Venous Graft for Reconstruction of Neoplastic and Post-traumatic Eyelid Defects

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Abstract. Aim: The repair of an eyelid-wide full-thickness defect is a challenging procedure, mostly for the tarso-conjunctival layer reconstruction. The Authors illustrate their own experience in reconstructing eyelid-wide defects with a composite venous wall and skin graft to repair both neoplastic and post-traumatic injuries, aiming to reach both functionally and cosmetically satisfactory results. Patients and Methods: Eight patients were treated with this procedure; six of them were affected by a local invasive tumor, two had a wide defect following a trauma. Results: Most of the patients had good functional and cosmetic results after a median follow-up of 51 months; only one had a minor complication. Conclusion: Eyelid reconstruction with a venous wall and skin graft is a recently introduced technique that represents a reliable alternative to traditional procedures, granting esthetically and functionally good results.

Surgical reconstruction of the eyelid may be indicated in the treatment of a skin tumor (often basal cell carcinoma) or for the correction of disabling or disfiguring defects following trauma.

In full thickness reconstruction, the most differentiated and the most difficult part to set up is the tarso-conjunctival layer, also known as the posterior lamella (1). In the presence of great eyelid substance detriment, more than a fourth of the total length, several approaches are possible (2), including a rotational flap from the residual eyelid (3-4), removal of tissue from the other eyelid (5-6), or a chondromucosal flap (7-8). In the latter technique, a fragment of cartilage, commonly auricular, is positioned on the defect and covered with mucosa, usually harvested from the nasal septum or the oral cavity; the operation usually requires a two-step procedure due to the cartilage thickness and can lead to unsatisfactory esthetic and functional results. To overcome these problems, an alternative surgical technique has been introduced for oncologic patients (9); it consists of a full thickness reconstruction with a graft of a wall segment of a propulsive vein, combined with skin covering (Figure 1A).

We used this novel technique in eight cases, including repair not only of neoplastic but also of post-traumatic defects.

Patients and Methods

Since January 2007, eight patients affected by full-thickness wide defect of the eyelid were treated with venous and skin graft at the Perugia General Hospital and University of Perugia Medical School. According to the international literature (9), a defect is defined as being wide when it involves more than one quarter of the eyelid length.

Six of them presented a wide defect after the excision of basal cell carcinoma, while in the remaining two cases, the defect was caused by a trauma. There were four men and four women, with age ranging from 31 to 91 years, median of 77.5 years and mean of 71.5 years. Table I summarizes the patients data.

The patients with traumatic defect had all been previously treated with an emergency procedure, one of them in a service other than our unit. In all those with neoplastic disease, the treatment had been entirely performed in our unit.

In the latter group, planned treatment was radical removal of the neoplasm and correction of the resulting functional defect by reconstructing a functionally and esthetically acceptable eyelid with a saphenous graft, covered by a cutaneous flap.

Radical removal was performed to obtain wide, radical excision of the tumoral tissue (Figure 1B). Replacement tissue for the internal portion (bulbar) of the conjunctiva, ideal for reconstructing the eyelid tarsus, was obtained from a segment of saphenous vein, average length 5 cm, harvested after ligation through a groin opening. The incision site had been previously marked by means of ultrasonography and the preferred donor site was immediately distal to the collateral veins inlet (Figure 2A). The preoperative ultrasonography was also useful in order to assess the patency of the deep venous system prior to proceeding with the saphenous interruption, and to ensure that we were harvesting an undamaged vessel without valves. This venous cylinder was cut...
lengthwise to form a flat surface (Figure 2B) and then buried in the surgical breach, with the intimal layer abutting the bulbar conjunctiva, and was fixed with absorbable sutures, leaving a free tissue margin from which the ciliary edge was reconstructed (Figure 2C). The skin plane was reconstructed with a nasogenial transposition flap with an upper pedicle (Figure 3). Representative images of preoperative eyelid neoplastic disease and the final outcome at 36 months are shown in Figure 4.

Table I. Patients treated since January 2007.

<table>
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<tr>
<th>Gender</th>
<th>Age (years)</th>
<th>Eyelid</th>
<th>Side</th>
<th>Origin</th>
<th>Anesthesia</th>
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<tr>
<td>Female</td>
<td>91</td>
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<td>Local</td>
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<td>Right</td>
<td>Trauma</td>
<td>General</td>
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<tr>
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<td>Left</td>
<td>Neoplastic</td>
<td>General</td>
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<tr>
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<td>Neoplastic</td>
<td>General</td>
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<tr>
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<tr>
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<td>General</td>
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<tr>
<td>Male</td>
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<td>Lower</td>
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<tr>
<td>Male</td>
<td>31</td>
<td>Upper</td>
<td>Right</td>
<td>Trauma</td>
<td>General</td>
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</tbody>
</table>

Figure 1. Eyelid reconstruction. A: The operative design. B: Radical removal was performed in order to obtain wide, radical excision of the tumoral tissue.

Figure 2. A: Saphenous vein harvesting for eyelid reconstruction. B: The venous cylinder was cut lengthwise to form a flat surface (inside view). C: The venous graft in the surgical breach with the intimal layer abutting the bulbar conjunctiva.
In the case of post-traumatic injuries, the treatment plan was first to debride the palpebral adherences and then follow procedure as given above (Figures 5 and 6), except that the skin plane reconstruction was carried out with full-thickness skin grafts harvested from the pre-auricular area.

We contemporaneously conducted the first ophthalmic step and the saphenous harvesting, thus dramatically reducing the total operating time; in our experience, the operations lasted from 180 to 240 minutes with a median of 200 minutes.

Results

We did not record any intraoperative complication, but there was one postoperative complication. In detail, no complication was recorded in the donor sites, nor infections or hematomas in the orbital area.

The youngest patient affected by severe post-traumatic defect of the upper right eyelid developed skin graft necrosis, leading to a cutaneous retraction that required a second intervention one month after the first procedure; in this second procedure, the retraction was treated using a skin graft harvested from the contralateral eyelid, with good results (Figure 6C). Except for this case, no other grafts or flaps failed, and no patient complained of unsatisfactory cosmetic or functional results.
The average hospital stay was 4 days postoperatively, ranging from 2 to 6 days. All patients were followed up in our service; the median follow-up was 51 months, range 4 to 54 months.

In the group of oncologic patients, no cancer relapse was recorded.

**Discussion**

Several surgical approaches are usually described for repairing full-thickness defects of the eyelid, with the use of full-thickness flaps from the contralateral eyelid (10), rotation flaps from the residual eyelid (7), composite grafts with nasal or buccal mucosa supported with ear cartilage (7-8) or, more recently, with microsurgical free flaps raised from the foot (11) or thigh (12).

In 2008 Barbera et al. (9) first described a new reconstruction technique using a venous wall graft in patients affected by neoplastic disease of the eyelid. We tried the same technique, not only in patients with neoplastic disease
but also for repairing post-traumatic defects. We found that the venous graft is a very reliable tool to obtain tarso-conjunctival layer repair for several reasons.

Firstly, this is due to the architectural and structural similarities between the wall of a propulsive vein and the tarso-conjunctival plane. Basically, the wall of a propulsive vein is composed of an intima consisting of an endothelium with one or two cell layers, a middle layer containing dense connective tissue rich in elastic fibres and with smooth muscle cells arranged concentrically and longitudinally, and an adventitial layer consisting of lax connective tissue with vasa vasorum. Similarly, the tarso-conjunctival plane is composed of the conjunctiva, which consists of a cylindrical epithelial layer of no more than two cells deep, and the tarsus made up of dense connective tissue rich in elastic fibres (Figure 7). The venous adventitial layer, missing from the tarso-conjunctival plane, could easily be removed but we would prefer to make use of it, given that the vasa vasorum can promote revascularization of the skin graft (9).

The similarities between the vein and the tarso-conjunctival plane favor the reconstruction of a new eyelid with a conjunctival fornix deep and thick enough to allow for the integration of the venous endothelium with the conjunctiva and the reconstructed ciliary edge.

Another issue to stress is that the vein segment is concave, elastic and smooth; thus it complies well with the implant site without causing any chronic inflammatory reaction of the bulbar conjunctiva or the cornea. Other advantages of this surgical technique are that no additional intervention on the eyelids, nasal septum and auricle are required and the operation can be carried out in one session without surgical symblepharon. The procedure is also useful for treating oculocutaneous disorders because the harvesting of the vein from superficial circulation is neither a complicated nor a risky intervention. Furthermore, the harvesting can be performed simultaneously with the first steps of the orbital preparation, thus reducing operating time.

We underline that we used this innovative reconstruction not only for the treatment of patients with neoplastic disease, often elderly and with reduced esthetic needs, but also for repairing post-traumatic damage in young or middle-aged patients. Our experience in repair of post-traumatic eyelid defects is very limited, and we found the procedure to be more difficult than in neoplastic cases; the difficulties arose from the site of the defect (in both cases we managed breaches of the superior eyelid) and from the need for reconstructing the skin layer using a full-thickness skin graft instead of a rotational graft, with consequently greater difficulty in ensuring the graft survival. Furthermore, post-traumatic defects are usually irregular and it can be difficult to obtain perfect wound debridement. Nevertheless the final outcome was very satisfactory, even in the cases of post-traumatic defect.

Conclusion

The saphenous graft can be an ideal tool for a full-thickness reconstruction of the eyelid because of the anatomical compliance of the graft with the recipient site. The procedure does not present major technical difficulties and can lead to excellent esthetic and functional outcomes with few complications.

Conflict of Interest and Source of Funding

None declared.

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References