a very clear and educational ✓



PIERFRANCESCO
FRANCO



At the Young ESTRO session day

perspective of this increasingly cogent aspect of modern medicine.

The next session consisted of a symposium investigating how best to combine research and clinical practice. Antonin Levy explained the benefits of taking time off for full-time research. Alexandria Escande gave a presentation on the basis and prerequisite for biostatistics analyses and provided some highlights on how to implement a critical analysis of the available literature. Steven Petit dedicated his talk to research and training in medical physics, with a focus on how to acquire a staff medical physicist position. Dusan Milanovic gave an overview



At the Young ESTRO session day

on the challenges of combining research and training. Finally, Rene Baumann closed the symposium, leaving us with a vision of a young head of a radiation oncology department. Overall, it was an interesting symposium which provided young professionals with tips and advice on a profitable career in both research and clinical practice.

The programme continued with the 'Speed dating' session, a well-established part of the Young Track. This networking session, which enables young researchers and professionals to share their experiences, projects, perspectives and visions, was carried out in a friendly atmosphere.

Next up in the programme was the lunch symposium, in which Pierfrancesco Franco, chair of the Young ESTRO committee, discussed perspectives on burn-out in the medical professions and presented data from the PRO BONO study (PROject on Burn-out in Radiation Oncology). This project was developed within Young ESTRO to explore burn-out syndrome in radiation oncology and to investigate whether personality traits, such as alexithymia and empathy, may affect the likelihood of developing burn-out.

The session continued with reports from people who had received a Technology Transfer Grant, ESTRO's mobility grants. We heard from a radiation oncologist (Irakli Zumbaze), medical physicist (Petros Kalendralis) and radiation technologist (Stanislav Prcic) on their experiences as recipients of the grants, which allowed them to visit a host institute to learn about a specific technology or treatment approach to be implemented in their own department.

The last session, organised as a symposium, was dedicated to exploring different perspectives on young national societies. There were a number of examples put forward: Spain, presented by Virginia Morillo, as a prototype of a well-established young national society; Romania, ✓

presented by Mihai Zerba, as an example of an emerging national society; and finally Poland, presented by Mateusz Spalek, to show how to create a new young national society. The session was very well received with a final panel discussion on how to strengthen cooperation and collaboration between young researchers and practitioners in Europe.

The Young Track came to a conclusion with the annual quiz, the winner of which received free registration for an ESTRO course. This was followed by the networking cocktail evening, which allowed participants to spend some enjoyable time together building their professional and social networks.

Young Poster Award

During the Poster Award Ceremony, three poster awards were given for the best clinical, physics and radiation therapist (RTT) posters. These awards were sponsored by the publisher Elsevier and consisted of a grant of €1,000 for each recipient and an additional waived fee to publish a full text article in one of the three ESTRO journals, *ctRO*, *phiRO* and *tipsRO*.



From left to right: young committee chair Pierfrancesco Franco, best poster awardee for radiation oncology Anders Schwartz Vittrup, and chair ESTRO 38 Clinical Track Claus Rodel

The award for the best young clinical poster was given by Daniel Zips and Pierre Blanchard (editors-in-chief of *ctRO*) to Lisa Van den Bosch, a radiation oncologist from the University of Groningen, The Netherlands, who presented an abstract entitled 'Development and validation of prediction models for salivary dysfunction in head and neck cancer patients'. The authors developed and externally validated Na⁺/taurocholate cotransporting polypeptide (NTCP) models to predict salivary dysfunction in head and neck cancer patients undergoing radiotherapy.



From left to right: young committee chair Pierfrancesco Franco, best poster awardee for physics Aurora Rosvoll Groendahl and chair ESTRO 38 Physics Track Catharine Clark

The award for the best physics poster went to Luise Anna Kunzel, a physicist from the University of Tübingen, Germany, with an abstract on 'Automatic radiotherapy treatment planning using particle swarm optimisation', which investigated the potential of particle swarm optimisation (PSO) for automatic planning during volumetric modulated arc therapy (VMAT) treatments. The award was given by Ludwig Muren, editor-in-chief of *phiRO*.

The award for the best RTT poster, given by Michelle Leach (editor-in-chief of *tipsRO*), ✍



From left to right: ESTRO 38 RTT Track chair Bartosz Bak, best poster awardee for RTT Matthew Beasley, and young committee chair Pierfrancesco Franco

went to Núria Esponosa, from the Hospital de la Santa Creu i Sant Pau, Barcelona, Spain, with an abstract entitled 'Strategies to maintain bladder and rectum volumes do not reduce the gross tumour volume (GTV) movement for rectal cancer RT'. The authors explored the influence of rectal and bladder filling on rectal volume during pre-operative radiotherapy for rectal cancer.



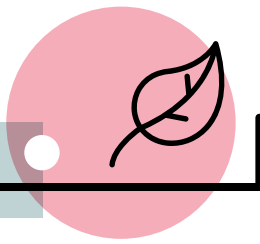
From left to right: editor-in-chief ctRO Daniel Zips, ESTRO Elsevier best poster awardee ctRO Lisa Van den Bosch, editor-in-chief ctRO Pierre Blanchard, young committee chair Pierfrancesco Franco

All three awardees had a couple of minutes to explain their projects in front of an interested and supportive audience. The Young Poster Award Ceremony is a good example of how ESTRO wants to increase the visibility of young researchers in Europe with a prize for their scientific efforts.



From left to right: editor-in-chief phiRO Ludvig Muren, ESTRO Elsevier best poster awardee Luise Anna Künzel, young committee chair Pierfrancesco Franco

Pierfrancesco Franco
Department of Oncology, Radiation Oncology,
University of Turin
Chair Young ESTRO Committee
Turin, Italy



Pre-meeting course at ESTRO 38: Basic course brachytherapy treatment



At the basic brachytherapy treatment pre-meeting course



ELISABET GONZALEZ

The annual ESTRO congress is an important opportunity to bring together radiation oncologists, medical physicists, and others professionals related to radiation and oncology from across Europe to share the latest advances in their specialties. Even more importantly, it is also an opportunity to share experiences about our day-to-day work.

The first day at ESTRO 38 was dedicated to pre-meeting courses, which were very interesting, particularly for in-training members. The aim of these courses is for experts in a specialist field to review the basics as well as the latest research in their area. ✍

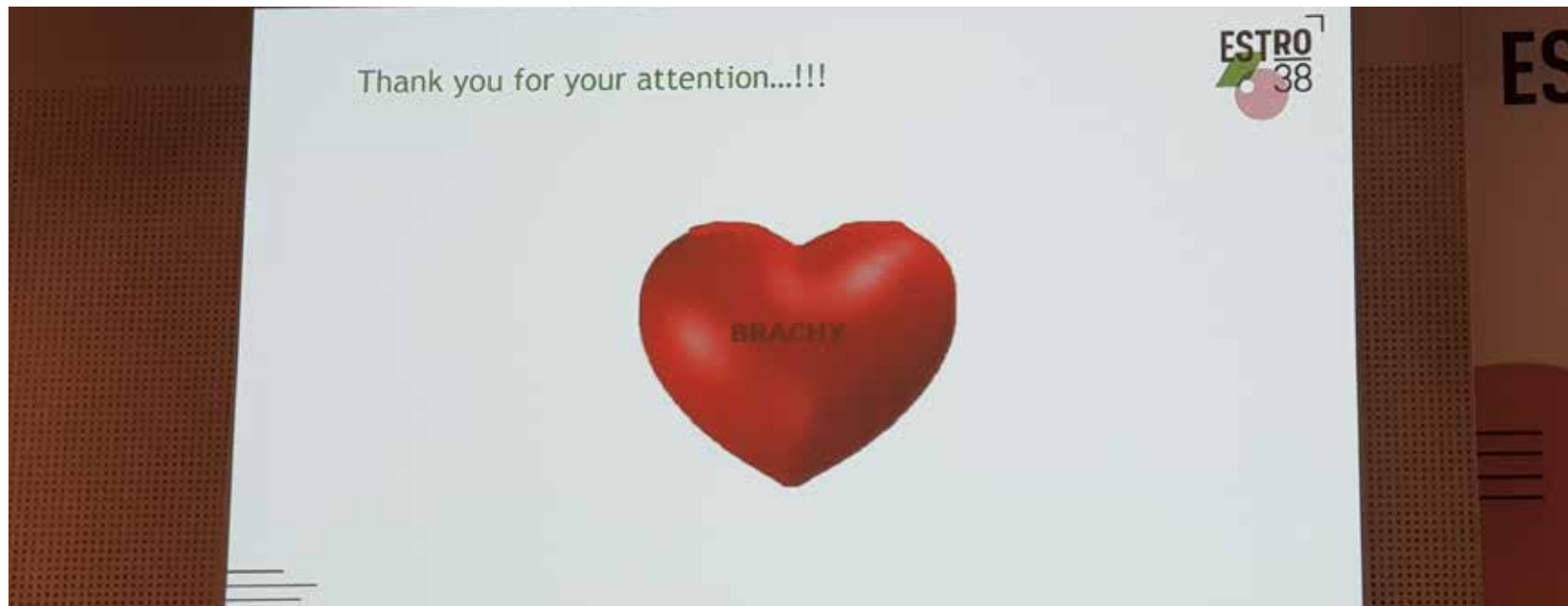


At the basic brachytherapy treatment pre-meeting course

The subject of the course I attended was 'Basic course brachytherapy treatment'. The course began by highlighting the importance of being properly trained in this technique to achieve good results. The experts offered a comprehensive overview of the treatment technique. They explained technical and physical aspects of the treatment, highlighted what can be achieved, and reviewed devices, applicators and imaging techniques. They also examined treatment prescription, concluding that treatment could be improved by becoming increasingly personalised.

The teachers emphasised the importance of working in interdisciplinary teams, bringing together radiation oncologists, medical physicists, dosimetrists, radiation therapists and nurses. In this way, we can deliver the best treatment to our patients, including providing support for their emotional needs. One lecture emphasised how important it is to be able to empathise with patients and their families.

The course ended with a debate, which was open to all course participants. We discussed the different ways in which our teams were organised at our centres. In talking about the role of radiation therapists and dosimetrists at our centres, we noticed that there are significant differences across countries. ✍

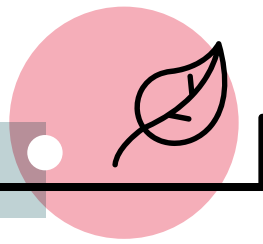


Finally, we brainstormed ways to improve treatment, which was one of the highlights of the course.

As an in-training radiation oncologist, you might imagine that it could be difficult to follow lectures delivered by experts. However, the course was well designed, introducing basic concepts, before moving on to more complex and advanced concepts. I would definitely recommend the pre-meeting courses to learn about radiation oncology and meet colleagues. I would like to express my gratitude to the course directors and teachers for sharing their knowledge and answering our questions.



Elisabet Gonzalez
Radiation Oncology Department
Hospital Clínico Universitario de Salamanca
Salamanca, Spain



First oral presentation at an ESTRO meeting

Delivering your first oral presentation at an ESTRO meeting can be a daunting challenge, a type of initiation experience for radiation oncology researchers. I was initiated at the ESTRO 38 congress in Milan, Italy. It was the first time that I had given an oral presentation in a conference of this importance, sharing the results of a research project that I have been developing with colleagues over the last year. However, an experience that could have been overwhelming was a pleasant experience, thanks to all the support from the ESTRO team.

In my case, it all started with winning a research grant, which I received from the CRIS Cancer Foundation, a Spanish foundation that supports research in radiation oncology by providing funding to young researchers in Spain. Without their support, it would be very difficult to obtain resources for research fellowships. Also, in France, I received support from the Odyssey foundation, which enabled me to present the results at the ESTRO congress.

During my fellowship at Institut Gustave Roussy (IGR) in Paris, I was accepted into the DUERTECC programme, a European university diploma in translational research, developed by IGR together with the Université Paris-Sud. The programme, focused on young researchers at the start of their

careers, includes the development of a year-long research project, with tutorial help and advice from highly qualified professionals and teams. It also takes place in a friendly environment and allows you to work with colleagues from different European hospitals and universities. This exchange experience is enriching at a personal and professional level. Building bridges in this way is fundamental in a European society like ESTRO.

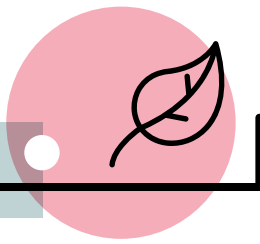
Facing difficulties, but finding the encouragement and support to learn from mistakes and to endure, is essential for young researchers starting their career. Being able to communicate the results of your research to colleagues at a meeting such as ESTRO is the perfect final touch to all the work. In those moments, despite the nerves and the emotion, it is important to remember that research is a team activity, because the task that lies ahead is challenging.



Ángela Matías Pérez
Institut Gustave Roussy
Villejuif, France



ÁNGELA MATÍAS PÉREZ



Young professionals and clinical research

At ESTRO 38, in-training members had our own session in which we could share experiences, learn from colleagues and discuss our situation. For me, one of the most motivating talks was Christian Ostheimer's on clinical research and the role of young ESTRO members. She explained how young doctors could become clinical researchers and contribute to progress in oncology from the start of their professional career.

In general, medical educational programmes do not usually include enough training on clinical research. To undertake research, it is not only important to know about biology, physics or medicine, but also to be well informed about regulations and policies that relate to research.

The European Organisation for Research and Treatment of Cancer (EORTC) is an independent organisation dedicated to coordinating clinical research in cancer. EORTC's work is made possible thanks to the collaboration of oncology experts around the world, who have created an international network to improve the standard of cancer treatment for patients. With the aim of continuing to strive for improvements day by day, EORTC has a strand of work dedicated to encouraging early-career investigators to

develop their research skills and contribute to medical progress.

As part of this, EORTC offers mentorship programmes for young clinical investigators, which help them to develop and provide an opportunity to be part of this international community. In this way, the organisation helps young mentees to become futures leaders in clinical research networking.

With other colleagues, we discussed our doubts and difficulties about becoming a clinical researcher. While I was listening to Dr Ostheimer, I found myself thinking about why a young ESTRO member would want to participate in the oncology research effort. I think the main reason is to satisfy natural curiosity and to put this desire at the service of cancer patients, contributing to the improvement of knowledge about the most common cancers. I think that the best way to make progress in our field is to work as a team, to learn from each other, to share our results and to be patient. Dr Ostheimer underlined that results take time and we need to be tenacious.

At ESTRO 38 it was clear to me that many young doctors, despite a lack of experience, want to ✓



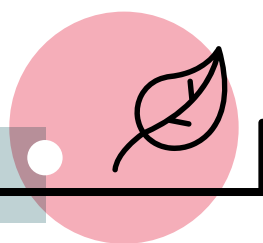
ELISABET GONZALEZ

do their best and participate in this amazing field. I would like to thank Dr Ostheimer very much for her inspiring words.



Elisabet Gonzalez
Radiation Oncology Department
Hospital Clínico Universitario de Salamanca
Salamanca, Spain





Quiz and networking session

ESTRO 38 saw another successful Young ESTRO day, with an interesting teaching lecture on precision medicine and systems biology. This was followed by three symposia on: 'Combining research and clinical/professional and training/practice', 'How to prevent burnout?', and 'Stronger together – news and projects from young national societies'. There was also speed dating and our famous annual quiz and Young networking cocktail evening.

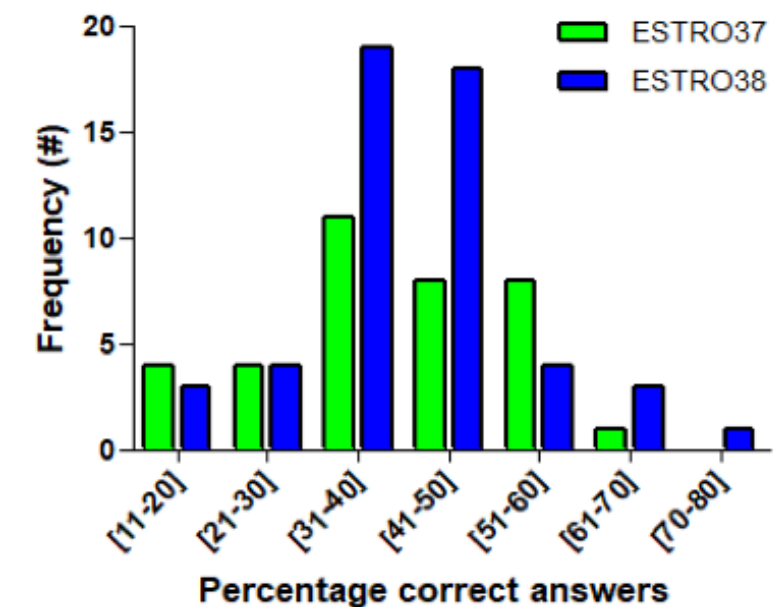
The quiz and networking session were held on "The Stage", guaranteeing their visibility. This year we had 51 contestants (30% more than at ESTRO 37). After the quiz, a number of people asked me to make the questions and correct answers publicly available. The following table provides the questions and answers in arbitrary order.

Question	Answer
What is the largest human cell?	Egg cell
In which year was the first iPhone released?	2007
How many members does ESTRO have according to the ESTRO membership website page?	>7,000
The ESTRO members are located in how many countries?	>100
The number of courses per year provided by ESTRO is?	>35
ESTRO 39 will take place in?	Vienna, Austria
The 2019 ESTRO Meets Asia Congress will take place in?	Singapore
What is the current (2017) impact factor of <i>Radiotherapy & Oncology</i> (known as the Green Journal)?	4.942
Who is the current ESTRO president?	Umberto Ricardi

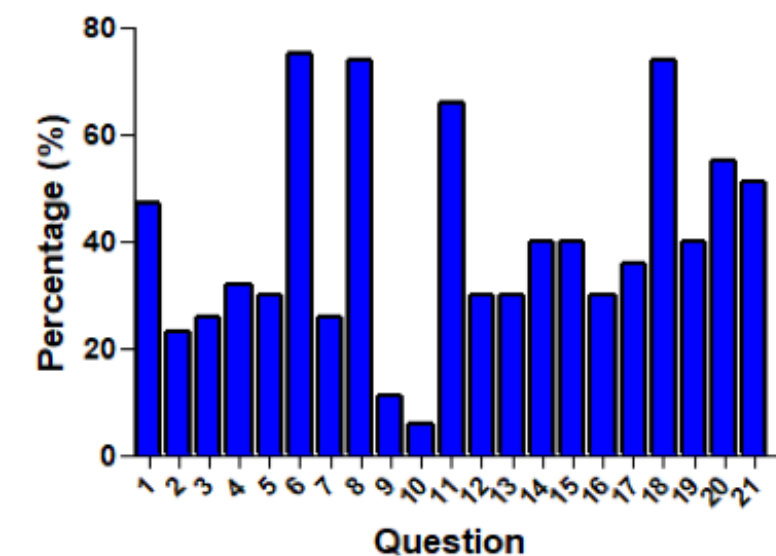


LUDWIG DUBOIS

The founding meeting of ESTRO took place on September 1980 in?	Milan, Italy
The new 2030 ESTRO Vision (doi.org/10.1016/j.radonc.2019.03.031) has been discussed in the strategy retreat organised in?	Mechelen, Belgium
ESTRO is active on social media. How many followers does ESTRO have on LinkedIn?	>7,500
Who is the Young ESTRO chair?	Pierfrancesco Franco
What is FALCON?	Fellowship in Anatomic deLineation and CONtouring
The STUPP protocol (primary treatment) for GBM consists of:	Temozolomide (75 mg/m ² /d for 6 weeks) + RT (60Gy/30fr)
FDA approved on 12 April 2019 an immune checkpoint inhibitor for first-line treatment of patients with stage III non-small-cell lung cancer (NSCLC) who are not candidates for surgical resection or definitive CRT or metastatic NSCLC. What is the name of the immune checkpoint inhibitor?	Pembrolizumab
The last AGORA meeting took place in?	Barcelona, Spain
Where is the ESTRO office located?	Brussels, Belgium
How many double strand breaks (DSB) would you observe after one Gy/diploid cell?	40
When an absorbed dose of 1 Gy is delivered to a point at the depth of maximum dose in a water-equivalent phantom whose surface is at the isocentre of the machine (field size 10 cm x 10 cm), how many MU would you measure?	100
When did the ESTRO Board approve the establishment of the ESTRO Young committee?	2010



Distribution of percentage correctly answered questions for ESTRO 37 (Green) and ESTRO 38 (blue).



Percentage of participants answering each individual question correctly.

Congratulations to Ahmed Salem, the University of Manchester, UK, for his victory – the second year in a row that he has won. However, the rules were very strict, stating that last year’s winner could not receive the award again this year. This year, therefore, the free registration for an ESTRO course went to Stephen Chin, The Christie NHS Foundation Trust, Manchester, UK – congratulations Stephen!

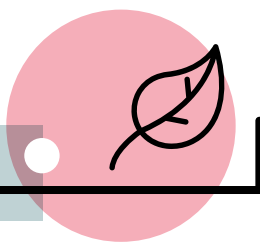
while enjoying some food and beverages. See you again next year!

└ Ludwig Dubois
Department of Radiotherapy
Maastricht University
Maastricht, The Netherlands

Compared with ESTRO 37, the distribution across the percentage of correct answers is fairly similar, although the frequency is higher for ESTRO 38. The majority of participants did know that ESTRO 39 will be held in Vienna (Q6), that Umberto Ricardi is the current ESTRO president (Q8), that ESTRO Meet Asia will be held in Singapore (Q11) and that the ESTRO office is located in Brussels (Q18). Only a minority knew that ESTRO was founded in Milan (Q9) and that the new ESTRO Vision has been discussed in the strategy meeting in Mechelen (Q10). On average, 45% of the questions were answered correctly, which is reasonably high taking into account the stress of the quiz, which saw more points awarded to people who answered a question correctly faster.

I hope you had fun at the quiz and that you have extended your professional network,





Spanish Young Radiation Oncology Group

The Spanish Young Radiation Oncology Group (SYROG) was formed around ten years ago. Its aim is to foster training, research and professional networks among young members of our Society – the Spanish Association of Radiotherapy and Oncology (SEOR) – as well as with other organisations, both nationally and internationally.

An executive committee was set up to oversee the objectives and functions of the group, made up of young specialists who wished to kindle the entrepreneurial spirit in other young medical specialists or those in training. The SYROG is also a way to raise our profile within the wider Society, to organise training, and to be seen as more than a form of generational succession.

Although we have a section within the Spanish Society website, we primarily use online social networks as a way to disseminate clinical guidelines, important new publications, information on scientific congresses and conferences, and job opportunities.

During our journey we have encountered numerous difficulties. Those that have had the greatest impact have been the lack of funding and human resources. This has slowed down our progress in achieving our aims. In spite of this, we have organised numerous training courses on subjects such as searching for relevant information in the literature, and properly interpreting published data to assess the clinical impact. These courses have also encouraged our members to present the results of their

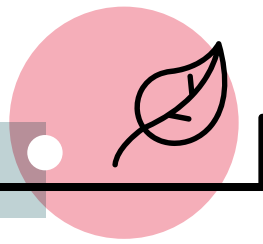
research in public, and have helped to foster collaborations with other international societies.

We have also promoted participation with national oncology research groups (e.g. the Spanish Clinical Research Group on Radiation Oncology, GICOR). This has enabled our members to work with other groups on big pieces of research, and to be involved in setting up clinical trials.

Looking to the future, we are involved with other young international societies to grow new opportunities, research and to help each other. However, we are still far behind many of these other young societies in terms of our outputs. We must continue to grow, and to unite all our efforts to be considered an example of best practice in Europe.



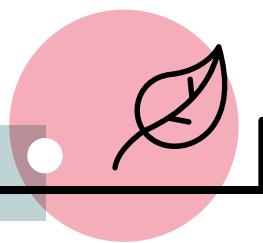
Virgina Morillo Macías
Radiation oncologist
Hospital Provincial de Castellón
Castelló, Spain



Mobility report

Radiomics and machine learning for cancer imaging and its implications for radiation oncology >>

To study the principles of stereotactic ablative body radiotherapy in primary and oligometastatic lung cancer >>



Radiomics and machine learning for cancer imaging and its implications for radiation oncology

Host institute: Universities of Applied Sciences (UAS), HES-SO Valais-Wallis, Techno-pole, Sierre, Switzerland

Dates: 11 February – 1 March 2019



RAJESH PASRICHA



In the research lab

I am a trained radiation oncologist, working at the India Institute of Medical Sciences, Rishikesh, India. I am thankful to ESTRO for supporting my visit to the Universities of Applied Sciences (UAS) in Switzerland. The aim of my visit was to learn about and understand radiomics for cancer image analysis, especially using a machine-learning approach. I wanted to get a picture of

how workflow is managed and to learn about the advantages, disadvantages, applications, and limitations of hand-crafted radiomics in comparison to deep radiomics.

UAS is undertaking lots of interdisciplinary work and it was an eye-opener for me to see how this can lead to great research. As a practicing radiation oncologist, I was also interested in learning how this new image analysis tool can help to improve patient care and the delivery of radiation therapy in order to improve the cancer control rate and decrease side effects.

Radiomics is a relatively new field of study, which involves quantitative analysis of various imaging features for a defined end point, such as detection of malignancy, control rate or prognosis. It can be performed on any kind of medical images such as CT, MR PET scans and even histopathological and retinal images. The radiomics workflow can be divided into segmentation of desired area of image, feature extraction and analysis.

Broadly it can be divided into hand-crafted radiomics, where the user selects the features themselves, depending upon various factors, and uses it for analysis, and the fully automated or semi-automated approach for feature selection ✓

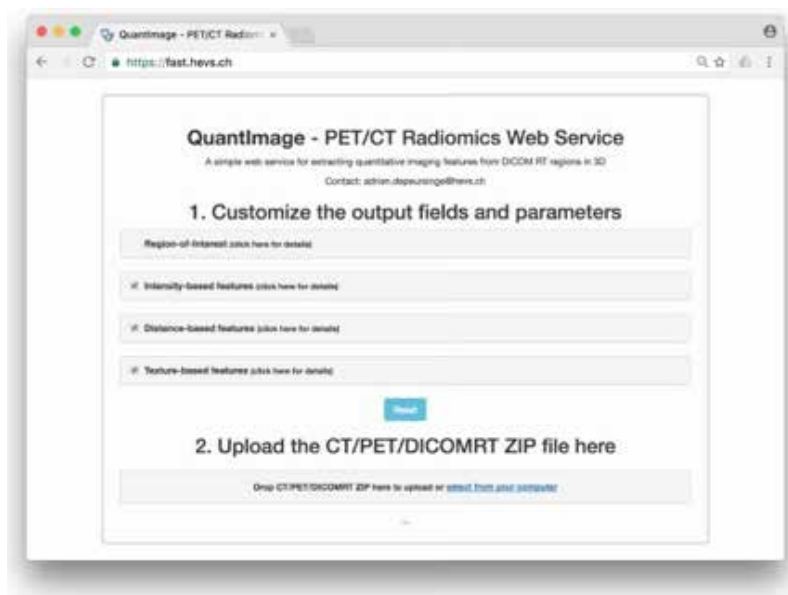


Figure 1- Screen-shot of cloud-based software – Quantimage used for radiomic feature extraction

and analysis, which uses machine learning algorithms, such as deep neural networks. The latter approach is termed ‘deep radiomics’.

I gained lots of experience at UAS by observing ongoing research projects. My visit improved my understanding of the complexities of different approaches to radiomics, and the potential applications of these techniques to improve our understanding of tumour biology. The technique also has implications for various aspects of radiation oncology, including defining gross tumour volume (GTV), quantification of



My visit to CHUV University Hospital, Lausanne

clinical target volume (CTV) and use of radiomics features for analysing on-board CBCT images.

I aimed to observe various aspects of radiomics workflow processes, especially those featuring extraction. I wanted to learn about the process of feature extraction of segmented regions using in-house developed cloud-based software (Quantimage) and understand the methodologies used for feature selection for analysis, and finally the formulation of a model and internal validation of the model using statistical techniques like random forest and boot strapping.



With my guide, Professor Henning Müller

During my time at the UAS, I visited partner hospitals at Lausanne and Bern and was able to meet radiation oncologists, radiologists and nuclear medicine specialists, as well as physicists and data scientists, involved in research on image analysis using radiomics. I also observed the workflow for implementation of radiomics in clinical settings.

I attended weekly research meetings and multidisciplinary meetings to learn about current practices in the use of machine learning techniques for various aspects of medical

image analysis, including images other than radiologic images, as well as to learn about current research.

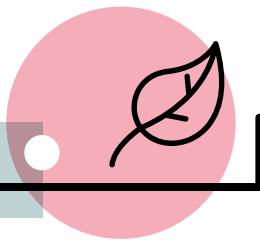
I am very grateful to Professor Henning Müller and his colleagues, especially Professor Adrien Depeursinge for allowing me in their lab, guiding me in understanding the nuances of this new technique and agreeing to work on a paper regarding implications of radiomics in low resource settings.

I believe this experience provided a unique opportunity to gain knowledge and insights into this complex topic, as well as form networks that will pave the way for similar interdisciplinary research in India where such collaborations are currently rare.



Rajesh Pasricha
Additional professor, radiation oncology
AIIMS, Rishikesh, India
drrajesh_pasricha@yahoo.com





To study the principles of stereotactic ablative body radiotherapy in primary and oligometastatic lung cancer.

Host institute: Weston Park Hospital, Sheffield Teaching Hospitals NHS Foundation Trust, Sheffield, UK

Date of visit: 3-16 March 2019



SANJUKTA PADHI

Non-small lung cancer (NSLC) is the leading cause of cancer-related deaths, with more than a million deaths annually worldwide. Around 2-30% of patients who present with Stage I have excellent tumour control rates with Stereotactic Ablative Body Radiotherapy (SABR). SABR is a high precision radiotherapy utilised for the control of extra cranial sites like thorax and abdomen. My institute, AH Regional Cancer Centre, Cuttack, is one of the largest centres in eastern India, and caters to a large number of patients with primary as well as metastatic lung cancer. In Weston Park Hospital, Sheffield, SABR treatment is delivered for primary lung cancers as well as oligo-metastatic disease under the 'Commissioning Through Evaluation' (CTE) with CORE, SHARON and HALT trials.

I was welcomed by my mentor, Dr Tathagata Das, the lead for thoracic oncology and a consultant clinical oncologist at the Sheffield Teaching Hospital, NHS Foundation Trust. He introduced me to my fellow oncologists, physicists and planners.

First, I studied the guidelines of the SABR UK consortium. Dr Das helped me to understand the basic principles and techniques of SABR, starting from the selection of patients for SABR multi-disciplinary team (MDT) 4D CT, planning,



With Dr Tathagata Das

evaluation of plan, post-planning MDT approval, and final treatment and timely follow-up.

A well-designed timetable organised my training and I could experience the workflow and responsibility of a dedicated SABR team from physicians to radiographers. Weston Park Hospital has eight Linacs, of which two are dedicated to SABR. The treatment delivery by the dedicated radiographers, in the presence of the physicists, makes SABR highly precise with a scheduled pre-scan and mid-scan. I could attend two SABR MDT on Friday mornings at 8.30am, ✓



With Dr Liza Siddall

which enriched my understanding and clarified most of my doubts, and I was happy to follow up a few patients in clinics.

My sincere thanks to the radiographers, who helped me to understand the 4D CT, Mr James Moore for the planning part, Dr Allice Dwiendwy for pelvic node SABR, Dr Liza Siddall for taking time to help me understand the basics of SABR from a physics perspective, and lastly to all the staff and patients, who were very supportive and friendly. I also express my heartfelt gratitude to Dr Das for making my training so successful.

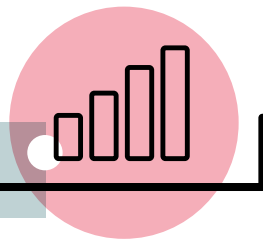
I have presented the whole workflow for SABR in my institute's monthly seminar and conveyed to my colleagues the importance of this technique so that we can provide the best possible treatment to our patients.



Sanjukta Padhi
Associate professor and senior consultant,
radiation oncology
AH Regional Cancer Centre
Cuttack, India
drsanjuktapadhi@gmail.com

Health economics





Health economics is essential to maximise population health



BRAM RAMAEKERS

Why do we care about health economics or health costs? The short answer might be provided with a quote from Professor Karl Claxton: “If you care about health gains, we have to care about costs” [1].

One of the main aims of healthcare systems is to maximise health given the available budget. Thus, if a new technology becomes available (e.g. a new oncology drug), we have to decide whether to adopt this new technology with the aim of maximising population health. As healthcare budgets are limited, adopting new technologies might result in displacing other effective technologies (i.e. giving up health outcomes) elsewhere in the health system. Alternatively, resources for funding new health technologies might become available by expanding the healthcare budget. However, in both cases, it is important to consider what else we could have done with these healthcare resources. In other words, what are the health opportunity costs? Perhaps we could have spent it on something ‘better’ than the new technology.

So, healthcare system costs matter, given that limited resources are available for improving healthcare outcomes for patients. Thus, if health gains are important, healthcare costs are important too.

To decide what (new) technologies to adopt and for whom, with the intention to maximise health, given the available budget, we have to measure health benefits related to these technologies. Ideally, this measure of health

should incorporate both the patients’ quantity and quality of life lived as well as a notion of how people feel about this trade off (between quantity and quality). In health economics, this is attempted (albeit there are shortcomings) by expressing health in terms of quality-adjusted life years (QALYs). One QALY represents one life year lived in perfect health. The next step is to measure the added benefit (i.e. QALY gain) and the added costs of the new technologies compared to current practice and decide whether this represents value for money. In other words, do the additional QALYs potentially yielded by the new technology outweigh its extra costs? Thus, what should we pay per additional QALY gained?

Traditionally, there have been recommended thresholds, for instance €20,000 to €80,000 per QALY gained in The Netherlands and £30,000 to £50,000 per QALY gained in the UK. This is typically based on notions of what society is willing to pay per QALY gained.

However, recently there have been attempts to empirically estimate these thresholds for different countries (i.e. estimating the marginal returns to healthcare using health spending data linked to health outcomes). These studies found that, to maximise health given the available budget, the threshold was estimated to be £12,936 per QALY gained for the UK, \$28,033 per QALY gained for Australia, €24,870 per QALY gained for Spain and €41,000 per QALY gained for The Netherlands [2-5]. These thresholds might

help to determine whether new technologies represent value for money and whether adopting and reimbursing them would likely increase (rather than decrease) population health given the available budget.

Scrutinising new oncology drugs (or other technologies) before adopting them is therefore crucial. Not only from a health economic perspective, but also from a clinical perspective.

Davis *et al.* [6] recently performed a systematic evaluation of oncology approvals by the European Medicines Agency (EMA), and concluded that most drugs entered the market without evidence of benefit on survival or quality of life. There was mostly no conclusive evidence that these oncology drugs either extended or improved life. If there were survival gains, these were often marginal [6].

It is reassuring that not all EMA-approved oncology drugs automatically enter the market. National authorities, such as the National Institute for Health and Care Excellence (NICE) in the UK, assess and appraise new oncology drugs before they enter the market. However, it is becoming more and more challenging for national agencies to estimate the added benefit (i.e. QALY gain) and added costs of new technologies and thus to make adoption recommendations. In part, this is due to the increasing uncertainty in the available clinical data (e.g. increasingly facing data from small, single-arm studies

with short-term follow-up) [7].

The recent analyses by Anderson *et al.* [8], might indicate that there is an increase in non-randomised data being assessed by NICE. This is, for instance, illustrated by the case of nivolumab for treating metastatic or unresectable urothelial cancer (recently appraised by NICE [9]), where NICE needed to decide whether to adopt nivolumab, while facing immature single arm clinical data. Ultimately, NICE did not recommend nivolumab in this indication [9].

To address these increasing uncertainties, coverage with evidence development (or managed entry) agreements might be used to address the most important uncertainties in a given assessment and regulate the reimbursement of new technologies [10]. However, for these agreements to be successful it is necessary to systematically identify uncertainties in assessments and to explore the impact of these uncertainties on the results and decision-making [10]. Moreover, these agreements might not be suitable for all cases. NICE, for instance, concluded that nivolumab for treating metastatic or unresectable urothelial cancer was not suitable for the Cancer Drugs Fund (which is a type of managed entry agreement).

In conclusion, before adopting new technologies and especially new oncology drugs, it is essential to critically review the clinical benefits as well as the additional costs compared to current practice. However, this

is becoming more challenging due to the increasing uncertainty national authorities are facing. To overcome this challenge, coverage with evidence development (or managed entry) agreements might, when carefully applied, prove to be a useful tool for specific cases.



Bram Ramaekers
Senior researcher health economics
Department of Clinical Epidemiology and
Medical Technology Assessment (KEMTA)
Maastricht University Medical Centre
Maastricht, The Netherlands
<http://orcid.org/0000-0001-5785-9228>



REFERENCES

- [1] Claxton K. NOAHE - Estimating Cost Effectiveness Thresholds for Canadian Provinces; 2018 <https://livestream.com/accounts/3923053/events/8359193>.
- [2] van Baal P, Perry-Duxbury M, Bakx P, Versteegh M, van Doorslaer E, Brouwer W. A cost-effectiveness threshold based on the marginal returns of cardiovascular hospital spending. *Health Econ*. 2019;28:87-100.
- [3] Vallejo-Torres L, Garcia-Lorenzo B, Serrano-Aguilar P. Estimating a cost-effectiveness threshold for the Spanish NHS. *Health Econ*. 2018;27:746-61.
- [4] Claxton K, Martin S, Soares M, Rice N, Spackman E, Hinde S, *et al*. Methods for the estimation of the National Institute for Health and Care Excellence cost-effectiveness threshold. *Health Technol Assess*. 2015;19:1-503, v-vi.
- [5] Edney LC, Haji Ali Afzali H, Cheng TC, Karnon J. Estimating the Reference Incremental Cost-Effectiveness Ratio for the Australian Health System. *Pharmacoeconomics*. 2018;36:239-52.
- [6] Davis C, Naci H, Gurpinar E, Poplavska E, Pinto A, Aggarwal A. Availability of evidence of benefits on overall survival and quality of life of cancer drugs approved by European Medicines Agency: retrospective cohort study of drug approvals 2009-13. *BMJ*. 2017;359:j4530.
- [7] Dickson R, Boland A, Duarte R, Kotas E, Woolacott N, Hodgson R, *et al*. EMA and NICE Appraisal Processes for Cancer Drugs: Current Status and Uncertainties. *Appl Health Econ Health Policy*. 2018;16:429-32.
- [8] Anderson M, Naci H, Morrison D, Osipenko L, Mossialos E. A review of NICE appraisals of pharmaceuticals 2000-2016 found variation in establishing comparative clinical effectiveness. *J Clin Epidemiol*. 2019;105:50-9.
- [9] Grimm SE, Armstrong N, Ramaekers BLT, Pouwels X, Lang S, Petersohn S, *et al*. Nivolumab for Treating Metastatic or Unresectable Urothelial Cancer: An Evidence Review Group Perspective of a NICE Single Technology Appraisal. *Pharmacoeconomics*. 2018.
- [10] Pouwels XG, Grutters JP, Bindels J, Ramaekers BL, Joore MAJViH. Uncertainty and Coverage With Evidence Development: Does Practice Meet Theory? 2019.

Conferences





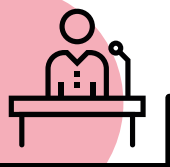
FOCUS ON ESTRO 38

[Congress report >>](#)

[Awards >>](#)

[Statistics >>](#)

[Photo album >>](#)



ESTRO

ESTRO
CONFERENCE

#38

CONGRESS
REPORT

26-30 April 2019

Milan, Italy

Targeting optimal care, together

WWW.ESTRO.ORG

The congress report: a selection of the best studies explained by their authors

You can still access the various scientific materials from the congress, such as the abstract book and the programme book. More importantly, do not miss the congress report: the chairs of each track have selected some of the highest-

scoring abstracts. We have asked their authors to share the outcome of their work with us. The report also includes summaries of the awarded lectures.

Access the congress report here: [ESTRO38-Post-Conference-Report >>](#)



AWARDS

Lifetime Achievement Award

Riccardo Calandrino >>

Christian Carrie >>

Ekkehard Dikomey >>

György Kovács >>

Klaus Breur Award Lecture

Vincenzo Valentini >>

Emmanuel van der Schueren Award Lecture

Núria Jornet >>

Honorary Members Award Lectures

Angelita Habr-Gama >>

Julie Torode >>

Giorgio Scagliotti >>

Jack Fowler University of Wisconsin Award

Simon Skouboe >>

ESTRO-Elekta Brachytherapy Award

Anton Bouter >>

GEC-ESTRO Best Junior Presentation – sponsored by Elekta Brachytherapy

Max Peters >>

ESTRO-Varian Award

Frank Dankers >>

Timo Deist >>

Claudius Regaud Award Lecture

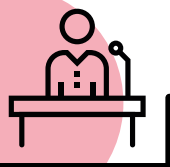
Dirk De Ruyscher >>

Donald Hollywood Award Lecture

Roel Steenbakkers >>

Jens Overgaard Legacy Award

Philip Poortmans >>



Lifetime Achievement Award



Riccardo Calandrino

*Istituto Ricovero e Cura a Carattere Scientifico Ospedale San Raffaele.
Milano, Italy*

What does this award mean to you?

To be honest, I didn't expect to receive this award! During my career, I've always pursued the optimisation of knowledge for my research group and wider community. From the beginning, ESTRO has represented a reference point for this goal.

To whom would you like to dedicate your award?

To my institute, the San Raffaele Scientific Institute in Milan, Italy, which gave me the opportunity to develop as a professional and to create a good department. And to my research group who have performed their duties so diligently and seriously.

What has been your involvement within ESTRO?

I have been a member since the early 1980s. I attended several ESTRO courses. One of the first was held in Leuven, Belgium, in the 1990s. The teachers were Professor Andrée Dutreix, Professor Hans Svensson, Professor Jack Cunnigam, and Professor Ben Mjnheer, among others. I appreciated the warmth of the teaching group and the accuracy of the lectures. The Belgian beer was also good! I

was the chief of the scientific committee for the ESTRO congress in Seville in 2001. This was the high point of my collaboration with ESTRO. After that I convinced other young physicists in my group to take over the responsibility for the scientific representation of the group and my country in ESTRO.

What started your interest in science?

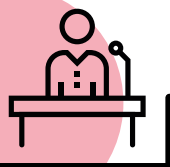
I have loved physics since my college years. I graduated in physics measuring reaction cross sections for (p,n) reaction at the Milan and Bonn Cyclotron. After this I decided to move into applied physics. Medical physics was my ultimate choice. I am very proud of that choice.

What do you do in your spare time?

I have two main hobbies: outdoor sports (running and swimming) and watercolour painting.

Next challenge:

To swim across the Strait of Messina.



Lifetime Achievement Award



Christian Carrie

*Centre Leon Berard
Lyon, France*

What have been the proudest moments of your career?

There are three that stand out for me:

- Without any contest, the creation of the Paediatric Radiation Oncology Society (PROS) and my election as the first president of this society in 2006, followed by my election to the ESTRO Board in 2008
- The success of the ESTRO paediatric teaching course over the last ten years, with Umberto Ricardi, Rolf-Dieter Kortmann and all the PROS executive committee
- The certainty that my radiotherapy department will continue to be one of the most famous in the world and not only for paediatric radiotherapy. I was fortunate enough at the beginning to meet young radiation oncologists who trusted me and shared my vision of radiotherapy, helping me to create the department as it is now.

What is your next challenge?

I will continue to work with the PROS and contribute to teaching courses for at least a couple of years. Also, I will take care of my family – my spouse and children.

What do you think are the next challenges for radiation oncologists?

The biggest challenge for radiation oncologists is to be included in the new advances in oncology. I remember in 1982, it was the beginning of cisplatin and anthracyclines: patients with germ cell tumours were cured and the medical oncologist predicted the end of radiotherapy (and even surgery). We see the same enthusiasm today with new targeted therapies and the same discussion around radiotherapy. But I am convinced that radiotherapy has a big future alongside particle therapy, and integrated immune therapy and radiotherapy.

What does this award mean to you?

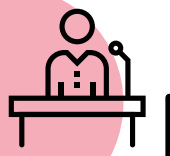
This is the reward of an unexpected career. I had not realised until now that what I was doing could be considered so important.

To whom would you like to dedicate your award?

To my family. I could not have taken this path without their support.

What do you do in your spare time?

Sailing, gardening, and travelling arounds the world.



Lifetime Achievement Award



Ekkehard Dikomey

Laboratory of Radiobiology & Experimental Radiation oncology, University Hospital Hamburg-Eppendorf. Hamburg, Germany

What do you think are the next challenges for radiation oncologists?

There needs to be a better platform (either during the annual ESTRO meeting or outside this) to present translational research and to find an infrastructure to accelerate the translational process. Recently, there have been many excellent ideas about specific targeting of tumours. These ideas need to be taken forward, especially targeting DNA double-strand break repair.

What has been your involvement within ESTRO?

Over the years, I have particularly enjoyed the Conference on Experimental Research in Radiation Oncology (CERRO) meetings organised by ESTRO, where I've always met highly engaged clinicians, physicists and radiobiologists. And, of course, the Wolfsberg Meeting on Molecular Radiation Biology / Oncology, which was organised in collaboration with ESTRO. Both of these meetings have been extremely important for my research and career.

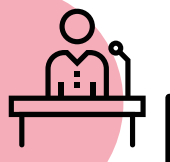
What started your interest in science?

I found my interest in radiobiology after a visit to Jens Overgaard's department at Aarhus

University Hospital, Denmark. I really enjoyed his unconventional way of thinking and acting.

What is your next challenge?

To improve my tennis, especially my backhand!



Lifetime Achievement Award



György Kovács

University of Lübeck / UKSH-CL
Lübeck, Germany

What is your next challenge?

The next challenge? Challenges are constantly present in my life – it is only the focus that changes. I would like to spend less time on routine clinical work and administration, and dedicate more time to education and tutoring. In my career, especially at the start, I was educated and supported by people who trusted me to be able to overtake their experience and ideas. Over the course of my professional career, I have followed this line and I now feel responsible for passing on my experience and ideas to the next generation, tutoring them at the beginning – and being happy if I see them grow and start to be successful in their professional career, serving the oncology community.

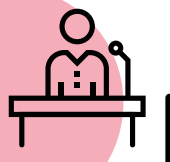
What do you think are the next challenges for radiation oncologists?

Radiation oncology has developed over the decades since X-rays and radium were discovered. It has been used in the treatment of malignant and some benign diseases, creating a medical specialty dominated by high-technology machines and methods. I observe a very dangerous tendency in the young generation: treating "2D black and white patients" (only images . . .) and not human beings! This means that the role of a physician seems to turn on

analysing cross-sectional images, dose-volume histogram (DVH) values, etc. We are losing the classical medical skills of manually investigating a patient. We need to take care not to turn the focus onto technology. Instead, the latest technology should help us to be good doctors. Another important issue is interdisciplinarity. In oncology, we are the link between many different specialties, such as gynaecology, head and neck surgery, urology and medical oncology.

To whom would you like to dedicate your award?

I'm privileged and honoured to represent the fourth generation of the brachytherapy school founded by Professor Pál Kisfaludy in Budapest, Hungary. I dedicate this award to my mentor, the late Professor György Németh.



Klaus Breur Award Lecture

A stroll in Rome together



Vincenzo Valentini

Radiation Oncology Department, Fondazione Policlinico Universitario A.Gemelli IRCCS, Università Cattolica S.Cuore, Rome, Italy

What does this award mean to you?

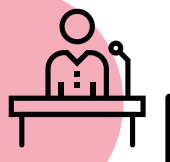
Independent recognition of my professional life. I wasn't always sure that my desire to do my best in my job in the best possible way would have produced a result that was truly appreciated by patients and colleagues. This award tells me that in some ways it has, and this consoles me.

To whom would you like to dedicate your award?

To my patients and students. Because every day they urge me not to keep to myself what they give me in knowledge and the ability to communicate.

Did your parents encourage you in your career, or would they rather you had done something else?

They left me free to choose my own career. They always supported me, even though what I did took me away from them and their business. This was a great lesson for me: respect the freedom of the people you love, even when they make choices that are different to the ones you would wish for them.



Emmanuel van der Schueren Award Lecture

Learning from clinical practice:
pushing quality forward



Núria Jornet

*Servei de Radiofísica i Radioprotecció
Hospital Sant Pau
Barcelona, Spain*

What have been the proudest moments of your career?

Probably one of the proudest moments in my career was when I had my first paper accepted. I still remember how happy and proud I was. More recently, receiving the Emmanuel van der Schueren Award was an unexpected recognition, and an honour. These are two highlights from my career. But what makes me really proud is to see young colleagues that I have supervised or taught succeed in their professional careers.

What is your next challenge?

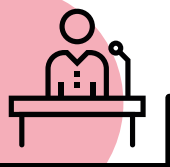
My next challenge is to promote research and innovation within the physics community in ESTRO. I am a strong believer that medical physicists can use their skills to help advance cancer treatment. However, we need to get out of our comfort zone and actively explore areas in which we can, together with radiation oncologists, radiobiologists, radiation therapists (RTTs) and other medical specialities, make advances. Over the last few years, the physics committee has instigated a number of different initiatives to this end. The research masterclass, the physics workshop on science in development and the future task force are some of the activities that try to promote scientific collaboration among our members.

What does this award mean to you?

I met Emmanuel van der Schueren early in my career at a European 'Quality network in radiotherapy' meeting. He made an impact on me. His commitment to radiation oncology and, in particular, to ensuring quality and safety by promoting quality management, education and training in Europe was remarkable. It has been an inspiration to me ever since. I have had a special interest in quality management in radiotherapy and in particular in quality assessment. It is an honour and responsibility to receive this award. I am committed to being an ambassador for his values.

What started your interest in science?

I had very good maths and physics teachers at high school who inspired me. In particular, when I was 16 years old, I had to prepare an exposition on elementary particles (quarks and leptons). It was challenging, and so interesting that I wanted to understand more, and for that I knew that I needed more maths and physics. It was at that moment that I decided that I wanted to study physics.



Honorary Member Award Lecture

Putting down the scalpel.
The evolution of rectal cancer treatment.



Angelita Habr-Gama

*Angelita and Joaquim Gama Institute
São Paulo, Brazil*

Did your parents encourage you in your career, or would they rather you had done something else?

When I graduated from high school, I was not sure what career to pursue. Some of my best friends were applying for medical school and I decided to follow in their steps. In those days it was very unusual for a woman to pursue a medical career in Brazil. The admission exams were very difficult, with more than 600 candidates applying for 80 places at the University of São Paulo Medical School. My parents were not very supportive of my decision. I came from a family that had emigrated from Lebanon and the majority of my aunts and two of my older sisters had been teachers. Despite this, I applied and was accepted into medical school. My parents were very happy and became very supportive of and enthusiastic about my medical career. They were also happy because they did not have any further costs for my education, as the University of São Paulo is a public university and one of the most prestigious in the country.

What started your interest in colorectal surgery?

During medical school, I completed several different specialist rotations. To my surprise, my teachers told me that I had natural skills

for surgery and this pushed me to apply for surgical training. Over the next four years I worked in all the surgical departments. Digestive surgery was the one that enchanted me. After my training, I became so interested in colorectal surgery that I applied for a scholarship at St Mark's Hospital, London, UK, one of the most prestigious hospitals in this field in the world. As a woman, being accepted at this institution in the 1960s was not easy, but after a great effort I was accepted. Going to St Mark's was a cornerstone in my career as colorectal surgeon.

What have been the proudest moments of your career?

One of the proudest moments of my career was when the 'watch and wait' strategy was accepted as an alternative on distal rectal cancer treatment. I have dedicated a significant amount of time during my career to the care of patients with rectal cancer. Something that always worried me was when patients with a complete clinical response to neoadjuvant treatment were submitted to a major abdominal resection with a potential permanent colostomy. It did not seem right to put patients through this, without removing a single cancer cell. In the early 1990s I decided that instead of operating straight away with these patients, I would follow them ✓

up closely and perform the operation only if a relapse was identified. This was the beginning of the ‘watch and wait’ strategy. For many years it was considered unethical by my peers in the university and scientific community. It was only about ten years ago that some prestigious American and European cancer centres began to offer the ‘watch and wait’ strategy for selected patients with distal rectal cancer. I am proud to say that each year I hear that more and more centres are considering this strategy, and that many patients are avoiding such unnecessary and even mutilating operations.

What does this award mean to you?

This award is one of the most prestigious I have received. ESTRO is one of the most important international authorities in this area. As a surgeon, receiving an award from a society like ESTRO, which covers a different specialty to my own, makes me very proud.





Honorary Member Award Lecture

Are radiation specialists good global cancer citizens?



Julie Torode

*Union for International Cancer Control (UICC)
Geneva, Switzerland*

What does this award mean to you?

I am honoured, as I am not a radiation specialist. I have been calling for cancer professions to work together and leverage our collective voice on the global, regional and national policy stages for some time. This award is a clear signal that the ESTRO community recognises this role and is now ready to step up and press for the political commitments needed for meaningful investment in treatment services to impact on the cancer burden in Europe and around the world.

What is your next challenge?

Cervical cancer is an avoidable killer of women in so many countries. I am committed to making the recently announced ambition to eliminate cervical cancer globally a shared, feasible goal that we can achieve in a stepwise manner in all countries over the coming decades.

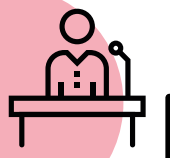
To whom would you like to dedicate your award?

I dedicate this award to cancer advocates in low- and middle-income countries who, with few financial resources, find the time, energy and enthusiasm to give cancer patients in their communities a voice, and who fight every day

for meaningful access to cancer services and quality care.

What started your interest in science?

I suppose a fascination with living things, plants and animals, was the starting point. I recall being amazed that I could calculate and then extract the precise amount of aspirin in a headache table in the school chemistry lab – perhaps that's when I was hooked. I am attracted to contributing and using the ever-expanding science knowledge base in meaningful ways.



Honorary Members Award Lectures

Multidisciplinary approaches as the keys to defeat lung cancer



Giorgio Scagliotti

*University of Turin
Turin, Italy*

If you hadn't been a scientist, what would you have liked to have been?

While studying, I was influenced by two professors: a philosopher and a mathematician. They transferred their enthusiasm to me and for some time I considered becoming either a basic mathematician or a philosopher.

What started your interest in science?

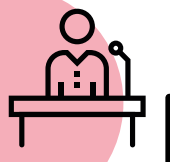
I started to become interested in science just after graduating. I was studying internal medicine at the University of Turin, Italy, to become a clinician. However, my research interests deviated from the clinical path and brought me to study the biology of lung cancer.

What have been the highlights of your career?

The best moment in my career was when my team and I discovered the relevant role of histology in selecting systemic therapy for lung cancer. In 2000, we started to investigate the role of the thymidylate synthase enzyme in lung cancer. The second moment that stands out for me was my election as President of the International Association for the Study of Lung Cancer (IASLC). This meant that a very large community of scientists acknowledged my work.

What is your next challenge?

My next challenge is my forthcoming retirement. I have four years ahead of me. During this time, I would like to implement into daily clinical work the concept of precision medicine, not only at a theoretical level, but also in practice, so that it will have a positive impact on patients.



Jack Fowler University of Wisconsin Award

First clinical real-time motion-including tumour dose reconstruction during radiotherapy delivery



Simon Skouboe

*Department of Oncology, Aarhus University Hospital
Aarhus, Denmark*

What does this award mean to you?

I strongly believe that real-time treatment evaluation and motion mitigation can be vital to ensure high-quality treatment. I think the award is an acknowledgement of not only the quality of my work, but also its importance. This increases my desire to do further work on this project. I have less than a year left of my PhD and hope to write a successful grant application for a post-doc position to continue and expand the work. Receiving this award and acknowledgement will, I hope, increase my chances of being successful in securing a grant.

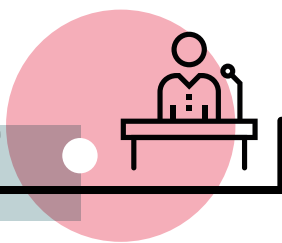
What do you think are the next challenges for radiation oncologists?

Briefly put, patient-specific treatment adaptation. Sometimes, this should be done on a day-to-day basis, where clinically relevant and feasible. Ideally, it should be in real-time, during treatment. In recent years, tumour monitoring has become more widely used, with multiple vendors and research groups making great progress. We have presented methods for dose-based evaluation during treatment. Treatment adaptations such as multi-leaf collimator (MLC) tracking and couch-tracking could see more widespread use. Several clinical trials on the former have been carried out. At least one was presented

at ESTRO 38. Ensuring that modalities such as these are taken up more widely is a challenge, but one worthy of the effort.

What started your interest in science?

Ever since I was a kid, I have liked data and to quantify things, even in video games, where optimisation was rewarded, for example, in strategy-based games. I also really enjoyed maths in school. Furthermore, my father is an engineer and my older cousins studied maths, computer science and molecular biology. Maybe I was slightly nurtured to like science, but without any pressure. Over the years, my interest grew and led to where I am today.



ESTRO-Elekta Brachytherapy Award

Bi-objective optimisation of dosimetric indices for high-dose rate (HDR) prostate brachytherapy within 30 seconds



Anton Bouter

*Centrum Wiskunde & Informatica (CWI)
Amsterdam, The Netherlands*

What does this award mean to you?

I am very honoured to have received the ESTRO-Elekta Brachytherapy Award, and I would like to thank everyone who collaborated on this project. As a PhD candidate in computer science, working in close collaboration with Amsterdam UMC, it means a lot to me to be able to contribute to the field of radiation oncology. It is incredible to receive this kind of recognition for our work.

What do you think are the next challenges for radiation oncologists?

With the rise of artificial intelligence and the vast amount of computing power that is currently available, I think that a big challenge will be finding the best way of incorporating state-of-the-art computational intelligence research into current clinical practice. This will require close collaboration between radiation oncologists and computational intelligence researchers, and will rely on expertise coming from both these fields. For example, in the work presented in our abstract, we use computational intelligence to present a number of treatment plans with different trade-offs between coverage of the target volumes and sparing of the organs at risk. This brings new insight into the treatment planning process, while ultimately leaving the

responsibility of selecting the most appropriate treatment plan to an experienced clinician.

What is your next challenge?

As we have only tested our treatment planning method retrospectively, our next challenge is to use it in our clinic at Amsterdam UMC. We are also eager to collaborate with other clinics in order to use our treatment planning method for the optimisation of treatment plans for different clinical protocols, and to compare our outcomes with those in the other clinics.



GEC-ESTRO Best Junior Presentation – sponsored by Elekta Brachytherapy

Clinical outcomes of focal salvage high-dose-rate brachytherapy for radio-recurrent prostate cancer



Max Peters

*University Medical Center
Utrecht, The Netherlands*

What have been the proudest moments of your career?

One of the proudest moments was when my team and I were awarded a substantial grant for this research. We have been developing this technique for many years, and it is incredibly satisfying that there is so much interest from the radiation oncology community and industry.

What are the next challenges for radiation oncologists?

If we look at my research area of interest, localised prostate cancer, the main challenge would be to identify which patients will benefit most from focal therapy, both in primary and the radio-recurrent salvage setting. Also, as we have so many available treatments, we need to compare these. This means recording toxicity and quality of life outcomes uniformly and systematically in trials. Close collaboration with the biology community is crucial to achieving this.

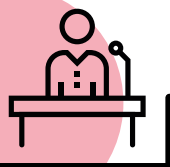
What does this award mean to you?

It's an honour that this treatment, which has been in development for so many years, is finally getting attention from professionals and patients. It's also an honour to develop new

methods that will improve the quality of life for prostate cancer patients.

To whom would you like to dedicate this award?

First and foremost, this is a team effort. This award goes to my PhD student who managed all the data and analysed them for this congress, to the entire high-dose rate (HDR) brachytherapy team at Utrecht University, and finally to my father.



ESTRO-Varian Award

Distributed learning on 20,000+ lung cancer patients



Frank Dankers

*MAASTRO clinic
Maastricht, The Netherlands*

What is your next challenge?

This summer I will defend my PhD research, a joint project with the Maastricht clinic and Radboud university medical centre, on prediction modelling and distributed learning for radiotherapy outcomes in lung cancer patients. From June 2019, I will start my next challenge: a full-time position as a medical physicist in radiotherapy at the Leiden University Medical Centre. I am very much looking forward to being active in the clinic again, while still contributing to radiotherapy research.

What do you think are the next challenges for radiation oncologists?

At present, I think the biggest challenge in healthcare, and thus also in radiation oncology, is transitioning from the current machine learning 'hype' towards sustainable implementation. The potential of machine learning and artificial intelligence (AI) to transform healthcare practices is enormous, but successful clinical implementations are still limited. Radiation oncology has a strong history of using sophisticated computational techniques to improve the level of care for our patients. Our field is therefore well-suited to be one of the leaders in clinical machine-learning research, and

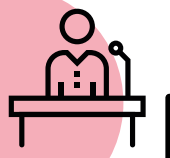
to act as a frontrunner in translating research findings into clinical practice.

What does this award mean to you?

The past three years have been a busy, but thoroughly enjoyable mixture of research and medical physics for me at the Maastricht clinic and Radboudumc. This award comes at the conclusion of my PhD project and feels like recognition of this research. I am grateful to the many colleagues that contributed and the hospitals that participated, which made it all possible.

If you hadn't been a scientist, what would you like to have been?

An astronaut or engineer – always a scientist.



ESTRO-Varian Award

Distributed learning on 20,000+ lung cancer patients



Timo Deist

*Maastricht University
MAASTRO clinic
Maastricht, The Netherlands*

What is your next challenge?

I have started as a post-doc at the National Research Institute for Mathematics and Computer Science (Centrum Wiskunde & Informatica, CWI) in Amsterdam, The Netherlands. We work in collaboration with the Department of Radiotherapy at Amsterdam University Medical Centre to improve deformable image registration using evolutionary algorithms and machine learning. I will still have to learn a lot about evolutionary algorithms in the coming months, but I am really looking forward to it.

What do you think are the next challenges for radiation oncologists?

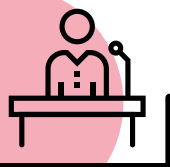
Speaking as a data science / machine learning researcher, one big challenge for the field of radiation oncology will be to translate machine learning applications into clinical practice. The first step is to identify useful and safe machine learning applications from the vast body of published results. Each year, there are more findings published than could ever reasonably be implemented. Medical professionals and data scientists will need to understand the capabilities and also, more importantly, the limitations of these machine learning applications. Translation into the clinic should not happen

without thorough conceptual understanding and extensive empirical validation.

Furthermore, we need to give special attention to data collection and standardised data storage. In my opinion, data science in radiation oncology is currently limited by how data are collected and accessed. This is mostly an organisational challenge, rather than a scientific problem; healthcare organisations should think more carefully about data collection and handling when defining strategies and budgets.

If you hadn't been a scientist, what would you like to have been?

I would probably have worked as a technical consultant for optimisation or machine learning projects. This involves solving technical challenges with an immediate impact, but with less generality. I am happy that it all worked out the way it did.



Claudius Regaud Award Lecture

Is fractionation history?



Dirk De Ruysscher

*Maastricht clinic
Maastricht, the Netherlands*

What is your next challenge?

There are multiple challenges. The first is to find the best way to combine radiation with new systemic treatments. The second is to integrate new technologies on a large scale, and to prove that they are beneficial for patients and worth the investment. The third challenge is to look at how we can make medicine more affordable and accessible. In part, this is about reducing administrative costs, which ultimately create needless delays and extra costs.

What are the next challenges for radiation oncologists?

To become better clinicians and to move away from being technicians. In my 33 years in radiation oncology, I have witnessed a huge shift away from clinicians delivering systemic treatments to a more technician-like work. The new generation is technically very skilled, better than we were, but may lack experience in clinical patient care. For physicists the challenge is the same: in the move towards automation, physicists have placed less focus on clinical care. As we increasingly use artificial intelligence (AI), it is fundamental that we focus on the quality of clinical care. In addition, as our traditional areas of work will be replaced by new technologies

in the next decade, we may need to reduce the number of people we train.

What does this award mean to you?

I am very glad to have received this prestigious award. It shows that ESTRO appreciates what I am doing.

To whom would you like to dedicate this award?

To my family. They have given me so much support. I work all day long, sometimes even during weekends, but they always value my work.

If you weren't a radiation oncologist, what would you like to have been?

A biochemist. During my studies, my first two publications were on fundamental biochemistry. I eventually followed the path that led me to radiation oncology.



Donald Hollywood Award Lecture

Stem cell sparing intensity-modulated radiation therapy (IMRT) for head and neck cancer patients: a double-blind randomised controlled trial



Roel Steenbakkers

*University Medical Centre Groningen
Groningen, The Netherlands*

What is your next challenge?

I am a radiation oncologist specialising in head and neck cancer. I have recently conducted research on a new approach that will allow the sparing of organs at risk while treating this cancer. The challenge is to make the public case for this new treatment, so that ultimately it becomes the standard treatment for patients. We must also prove that it will enhance patients' quality of life.

What are the next challenges for radiation oncologists?

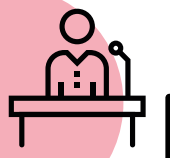
It is mostly to minimise side-effects after treatment. Today, we know about side-effects that in the past were overlooked. It is important that we start tackling them.

What does this award mean to you?

I am very happy and proud to have received the award. It shows that the research is appreciated and valued by the radiation oncology community.

What started your interest in science?

As a student I was interested in oncology as well as the physics of radiation. I also wanted to develop new methods to help cancer patients.



Jens Overgaard Legacy Award

Back to the future, a tale of volumes



Philip Poortmans

*Institut Curie
Paris, France*

What have been the proudest moments of your career?

When I moved to The Netherlands, I worked at the Verbeeten Instituut, which was a non-academic environment (it is a radiation oncology hospital). It is now to my opinion one of the best radiation oncology centres in Europe. I am proud that my team and I transformed this hospital into an centre of excellence that has contributed to clinical research and development. Also, we managed to bring the same level of organisation and patient care to other departments and therefore to numerous cancer patients. Another proud moment involves my election as ESTRO President, despite not coming from an academic hospital. I am also proud that my research, as part of teamwork of course, has had a real clinical impact on patients. And today I am proud of having been awarded the Jens Overgaard award. Last but not least, I am very proud of my family.

What is your next challenge?

I have two main challenges: the first one is to provide rebranded leadership and a new strategic direction to the European CanCer Organisation (ECCO). It is important to have a Society which represents all oncological professions in a truly multidisciplinary way and that advocates for

putting the patients in the centre of oncological health care. My second challenge is to help making Institut Curie the number one cancer centre in France.

What are the next steps in your career?

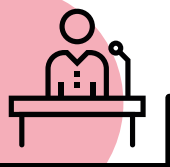
I love patient care itself. I can be more involved in this again, once I have optimised the organisation of the workflow at my department and the multidisciplinary environment of Institut Curie as that has my absolute priority as it benefits a much larger number of patients.

What does this award mean to you?

The recognition of my clinical research. As this is applicable in everyday practice, it makes a real impact.

What do you do in your spare time?

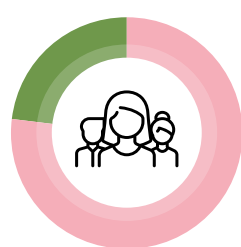
I love wine. My profession is oncology and my passion is oenology. If I hadn't become a scientist, I would have grown my own vineyard in difficult and challenging areas (otherwise it wouldn't be so much of fun).



Statistics

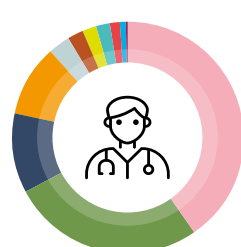
DELEGATES

6,633 Delegates



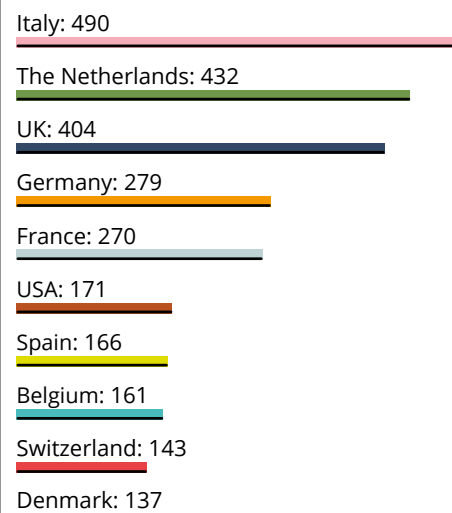
- 77% Participants
- 23% Company delegates

Breakdown per Specialty



- 40.4% Radiation Oncologists
- 26.9% Medical Physicists
- 11.00% RTTs, RT nurses
- 10.20% Clinical Oncologists
- 2.80% Other Non-Medical Specialities
- 2.40% Other Medical Specialities
- 1.90% Radiobiologist
- 1.90% Computer Scientist
- 1.40% Dosimetrist
- 0.80% RO Industry - Corporate
- 0.20% Quality Manager

Top 10 Countries



CONFERENCE

Overview



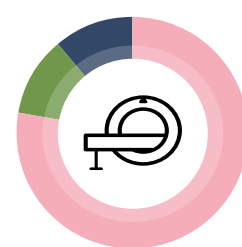
EXHIBITION

5,750.5 Sqm



- Main Exhibition: 5,516.5
- Start-up Corner: 84
- Community Pavilion: 150

123 Exhibitors

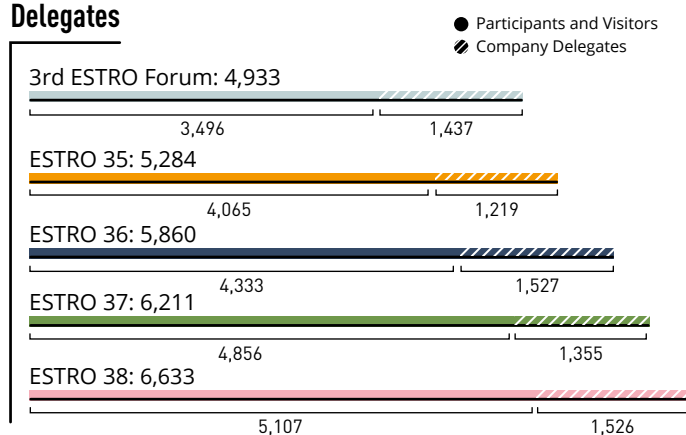


- Main Exhibition: 95
- Start-ups: 14
- Community Pavilion: 14

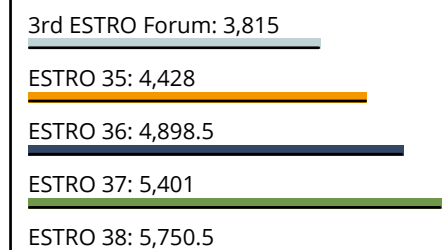
EVOLUTION

of the ESTRO annual conference (From 2015 to 2019)

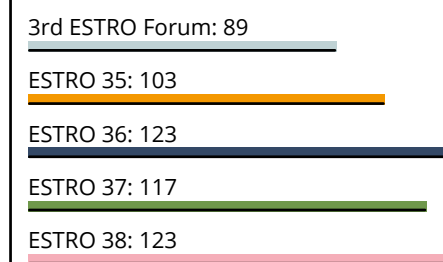
Delegates



Exhibition Sqm



Exhibitors



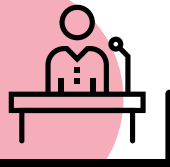


Photo album

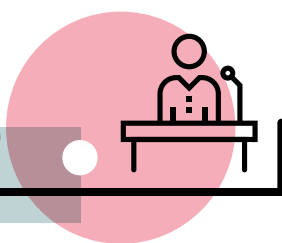






Find more pictures [here](#) >>





Forthcoming conferences

XVII Annual TMH Radiotherapy Practicums >>

20-21 September 2019 | Mumbai, India

The Romanian Society of Radiotherapy and Medical Oncology's 29th Annual Congress >>

17-19 October 2019 | Cluj-Napoca, Romania

The International Federation of Head and Neck Oncologic Societies (IFHNOS) 2019 World Tour >>

18-20 October 2019 | Leuven, Belgium

7th Trends in Head & Neck Oncology Meeting >>

7-9 November 2019 | Athens, Greece

3rd International Oncology Leadership Conference (IOLC) >>

17-19 November 2019 | Antwerp, Belgium

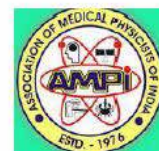


XVII Annual TMH Radiotherapy Practicum

20-21 September 2019
Tata Memorial Centre, Mumbai, India



Endorsed by
ESTRO



Tata Memorial Centre

Departments of
Medical Physics & Radiation Oncology

XVII Annual TMH Radiotherapy Practicum

**Implementation of Code of Practice
(CoP) for Dosimetry of Small Fields**

20 -21 September, 2019

Small fields are an essential part of advanced radiotherapy techniques such as stereotactic radiosurgery (SRS), stereotactic radiotherapy (SRT), stereotactic body radiotherapy (SBRT), intensity modulated radiation therapy (IMRT) and volumetric modulated arc therapy (VMAT).

Despite being widely used, the dosimetry of small fields is not well understood and we do not have universally accepted dosimetry procedures. It is important to address this topic to improve the accuracy of beam dosimetry in small fields and thus improve the safety and efficacy of patient treatments.

TO FIND OUT MORE, VISIT:

<https://ampi.org.in/xvii-annual-tmh-radiotherapy-practicum-sep-2021-2019-at-tata-memorial-centre-mumbai>

This two-day workshop is designed to help participants acquire practical knowledge on how to implement the new International Atomic Energy Agency (IAEA) / American Association of Physicists in Medicine (AAPM) code of practice on small field dosimetry.

The workshop will consist of lectures, presentations and discussions, followed by hands-on demonstrations involving participants. The workshop is an opportunity for clinical medical physicists in India to obtain first-hand information on the dosimetry of small fields in radiotherapy.

Organising chairs: Jai Prakash Agarwal and Rajesh Kinhikar

Organising secretary: RituRaj Upreti



The Romanian Society of Radiotherapy and Medical Oncology's 29th Annual Congress

17-19 October 2019
Cluj-Napoca, Romania



Founded in 1991 and with 286 members, the Romanian Society of Radiotherapy and Medical Oncology (RSRMO) connects people working in the oncology field, including physicians, physicists, radiotherapy technologists, biologists and others.

This year RSRMO is proud to be holding its 29th Annual Congress in Cluj-Napoca, Romania. The congress takes place over three days (17-19 October), with one day dedicated to young physicians and special sessions dedicated to medical physicists. On the second and third day there will be sessions dedicated to breast, gynaecological and colorectal cancer with debates regarding the multidisciplinary of treatment, surgery, radiotherapy and medical

oncology. There will be two other sessions: one dedicated to research and the other dedicated to international speakers with guests from the UK, France, Germany and Austria.

The best presentation in the young physicians' session will receive a free place on an ESTRO School course in 2020.

TO FIND OUT MORE, VISIT:
<https://srrom.ro>



The International Federation of Head and Neck Oncologic Societies (IFHNOS) 2019 World Tour

18-20 October 2019
Leuven, Belgium

TO FIND OUT MORE, VISIT:
http://ifhnos.net/world_tours.html



The European part of the International Federation of Head and Neck Oncologic Societies (IFHNOS) World Tour will take place in the vibrant university town of Leuven in Belgium, where academic rigour is combined with the art of enjoying life. The meeting is an opportunity to be updated on the latest developments in head and neck oncology. It will combine keynote lectures by world experts on head and neck radiotherapy, surgery and medical oncology, with extensive interactive discussions between the audience and the panellists; there will also be three sponsored satellite symposia.

The panels consist of the touring faculty and a strong European faculty of regional head and neck oncology leaders.

The IFHNOS World Tour is an excellent opportunity to update knowledge in this rapidly evolving field, to share ideas around the management of head and neck cancers, and to discuss difficult cases or controversial areas.

We are happy to announce the IFHNOS touring

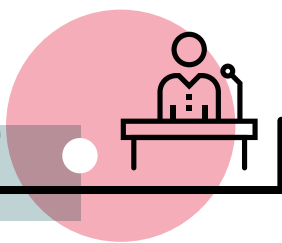
faculty of leading head and neck oncologists:

- Professor Jatin Shah (MSKCC, New York, USA)
- Professor Ashok Shaha (MSKCC, New York, USA)
- Professor June Corry (Genesis Care, Melbourne, Australia)
- Professor Alan Ho (MSKCC, New York, USA)
- Professor Barbara Wollenberg (Universität Lübeck, Germany)
- Professor Joseph Califano (UC San Diego, USA).

The event is hosted by the Flemish Head & Neck Society (VWHHT) and the Fund for Scientific Research (FNRS) Head & Neck Cooperative Group, and incorporates their annual joint meeting. Please visit our website www.ifhnosleuven2019.org. Special rates apply to residents-in-training, and members of the European Laryngological Society and European Head and Neck Society (EHNS).

Professor Dr Vincent Vander Poorten
Chair, IFHNOS World Tour
Otorhinolaryngology
Head and neck surgery
UZ Leuven, Belgium

Professor Dr Vincent Grégoire
Chair, IFHNOS World Tour 2019
Head of the Radiation Oncology Department
Centre Léon Bérard,
Lyon, France



7th Trends in Head & Neck Oncology Meeting

7-9 November 2019
Crowne Plaza, City Centre
Athens, Greece



SAVE THE DATE AND REGISTER FOR THNO 2019!

It is with great pleasure that we invite you to the 7th Trends in Head & Neck Oncology Meeting (THNO-7) being held in Athens, Greece, from 7-9 November 2019. This meeting will offer you up-to-date information on many aspects of head and neck cancer research translated into daily practice.

The 7th-THNO is designed for medical oncologists, surgeons, radiation oncologists, otolaryngologists, and other medical professionals involved in the treatment of patients with head and neck cancer.

The 7th-THNO will showcase the most up-to-date science and offer excellent opportunities for networking with key opinion leaders in head and neck oncology in the beautiful and sunny city of Athens.

Meeting chairs and scientific committee:

Volker Budach, Berlin, Germany
René Leemans, Amsterdam, The Netherlands
Jean-Pascal Machiels, Brussels, Belgium
Piero Nicolai, Brescia, Italy
Brian O'Sullivan, Toronto, Canada
Jan B Vermorken, Edegem, Belgium

TO FIND OUT MORE, VISIT:
www.thno2019.org



3rd International Oncology Leadership Conference (IOLC)

17-19 November 2019
Antwerp, Belgium



The 3rd International Oncology Leadership Conference (IOLC) heads to the University of Antwerp in Belgium from 17-19 November 2019. After successful conferences in London and Milan, this year's IOLC is being organised by the Association of Cancer Executives in partnership with the University of Antwerp and Hauck & Associates Inc.

IOLC brings oncology leaders together from around the world to discuss the most pressing topics in oncology administration. In previous years, IOLC has welcomed oncology administrators, oncologists, administrative managers, business operations managers, chief administrative officers, chief nursing officers, clinical administrators, radiation oncology managers, patient navigators and service line directors.

This year's IOLC conference planning committee is led by the chairperson, Professor Didier Verhoeven, a medical oncologist based at AZ KLINA, Antwerp, Belgium.

Prof Verhoeven and the committee have put together a very engaging agenda for IOLC 2019, which is divided into three parts: economy, technology and patient involvement / leadership. We are pleased to be welcoming speakers from around the world, who will be able to offer unique perspectives on some of today's most pressing topics in oncology administration.

A few of the topics that will be covered at IOLC 2019 include:

- Understanding the actual cost of cancer care
- Value for money: a misconception experience of the Middle East
- Pay for quality: myth or reality?
- Bringing the oncology world together: the Chicago experiment
- Bringing research and the oncology world together
- Business side of patient care
- Urgent care for cancer patients: reducing ER visits
- Privacy regulations
- The Winship way: humanising patient, family and staff experience
- A workshop conducted by Antwerp Management School.

Attendees will have a number of opportunities to network with their peers during the IOLC social events.

TO FIND OUT MORE, VISIT:

Early-bird registration rates are available until 30 June 2019. Reserve your place today at: <http://oncologyleadership.org/register>



ESTRO meets ASIA 2019

**ESTRO
CONFE
RENCE**

6-8 December 2019

Singapore

Abstract deadline: 11 July
Early deadline: 27 August

www.estro.org



Bridging the Gap

Advanced Breast Cancer

Fifth ESO-ESMO International Consensus Conference

14-16 November 2019 | Lisbon, Portugal

Coordinating Chair: F. Cardoso, PT

Chairs: E.P. Winer, US - L. Norton, US - A. Costa, IT/CH

Co-Chairs: G. Curigliano, IT - S.A. Mertz, US

Scientific Committee Members: K. Gelmon, CA

F. Penault-Llorca, FR - E. Senkus, PL - C. Thomssen, DE

The ABC5 guidelines will be developed by ESO and ESMO



The ABC5 conference and guidelines are endorsed by



The ABC5 conference is held

under the auspices of



with official representatives of



and is endorsed by



RECEIVE UPDATES AT WWW.ABC-LISBON.ORG | #ABCLISBON



14-17 November 2019, Vienna, Austria



EMUC19

Implementing multidisciplinary
strategies in genito-urinary cancers

11th European Multidisciplinary Congress on Urological Cancers

In conjunction with the

- 8th Meeting of the EAU Section of Urological Imaging (ESUI)
- European School of Urology (ESU)
- EMUC Symposium on Genitourinary Pathology and Molecular Diagnostics (ESUP)

Calendar of events



AUGUST 2019

1-2 AUGUST 2019 | TEHRAN, IRAN

3rd International Conference on Head and Neck Cancer

Endorsed by
ESTRO

29-31 AUGUST 2019 | BASEL, SWITZERLAND

Advanced Prostate Cancer Consensus Conference (APCCC) 2019

www.apccc.org/apccc2019.html

Endorsed by
ESTRO

SEPTEMBER 2019

4-7 SEPTEMBER 2019 | LONDON, UK

London Breast meeting 2019

www.londonbreastmeeting.com

Endorsed by
ESTRO

9-11 SEPTEMBER 2019 | PARIS, FRANCE

Association of systemic treatments and radiation therapy in breast cancer:
From evidence based to clinical practice

Endorsed by
ESTRO

20-21 SEPTEMBER 2019 | MUMBAI, INDIA

XVII Annual TMH Radiotherapy Practicum

<https://ampi.org.in/xvii-annual-tmh-radiotherapy-practicum-sep-2021-2019-at-tata-memorial-centre-mumbai/>

Endorsed by
ESTRO

OCTOBER 2019

4-6 OCTOBER 2019 | LJUBJANA, SLOVENIA

4th international SEETRO congress

<https://seetro.org/2019>

Endorsed by
ESTRO

10-11 OCTOBER 2019 | CAIRO, EGYPT

2nd Arab African International Cancer Congress (AAICC)

www.aaicc-eg.net

Endorsed by
ESTRO



10-12 OCTOBER 2019 | WARSAW, POLAND

Treatment Planning systems - Jointly organised by ESMPE and COCIR

www.efomp.org/uploads/EFOMP_school_2019_RT.pdf

Endorsed by
ESTRO

10-12 OCTOBER 2019 | PADUA, ITALY

15th Meet The Professor Advanced International Breast Cancer Course (AIBCC)

<https://meettheprofessor.accmed.org>

Endorsed by
ESTRO

17-19 OCTOBER 2019 | CLUJ-NAPOCA, ROMANIA

The 29th Annual Congress of the RSRMO

<https://srrom.ro>

Endorsed by
ESTRO

18-20 OCTOBER 2019 | LEUVEN, BELGIUM

IFHNOS World Tour

<https://kuleuvencongres.be/ifhnos2019>

Endorsed by
ESTRO

21-23 OCTOBER 2019 | ROME, ITALY

29th Residential Course on Modern Radiotherapy, time issues and new drugs

www.unicatt.it

Endorsed by
ESTRO

23-24 OCTOBER 2019 | PARIS, FRANCE

PROSCA 2019

<https://proscala.org>

Endorsed by
ESTRO

24 OCTOBER 2019 | POZNAN, POLAND

Young Scientists' Forum

Endorsed by
ESTRO

25-26 OCTOBER 2019 | PARIS, FRANCE

BLADDR 2019

<https://bladdr.org>

Endorsed by
ESTRO

25-26 OCTOBER 2019 | BUDAPEST, HUNGARY

3rd ESTRO Physics Workshop - Science in Development

www.estro.org/congresses-meetings/items/3rd-estro-physics-workshop

ESTRO
Event



NOVEMBER 2019

7-9 NOVEMBER 2019 | ATHENS, GREECE

7th Trends in H&N Oncology

www.thno2019.org

Endorsed by
ESTRO

8 NOVEMBER 2019 | BUDAPEST, HUNGARY

ESTRO RTT Workshop 2019

www.estro.org/congresses-meetings/items/estro-rtt-workshop-2019

ESTRO
Event

13-15 NOVEMBER 2019 | MADRID, SPAIN

2nd MD Anderson International meeting in Gastrointestinal Oncology. Current Practice and Controversies in the Era of Personalized Medicine

www.doctaforum.org/2019/gastrointestinaloncology2019

Endorsed by
ESTRO

14-16 NOVEMBER 2019 | LISBON, PORTUGAL

ABC5

www.abc-lisbon.org

Endorsed by
ESTRO

14-17 NOVEMBER 2019 | VIENNA, AUSTRIA

EMUC 2019 - 11th European Multidisciplinary Congress on Urological Cancers

<https://emuc.org>

Joint with
ESTRO

17-19 NOVEMBER 2019 | ANTWERP, BELGIUM

International Oncology Leadership Conference by Association of Cancer Executives

<http://oncologyleadership.org>

Endorsed by
ESTRO

21-22 NOVEMBER 2019 | MILAN, ITALY

MIBIOC - The way of the microbiota in cancer

<http://mibioc.shareevent.it>

Endorsed by
ESTRO

21-22 NOVEMBER 2019 | BUDAPEST, HUNGARY

7th GEC-ESTRO workshop

www.estro.org/congresses-meetings/items/7th-gec-estro-workshop

ESTRO
Event



DECEMBER 2019

6-8 DECEMBER | SINGAPORE

ESTRO meets Asia

[https://www.estro.org/Congresses/ESTRO-meets-Asia-2019-\(1\)/ESTRO-meets-Asia-2019](https://www.estro.org/Congresses/ESTRO-meets-Asia-2019-(1)/ESTRO-meets-Asia-2019)

ESTRO⁷
Event

MARCH 2020

30 MARCH - 1 APRIL 2020 | CAMBRIDGE, UK

The role of Epigenetics in DNA Damage Response, DNA Repair and Radiosensitivity

www.eacr.org/conference-series

Endorsed by⁷
ESTRO



ESTRO

Bimonthly newsletter
N° 125 | July-August 2019
European Society for
Radiotherapy & Oncology

OFFICERS

President: Umberto Ricardi
President-elect: Ben Slotman
Past-president: Yolande Lievens

EDITORIAL TEAM

Managing editor
Evelyn Chimfwembe

Editorial coordinator
Michela Mizzi

Sub-editors
Emma Mason
Nick Sarson

Graphic designers
Daneel Bogaerts
Sophie Nelis

Published every two months and
distributed by the European Society for
Radiotherapy & Oncology.

For permission to reprint articles please
contact the editor.

If you want to submit articles for
publication, please contact:
echimfwembe@estro.org

For advertising, please contact:
hyilmaz@estro.org

ARCHIVE

Latest issues of the newsletter can be
found on the ESTRO website under www.estro.org/about and older issues are
accessible on e-library, from the home
page of www.estro.org.

Opinions expressed in the ESTRO
newsletter do not necessary reflect those
of the Society or of its officers.