1 **Introduction**

Pterygium is relatively rare in Europe. Most patients come from latitudes 30 - 35 both sides from the equator. This geographical distribution indicates that UV exposure constitutes a significant risk factor.

The symptoms are cosmetic defects and, in case of large extension to the central part of the cornea, decrease of the vision (2).

The standard treatment is surgery followed by irradiation because, in surgery alone, the recurrence rate ranges from 30% to 50% (7,8).

2 **Anatomical Topography**

Pterygium is situated from the cornea to the internal canthus in the interpalpebral aperture (Fig 34.1).

Critical organs for radiation therapy are all the structures of the eye and more particularly the lens. In case of irradiation the dose received by the lens and other critical sites in the anterior eye segment must be strictly evaluated.(5)

![Fig 34.1: Typical case of pterygium extending from the cornea to the internal conjunctival angle.](image)

3 **Pathology**

Pterygium is consists of hypertrophy of the sub conjunctival tissue (fig. 1). This sheet of tissue has an organised vascularisation in the form of an open fan with its apex pointing toward the pupil.
4 Work Up

Work-up consists of an aesthetic evaluation taking into account the opinion of the patient. A complete ophthalmologic exam of both eyes is necessary, with measurement of visual acuity and search for possible lens disease (well-known role of UV in the aetiology of cataracts) (5).

5 Indications, Contra-indications

Knowing that, after surgery alone, relapse may occur in about one third of patients, complementary treatment is indicated. Irradiation constitutes one of the possibilities to be performed immediately after surgery.

Brachytherapy with dedicated eye plaques can be performed in case of cosmetic defects and is mandatory if vision is affected (1,5,7).

6 Target Volume

The patient lesion has to be evaluated by the radiation oncologist before resection to be able to select the applicator size.

The clinical target volume is established during the surgical excision.

The whole resection area has to be considered as target volume in terms of surface and depth.

7 Technique

The standard technique is a plesio-brachytherapy with an epibulbar plaque adapted as well as possible to the volume to be treated. The applicator has a central radioactive disc and a non active rim of 2mm (Fig 34.2). It is applied as soon as possible after surgery. Usually a strontium applicator is used following surgical excision within one day (1,8 - 10).

Fig 34.2 : Epibulbar SR 90 applicator for treatment of pterygia and conjunctival melanoma. Notice the central active zone and the non-active peripheral rim.
The conjunctiva and the cornea are locally anaesthetised, the eyelids are kept open by a lid retractor. The applicator is placed in contact with the area of resection. A star is used to maintain the applicator in a central, adapted position.

The radioactive area of the source overlies 1 - 1.5 mm of the cornea and 3 - 4 mm of the limbus. If the surgical resection area is too large, two applications can be carefully and meticulously performed.

In case a large overlap with a circular applicator and healthy cornea, an individual protector can be made of a thin (0.5mm) lead foil to protect that part of the cornea. With Sr 90 applications the lens will in all cases receive less than 5% of the surface dose.

8 Dosimetry

Before starting irradiation the actual dose rate at the surface of the application has to be calculated taking into account the decay of the strontium source \( A(t) = A(0) e^{-0.000206 t} \).

Although doses at a certain depth can be derived from available depth dose curves, dose prescription and recording and reporting are done in case of epibulbar plaque brachytherapy at the surface of the applicator.

Doses to the lens can be calculated from the depth dose curve and the distance from the plaque to the lens.

9 Dose, Dose Rate, Fractionation

Treatment with a Sr\(^{90}\) epibulbar plaque is HDR brachytherapy. The dose rate ranges from 5 -20 Gy/min. Total doses delivered range from 25 - 60 Gy delivered in 1-6 fractions. Usually a dose of 30 Gy is delivered in 3 weekly fractions of 10 Gy. The first application may take place at the time of surgery, or at least within 48 h after surgery. Each application is be delivered in a few minutes.

10 Monitoring

During the application the tolerance is quite acceptable because of the local anaesthesia. It is important to keep carefully the correct position of the applicator during the application. In applications lasting for several minutes it is advised to stop half way, to relax a while and to check correct positioning.

During the days following the irradiation a local reaction with redness, tearing and sometimes minor conjunctivitis is noted and may last for 4 - 6 weeks following the treatment (Fig 34.3A). A topical ointment application is prescribed with 3 - 4 days local antibiotics and corticoids until inflammation has disappeared (usually within one week).

11 Results

The long term results are usually very satisfactory (Fig 34.3B). A literature review including about 4400 patients (Table 1), shows the results of different brachytherapy procedures with total dose ranging between 25 - 60 Gy delivered in 1 - 6 fractions (2,4,6 - 10);
Fig 34.3A: Result directly after treatment 1997, 3B: Result after long follow up 1999 (see Fig 34.1)
A. Acute reactions 1 week after re-excision and 3 x 10 Gy surface dose with a strontium-90 epibulbar applicator.
B. Result at 14 months.

Table 34.1: Results of brachytherapy in pterygium

<table>
<thead>
<tr>
<th>Authors</th>
<th>Pts N</th>
<th>Dose Gy</th>
<th>Fractions N</th>
<th>Interval surgery/BT</th>
<th>Recurrence %</th>
<th>Complications %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brenk (9)</td>
<td>1300</td>
<td>24-30</td>
<td>3</td>
<td>&lt;1 day</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Cooper (3)</td>
<td>272</td>
<td>30</td>
<td>3</td>
<td>Various</td>
<td>12</td>
<td>?</td>
</tr>
<tr>
<td>Mc Kenzie (6)</td>
<td>764</td>
<td>22</td>
<td>1</td>
<td>___</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>Wilder (10)</td>
<td>338</td>
<td>24</td>
<td>3</td>
<td>&lt;1 day</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Parayani (8)</td>
<td>825</td>
<td>60</td>
<td>6</td>
<td>&lt;1 day</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Fukushima (4)</td>
<td>393</td>
<td>30</td>
<td>3</td>
<td>&lt;2 days</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Nishimura (7)</td>
<td>490</td>
<td>30-40</td>
<td>4-5</td>
<td>1-3 days</td>
<td>12</td>
<td>2</td>
</tr>
</tbody>
</table>

The recurrence rate is only 2 - 12%, and the complication rate usually around only 1 - 2%. It has been reported by Mc Kenzie (6), however, to be as high as 17%.

12 References


9. Van den Brenk HAS et al. Results of prophylactic postoperative irradiation in 1300 cases of pterygium.