Lower Eyelid Reconstruction after Basal Cell Carcinoma Removal

A Decision Management Tool

Abstract
We describe the clinical features in a case series of 64 patients presenting with a primary basal cell carcinoma (BCC) involving the lower lid and/or adjacent inferior periorcular area, and present simple surgical guidelines for reconstruction based on the location and size of the lesion.

Key words: basal cell carcinoma; diagnosis, surgical management.

INTRODUCTION
When patients present with lesions suspicious for malignancy involving the lower eyelid, it is often the intricacies associated with reconstructing the anterior and posterior lamellae that pose the biggest challenges to maintain appropriate function and to provide adequate ocular surface protection. Factors such as the patient’s age, degree of eyelid laxity, the location of the lesion within the lower lid, and the potential involvement of additional anatomical landmarks such as the punctum, canaliculus, and medial and/or lateral canthal tendons, should be taken into account when planning for surgery. A successful procedure involves complete excision of the malignancy with margin control, lower eyelid stability, adequate corneal protection, minimal vertical tension on the lid, and a good cosmetic result. The purpose of this study is to describe the clinical features in a case series of 64 patients presenting with a primary basal cell carcinoma (BCC) involving the lower lid and/or adjacent inferior periorcular area, and present simple surgical guidelines for reconstruction based on the location and size of the lesion.

METHODS
A non-comparative retrospective review of the clinical records, eyelid photographs, histopathology, and imaging of patients presenting with a single primary BCC affecting the lower eyelid and/or adjacent periorcular area, who were referred to a tertiary oculoplastic center between 2007 and 2013. We included only adults who underwent primary surgical excision of the tumor with en-face frozen section margin control, followed by reconstruction in either one or two stages performed by a single surgeon (AAV). Special care was taken to measure the size of the lesion before excision, which was estimated as small to moderate (<15 mm), intermediate (15-25 mm), or large (>25 mm) and guided the reconstruction. Data collected included patient demographics, prior history of skin malignancies and/or presence of actinic damage, clinical presentation, location of lesion, histopathology, type of surgical reconstruction, complications, and recurrence. We excluded all patients with prior history of a skin malignancy affecting the same eyelid, referrals for recurrent tumors, invasive disease beyond the orbital septum, as well as those due to obvious secondary extension from tumors originating from adjacent structures. No direct or indirect patient identifiers were collected at any time, and the entire protocol followed Tulane University’s Institutional Review Board policies.

RESULTS
A total of 64 patients were included in this study, of which 33 were male (51.5%).
Mean average age at referral was 60 years old (± 14.2 years), with a range of 21 to 81 years old. All tumors were unilateral, with 34 patients (53.1%) having lesions involving the right side. In 17 cases (25%) there was a positive history of a previous basal cell carcinoma, intra-epidermal carcinoma, squamous cell carcinoma, and/or melanoma elsewhere in the body: 4 patients had more than 10 previous skin lesions, 2 patients had between 5 to 10 tumors, and 11 patients had a history of less than 5 skin cancers. The most common presentation of BCC in the lower eyelid was a mass in 46 patients (71.9%), followed by 20 patients with madarosis (31.3%), 8 patients with eyelid retraction and/or frank ectropion (12.5%), and 5 patients with the presence of a crusted lesion (7.8%). Almost 60% of patients demonstrated evidence of extensive actinic damage affecting sun exposed areas of the head and neck. Computed tomography imaging was required only in two cases, to rule out deep orbital involvement.

Thirty-eight patients (59%) presented with a lesion isolated to the medial periocular area, which is defined as the region between the medial canthus and the bridge of the nose, and not involving the lower eyelid or its tarsal plate. Nine patients (14%) presented with a lesion involving both the medial periocular area and the lower medial eyelid. Finally 3 patients (5%) presented with a BCC lesion isolated to the lateral canthal periocular area (not involving the lateral tarsal plate). The average lesion size was 15.9 mm horizontally (± 8.0 mm) by 10.9 mm vertically (± 4.9 mm), with a range of 3 to 40 mm in the horizontal axis, and 3 to 20 mm in the vertical axis. Of note, horizontal lesions larger than 30 mm were due to extension into the medial or lateral periorbital area beyond the canthal tendons.

Surgical excision of all lesions was performed with en-face frozen section margin control, and clear margins were confirmed with permanent sections. Several surgical techniques were planned to reconstruct the lower eyelid defect depending on the size of the lesion, depth, involvement of the canthal tendons, and/or canalicul invasion. Of all 64 patients, 13 (20%) had canalicul involvement and after the lesion was removed, only 3 developed symptomatic epiphora.
that resolved after a dacryocystorhinostomy to optimize the lacrimal outflow through the remaining superior canaliculus.\(^4\)

The type of reconstruction for each defect took into account multiple factors including the size of the lesion, degree of eyelid laxity, and whether adjacent structures were involved, such as the lower canaliculus, canthal tendons, upper cheek and nasojugal area. Small to moderate full-thickness defects (up to 15 mm in largest dimension) in the lower eyelid were corrected with primary closure +/- cantholysis. Intermediately sized lower lid gaps (15-25 mm) were typically approached with a combination of a tarso-conjunctival graft with a myocutaneous advancement flap, or a tarso-conjunctival flap with full-thickness skin graft, +/- cantholysis. We choose one or the other, taking into account the best long-term outcome, the quality of the anterior lamella, the degree of horizontal and vertical laxity, and the requirement of a second surgical procedure. Large lower lid defects (\(\geq 25\) mm in largest dimension) always involved a full-thickness eyelid defect extending beyond the canthal area, and included the upper cheek centro-laterally or the nasojugal area medially. In these cases, the reconstruction was complex and included the recreation of a new posterior and anterior lamella and securing adequate blood supply for tissue survival with minimal post-operative retraction. The posterior lamella was reconstructed with one or a combination of: a tarso-conjunctival graft taken from the upper lid or a chondro-mucosal graft harvested from the nasal septum. If additional tissue was required beyond these sources, a periosteal flap was a useful tool when rotated from the lateral orbital rim. This also facilitated the creation of a new lateral canthal tendon if needed. A Mustarde myocutaneous cheek rotational flap was preferred to reconstruct the anterior lamella as all of our large defects defect involved the lid, the lateral canthus and the cento-lateral upper cheek. For lesions isolated to the medial periorcular area not involving the full-thickness eyelid, we used a bilobed or rhomboid myocutaneous flap harvested from the nasojugal area in combination with a bilobed or rhomboid myocutaneous flap. (Table 1a,b)

Histopathological analysis revealed several subtypes of BCC, with the nodular type being most common (77.5%), followed by morpheic (15.5%), and then superficial multifocal (7%). We observed 1 post-operative complication as a patient experienced lower lid retraction without corneal exposure at 3 months post reconstruction. This patient was

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<th>Table 1a: Defect Repair Technique Associated with Defect size for Full Tickness Lower Defects</th>
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<td><strong>Type of surgical repair</strong></td>
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<td>Primary closure ± cantholysis</td>
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<td>Tarsoconjunctival graft with myocutaneous flap</td>
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<th>Table 1b: Defect Technique Associated with Defect Size for Medical and Lateral Periorcular Defects</th>
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<td>Myocutaneous flap (bilobed or rhomboid + island advancement)</td>
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in his 8th decade and presented with extensive anterior lamellar actinic damage and a large lesion (35 x 10 mm) involving the entire lower lid, lateral and medial canthal tendons, medial periorbital area, as well as the inferior canaliculus. He underwent reconstruction with a nasal septum graft in conjunction with a rotational periosteal flap for the posterior lamella. A Mustarde myocutaneous cheek rotational flap was used for the anterior lamella defect. This patient did not choose to undergo further surgical management for the post-reconstruction lower lid retraction and was managed conservatively with ocular lubrication and observation. None of our patients required further surgery and there was no evidence recurrence after 5 years of follow up (range 1.5 to 9 years).

DISCUSSION

BCC is the most common skin cancer in Caucasians. It accounts for approximately 90-95% of all malignant eyelid tumors worldwide. The differential diagnosis for a lesion of the lower eyelid includes SCC, papilloma, nevus, epidermal inclusion cyst, chalazion, and sebaceous cell carcinoma, among others. As BCC is nearly always a locally invasive disease, definitive treatment is usually achieved with complete surgical excision with margin control.

Once a BCC has been removed in toto with pathologic confirmation, attention turns to reconstructing the eyelid in a meaningful way. It is important to conceptualize eyelid anatomy prior to embarking on surgical reconstruction. The lower eyelid ranges in horizontal dimension from 28 to 30 mm. The lower eyelid margin rests at the inferior limbus and the lateral canthus lies 2 mm higher than the medial canthus. The goals of reconstruction are to preserve lower eyelid anatomy and stability, prevent post-operative eyelid malposition such as entropion or ectropion, adequately protect the cornea, and achieve a good cosmetic result. As the medial canthal area is the second most common periorbicular location for BCC, it is important to take into consideration the anatomy of this area as well, which is beyond the borders of the tarsal plate and therefore consists only of skin and subcutaneous tissue.

When eyelid defects are full thickness, they require substantiation with anterior lamella (orbicularis oculi and epidermis) and posterior lamella (conjunctiva and tarsal plate). Anterior lamella repair requires a musculocutaneous flap with optimal skin color and texture match and a repair which conceals scar lines and minimizes vertical tension on the eyelid margin, as to not create a post-surgical eyelid malposition. Anterior lamella may be derived from the ipsilateral upper eyelid, cheek, nasojugal, or retroauricular area. In reconstructing a lower eyelid, the goal of posterior lamellar substantiation is to provide a thick mucosal surface and appropriate mechanical stenting of the graft, while providing support to the eyelid and substantiating infratarsal volume. Posterior lamella may be taken from a variety of places, including: ipsilateral or contralateral upper lid tarsocconjunctiva, nasal chondro-mucosa, and periosteum, which can emulate a lost lateral canthal tendon and add stability to the lower lid apparatus.

Lower eyelid defects are classified as small to intermediate (< 15 mm), moderate (15-25 mm), or large (> 25 mm). Whenever possible it is ideal to close a wound directly without utilizing a graft or flap. This technique of direct closure has traditionally been utilized for small full thickness defects of < 33% of the lid margin, with larger defects typically able to be closed directly in an older patient population with increased skin laxity. Additionally a lateral cantholysis allows for primary closure of defects slightly larger than a third of the lid margin, however the surgeon must take care to maintain the normal anatomical sharp angle of the lateral canthus post-operatively. Other factors such as vascular supply to the surrounding tissues, history of previous treatment, and histopathologic subtype of the tumor should be considered before attempting direct closure as they can affect tissue laxity and healing.

When lower eyelid defects are more moderately sized (15-25 mm), we primarily utilized two techniques for repair: a modified Wendell-Hughes procedure with full thickness skin graft or a tarsocconjunctival graft with myocutaneous flap. The easiest place to harvest a tarsocconjunctival graft is from the ipsilateral or contralateral upper eyelid, which need not be closed and can be left to heal secondarily. Alternatively a Hughes procedure may be employed which utilizes a tarsocconjunctival flap from the ipsilateral upper eyelid in addition to a full thickness skin graft. The Wendell-Hughes procedure, although effective, requires a second procedure in approximately 2 weeks to separate the flap from the upper eyelid, and is not ideal in
monocular patients or patients with extensive medical history, making a second procedure prohibitive.13 The authors note that when performing the second stage of this surgery, it is important to meticulously dissect Muller's muscle from the top of the tarsus. Failure to do so completely may result in upper eyelid retraction. Other considerations when deciding between these two options are that younger patients typically have less eyelid laxity, and therefore extending a myocutaneous flap may be more difficult. As a result we advocate the use of a Wendell-Hughes with full thickness skin graft in younger patients. It is also best to use a Wendell-Hughes to repair central or medio-lateral lower eyelid defects, while a myocutaneous flap is better suited for medial or lateral eyelid defects, largely due to increased eyelid laxity in these areas.

With large (> 25mm) lower eyelid defects, we utilized nasal septum, a tarsoconjunctival graft, peristeum, or a combination of these to substantiate the posterior lamella. Typically the modified Hughes procedure, referenced above, can substantiate posterior lamella in an eyelid defect up to 75% of the lid margin, but alternate sources need to be explored when larger defects are encountered.14 Nasal septum and/or peristeal grafts are advantageous for near-total lower eyelid defects because the cartilage is not only abundant, but it also possesses adequate strength to resist contractile forces generated at the eyelid.1 Because nasal septum, in particular, is typically thicker than the tarsal plate it is prudent to thin out the graft to a thickness of approximately 1mm prior to insertion. In our case series, these larger defects tended to involve the lateral face and as such a Mustarde rotational cheek flap was utilized to re-create the anterior lamella. Because of the sheer bulk weight of a Mustarde flap, a known complication of utilizing this technique is sagging of the midface resulting in lower eyelid retraction and ectropion.1,15 This complication can be partially obviated by having strong posterior lamellar anchored at the medial and lateral canthus. Of 6 patients who underwent a Mustarde procedure in our series, 1 patient had lower eyelid retraction without corneal exposure. Notably the histopathologic subtype of BCC in this patient was Morpheaform, which may have added to the predisposition of post-operative contracture and scarring.

Finally, we observed a high incidence of BCC presenting in the medial or lateral canthal area in isolation, not involving posterior lamella, which requires repair of anterior lamellar structures using a myocutaneous flap. Note that attempting closure of defects in this location with primary closure, even if the defect is small, is not advisable because it may lead to excessive lower eyelid retraction. The myocutaneous flap can be derived from adjacent skin and superficial muscle and should be approximately the size of the eyelid defect, if not slightly smaller, as to not to lead to excess laxity.16,17 Bilobed, rhomboid, and nasojugal island advancement myocutaneous flaps were utilized in this study, and two different types may be combined to repair a larger shaped defect. Bilobed flaps may be utilized in patients with a higher nasal bridge while rhomboid flaps may be better suited for patients with a flatter nasal bridge, so pre-operative determination of the patient’s facial structure is important to consider.17 In the event that a defect still exists after using a rotational bilobed or rhomboid myocutaneous flap, a nasojugal cheek advancement flap proved to be a useful tool.

While there is much discussion in the literature regarding reconstruction options for lower eyelid defects, we aim to provide a concise, comprehensive review of some straight-forward yet effective techniques that may aid the general ophthalmologist or novice oculoplastic surgeon. It is important to note that the simplest surgical solution is often the best one. It is also important to consider that basal cell carcinoma lesions are misleading in presentation, and in order to obtain clear margins, a significant portion of the lower lid needs to be excised. While this study examined the size of the presenting basal cell carcinoma lesion, often complete excision of this lesion resulted in a defect much larger than anticipated in pre-operative planning. While our study particularly focuses on lower eyelid reconstruction following basal cell carcinoma excision, many of the principles presented here can be applied to defects resulting from other etiologies, such as malignancies and trauma. By having a basic understanding of different sources for both anterior and posterior lamella, and conceptualizing how to manage small versus larger defects, our goal is to provide a basic framework for pre and intra-operative decision making that leads to successful functional and aesthetic appearance after lower eyelid reconstruction.

REFERENCES