The association of a lip commissure to eyelid transposition flap with a frontal transposition flap for reconstructive eyelid surgery following squamous cell carcinoma resection in a European short-haired cat

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Key Clinical Message

The surgical resection of a squamous cell carcinoma in a cat was performed on both the palpebral and nasal aspects of the OD medial canthus. A two-stage surgical technique was employed, involving two different transposition flaps, taking care to maintain eyelid function and estheticism, with a long follow-up.

Keywords

Association, cat, frontal flap, lip to lid, squamous cell carcinoma, surgery.

Introduction

Mammalian eyelid tissue appears to be relatively simple, although it is, in fact, anatomically complex. The anterior side of the eyelid is composed of a fine layer of highly mobile skin and the palpebral portion of the orbicularis muscle. This muscle is innervated by the facial nerve (VII), which controls eyelid closure and blinking. The posterior side of the eyelid is formed by the tarsus, a fibrous strip forming an effective armature, and covered by the palpebral conjunctiva [1]. The specific characteristics of the eyelids allow them to protect the corneal surface from external harm [1]. Therefore, when performing a blepharoplasty, the aim is to employ a reconstructive technique using a tissue capable of simulating the complex palpebral structure as closely as possible.

Feline palpebral tumors, unlike those of canines, are rare but frequently malignant [2]. In this species, the most frequent palpebral neoplasm is squamous cell carcinoma (SCC), also known as epidermoid carcinoma or spinocellular carcinoma [1–9]. The two other main cutaneous tumors found in cats are mastocytoma and hemangiosarcoma [1]. These types of carcinoma are locally highly invasive and destructive [1, 2, 4–6]. Although regional lymph node metastases can occasionally occur, they are rarely found at any distance from the primary site [1]. According to a study by Newkirk in 2009 [3], the predilection site of palpebral SCC appears to be the lower eyelid and medial canthus in cats subject to a lack of skin pigmentation.

Several therapeutic options exist to treat this destructive tumor, including surgical excision, which is often curative but is complicated by the difficulty of precisely identifying the exact boundaries of the tumor [2]. Consequently, two options can be considered: either extensive surgical ablation with often complex cutaneous...
reconstruction or more localized surgical ablation associated with an adjuvant therapy.

In this case, we describe a surgical technique following the en-block resection of an SCC and its clinically healthy margins located under the lower eyelid and the medial canthus of the eye of a cat. Two random (as opposed to axial) cutaneous flap techniques were combined for this blepharoplasty.

**Case Presentation**

**Anamnesis**

A seven-year-old, European, short-haired tabby and white female neutered cat were referred due to the presence of a penetrating ulcerative tumor in the region of the medial canthus of the lower right eyelid (Fig. 1). The coat color in this region was white. The lesion was initially diagnosed as a consequence of a bite that had progressed over a three-month period, with progressive ulceration and then local extension. A topical fusidic acid-based treatment BID (Fucidin ointment 2% ND, Leo-Pharma, Lier, Belgium) was administered by the attending veterinary physician for 30 days, without healing the lesion.

**General clinical and ocular examination**

The clinical examination and palpation of the regional lymph nodes did not reveal any abnormalities. A full ophthalmic examination was performed. The results of visual testing (cotton ball tests, menace response, and glare tests) were considered normal bilaterally. The direct and consensual pupillary light reflexes were normal. A mucus discharge was present in the conjunctival sac and on the palpebral boundary of the medial canthus of the right eye.

Examination at a distance showed that the free edge of the lower right eyelid adjacent to the lesion was deformed, depigmented, and thickened, with the presence of reddish secretions and erosions. An ulcerative 12 mm by 19 mm lesion had invaded the medial canthus and the nasal and infraorbital regions of the right eye. The remaining ophthalmic examination was unremarkable. The cornea was intact, with no corneal fluorescein absorption bilaterally. An examination of the anterior and posterior segments via slit lamp biomicroscopy did not reveal any abnormalities. A quantitative and qualitative evaluation of the precorneal tear film was performed; the Schirmer’s test scores were 13 mm/min in the right eye and 11 mm/min in the left eye. Lacrimal stability was assessed using the tear film break up time (TFBUT) and was found to be 24 sec bilaterally. Lastly, the intraocular pressure (IOP) was measured at 16 mmHg in the right eye and 17 mmHg in the left eye.

**Preoperative examination**

The species affected, the localization of the lesion in the eyelid beneath the medial canthus, its progressive nature over several months in a depigmented area, and the macroscopic appearance of this infiltrative ulcer was considered to be an aggressive palpebral tumor. Preoperative biochemical and hematological evaluations followed by a CT scan of the skull and thorax were performed to rule out other systemic disease or potential metastases.

The blood tests were unremarkable. The CT scan of the skull revealed a parenchymatous mass at the level of the medial canthus of the OD. The image was made heterogeneously clearer after the injection of iodinated contrast medium. The lesion was localized next to the bone but without reactional osteocondensation. It was 21 mm long, 19 mm wide, and 10 mm thick. A submandibular lymphadenopathy in the right proximal ventral cervical region was highlighted. The pulmonary examination revealed two discreet millimetric pulmonary lesions inside the right middle lobe, thus the possibility of pulmonary metastases could not be excluded despite the small size of the lesions.

**Surgical technique**

After obtaining the owner’s informed consent, en-block surgical resection was performed. Preoperative systemic antibiotic and nonsteroidal anti-inflammatory therapy was initiated and continued peri- and postoperatively.

A dual technique combining a transposition flap from the subdermal plexus of the upper lip, according to the “lip-to-lid” procedure, and a frontal transposition flap was utilized to reconstruct the lower eyelid and the nasal and infraorbital regions (Fig. 2).
General anesthesia was achieved with a medetomidine/morphine/propofol intravenous protocol, maintained on an inhaled mixture of isoflurane and oxygen.

A large area around the incision site was shaved. The temporal, frontal, and nasolabial zones were then surgically prepared with a 2% solution of povidone iodine (Vétédine ND, Vetoquinol S A, Lures France). The ulcerated area was similarly prepared but without mechanical constraints to avoid the propagation of cancerous cells.

To protect the corneal surface, the nictitating membrane was temporarily fixed by placing two U-sutures at each end with a polypropylene monofilament suture (Prolène 6-0, Elanco, Neuilly sur Seine, France).

After demarcation with a felt-tip marker, a circular resection was performed through the full thickness by excising the mass of the palpebral conjunctiva and part of the orbicularis oculi muscle with a no. 15 scalpel blade while ensuring a 7 mm margin of healthy tissue (Fig. 3). It was not possible to conserve the inferior lacrimal duct.

The periosteal tissue was removed from the operating site with a periosteal elevator.

Afterward, the cutaneous reconstruction was prepared using a felt-tip marker to delineate the transposition flap, using the "lip-to-lid" technique, and the frontal transposition flap.

Regarding the flap from the subdermal plexus of the upper lip, two slightly diverging downward incisions, of a width slightly larger than the defect of the lower eyelid, were performed with a no. 15 blade in the upper lip medially to the lateral commissure. The incision was made through the full thickness of the lip; then, the flap was everted to visualize the oral mucous membrane and to incise it. The mucocutaneous flap was incised over a length greater than that of the conjunctival gap of the lower eyelid to reduce tension due to possible tissue retraction. Metzenbaum fine dissecting scissors were used in association with bipolar electrocoagulation to separate the cutaneous flap from the underlying facial structures, starting from the previous incision. This dissection was performed along the appropriate length, allowing transfer without tension to the host site.

The oral mucous membrane defect was sutured using simple embedded sutures with resorbable thread 6-0 (Vicryl 6-0, Elanco, Neuilly Sur Seine, France).

An incision was made between the donor site and the host site. The flap was turned 180° toward the palpebral gap and sutured by affixing the oral mucous membrane, present at the end of the flap, to the adjacent palpebral conjunctiva with simple embedded sutures at the cardinal points and a subcutaneous overlock suture using braided absorbable polyglactin thread (Vicryl 6-0, Elanco, Neuilly Sur Seine, France). A Redon drain was installed under the cutaneous flap with the external part fixed to the skin without passing via the flap suture to permit the elimination of secretions for 72 h. The edges of the flap were sutured to the adjacent skin by a subcutaneous overlock suture using braided absorbable polyglactin thread (Vicryl 6-0, Elanco, Neuilly Sur Seine, France) and by a cutaneous overlock suture with a monofilament, nonabsorbable, polypropylene thread (Prolène 6-0, Elanco, Neuilly sur Seine, France). The skin edges of the donor site were sutured using the same technique.

Secondly, to prepare the rotation of the frontal pedicle flap, two incisions in the skin, slightly diverging toward the base, were made in the frontal region and in the plane parallel to that of the palpebral aperture. This flap was then dissected using Metzenbaum fine dissection scissors.

The resulting pedicle flap was turned 90° counterclockwise, toward the cutaneous gap on the nasal side of the medial canthus of the right eye. The edge of the flap was
sutured to the adjacent skin, along with the cutaneous
dges of the donor site, with sutures similar to those used
to affix the first flap (Fig. 4).

Lastly, the temporary nictitating membrane stay sutures
were removed, and a temporary tarsorrhaphy was made
to protect the corneal surface from the risk of exposure
related to possible lagophthalmos.

Postoperative antibiotic and anti-inflammatory treat-
ment was administered orally for 10 days and a protective
collar was used for 20 days.

The resected tissue was fixed in 4% buffered formalin,
processed routinely, embedded in paraffin, sectioned at
3–5 microns, mounted on glass slides, and stained with
hematoxylin and eosin. A histopathological examination
showed a large nonencapsulated neoplasm extending from
the epidermis and infiltrating the dermis. The mass was
composed of nests and cords of large cubic to polygonal
epithelial cells embedded in a dense collagenous and
inflammatory stroma. The cells had an abundant eosino-
philic cytoplasm and prominent intercellular bridges
(Fig. 5). Anisocytosis and anisokaryosis were mild. The
average mitotic rate was 5 per 10 high-power fields. An
SCC was diagnosed. The tumor extended close to one of
the lateral margins.

Regional lymph node resection and adjuvant radiother-
apy were recommended but refused by the owner.

**Follow-up**

The drain was removed 3 days after surgery.

One week after surgery, the cat was reexamined during
a control visit to evaluate scarring and the appearance of
the surgical wounds.

The different flaps presented edemas, but none
appeared to be necrotic. The pink color of the different
flaps showed that blood circulation was normal.

At two weeks (Fig. 6), the temporary third eyelid flap
sutures and all of the cutaneous sutures were removed
under mild sedation using a medetomidine/butorphanol
protocol. An area of fragile scar tissue was observed at
the end of the frontal transposition flap that had scarred
by granulation. A fusidic acid-based antibiotic ointment
(Fucidin ointment at 2% ND, Leo-Pharma, Lier, Belgium)
was applied locally. A sodium hyaluronate-based wetting
product (Viskyal ND, TVM, Lempdes, France) was
administered six times a day in the conjunctival sac of
the right eye. Fur grew on all of the sutured cutaneous
regions, but in a different direction than the initial eyelid tissue.

At 90 days after the operation (Fig. 7), the fur had regrown completely, without trichiasis. The lacrimal film was stable, and the lacrimal TFBUT was the same as that of the preoperative examination. The cornea was smooth and transparent, and Schirmer’s test scores were 14 mg/min OD and 19 mm/min OS. No local recurrence was detected at the last examination, 13 months after surgery.

Discussion

Ocular and periocular tumors are relatively rare veterinary presenting signs, representing only 2% of all canine and feline tumors [8]. In dogs, these tumors are usually benign (sebaceous adenomas, papilloma, histiocytomas, melanomas, and pseudotumors); however, SCC is observed more frequently in cats, horses, and cattle [1].

Although the clinical appearance of certain palpebral tumors may indicate their nature, a specific diagnosis can be achieved only through histological (or cytological) examination following surgical resection.

In feline SCC, one of the problems of surgical resection is the delineation of the resection margins. It is known that SCC is a locally highly invasive tumor [2] and is often ulcerative, but it possesses relatively weak metastatic potential [2]. The advantage of an assessment of the lesion’s extent, in particular by performing a CT scan, is that it permits accurate tumor margin definition in depth (for example, the periosteum) and determines the presence of regional lymph node anomalies and remote metastases. However, it is difficult to determine the precise boundaries of a tumor locally at the macroscopic level.

Depending on the outcome of the histopathological examination of the resected tumor margin, adjuvant therapy may be proposed for SCC, given that cryotherapy [2] appears to be less efficacious than radiotherapy (teletherapy or curietherapy) or immunotherapy [1]. In cases of very widespread periocular SCC in cats, exenteration may be considered directly with cutaneous reconstruction by a caudal auricular axial pattern flap [2].

Therefore, to remove a feline SCC, with or without adjuvant therapies, complete surgical resection with wide peritumoral margins must be achieved.

Several skin plasty techniques have previously been described according to the area to be reconstructed and the size of the resulting tissue deficit.

According to Mstradé’s rule, “a simple resection is sufficient for a loss of substance less than or equal to a quarter of the palpebral fissure, and a graft is required if the loss is greater than a quarter” [8]. Once the resection leads to the loss of more than one-third of the length of the eyelid, H-blepharoplasty, or the advanced flap procedure are indicated. Lastly, for more extensive wounds or specific localizations such as on the nasal side of the medial canthus, rotation, transposition, or axial flaps may be considered [1].

Feline SCC palpebral tumors usually develop on the lower eyelid [2] near the medial canthus. Thus, the challenge of providing surgical care consists of replacing the palpebral tissue with an anatomically comparable flap, notably by ensuring the protection of the corneal surface.

A study performed on five cats with SCCs located on the lower eyelid in the region of the medial canthus [6] described the use of a frontal transposition flap sutured to the scarred conjunctival surface of the nictitating membrane, which was advanced beforehand. The reported limitations of this method are the length of the flap used, as it can only be used to fill the cutaneous gap of the nasal side of the medial canthus. In addition, corneal complications linked to trichiasis have been observed.

It is important to state that when performing surgical skin repairs [7] using random skin flaps (as opposed to axial skin flaps), the length and width of the pedicle flap are very closely linked; the circulation of blood to the latter impacts its integration and thus scarring. It is noteworthy that this limitation does not exist in the case of axial flaps, which are described formally and precisely based on the cutaneous artery irrigating them. Thus, regarding a “free” flap, it is acknowledged that the width to length ratio of the pedicle flap should not be less than one-third. However, for facial skin, which has a higher blood pressure, this ratio can reach one-fourth [10].

In the case described above, the length of the flap used for the “lip-to-lid” technique was relatively short (approximately 3 cm) due to the conformation of the cat’s face [11]. However, as the width of the flap has to cover both the nasal side of the medial canthus and its palpebral side,
it was approximately the same size (approximately 3 cm). The width to length ratio was therefore clearly greater than one-fourth, which can be achieved using a technique that combines two flaps from different origins.

A frontal transposition flap was therefore used to reconstruct the nasal side of the medial canthus. A suture of the previously advanced and scarred nictitating membrane was used to complete the reconstruction of the canthus [6].

When reconstructing the lower eyelid following the loss of tissue, the lip commissure to eyelid transposition flap technique allowed restoration of the lower eyelid by the transposition of a mucocutaneous subdermal plexus flap [5]. This technique has the dual advantages of closely meeting the functional and esthetic requirements of the region to be replaced, with a cutaneous side, a mucous side and a lip commissure [11]. In addition, examination by electromyography showed that this technique permitted the effective reinnervation of the muscle fibers of the grafted tissue after 6 months [5]. Thus, the risk of paralytic lagophthalmos following en-block resection of the orbicular muscle was reduced.

However, the transposition led to the reorientation of fur growth, hence the risk of trichiasis. Nonetheless, this drawback was not observed, even after an examination was performed 1 year later.

**Conclusion**

Therefore, the dual transposition blepharoplasty flap technique, both labial and frontal, resulted in the successful reconstruction following resection of a palpebral SCC in the cat. Despite the resulting loss of tissue, the rules of the width to length ratio of the pedicle flap were overcome using a combination of two flaps of different origins, while ensuring successful esthetic and functional adaptation of the grafted tissues.

**Authorship**

ASP: main author, she wrote this manuscript by searching the literature on this subject. IM: aided in manuscript writing. TD: made the review of this article and approved the final version for submission. PFI: critically revised the manuscript. OB: doctor in charge of the patient, had the idea to treat this patient like this and approved the final version for submission.

**Conflict of Interest**

None declared.

**References**

1. Maggs, D. J. 2012. Chapter 6: Eyelids. Pp. 110–112 in D. J. Maggs, P. Miller, and R. Ofri, eds. Slatter’s Fundamentals of Veterinary Ophthalmology, Fifth Edition. Saunders Elsevier, Saint Louis, Missouri.
2. Stiles, J. 2013. Feline Ophthalmology . Pp. 1481–1482 in K. Gelatt, B. Gilger and T. Kern, eds. Veterinary Ophthalmology, fifth edition. Wiley-Blackwell, Philadelphia.
3. Newkirk, K., and B. Rohrbach. 2009. A Retrospective Study of Eyelid Tumors from 43 Cats. Veterinary Pathology 46:916–927.
4. Gelatt, K., and Whitley D. 2011. Surgery of the eyelids. Pp. 126–132 in K. Gelatt and J. Gelatt, eds. Veterinary Ophthalmic Surgery, First Edition. Saunders Elsevier, Philadelphia.
5. Pavletic, M., L. Nafe, and A. Confer. 1982. Mucocutaneous subdermal plexus flap from the lip for lower eyelid restoration in the dog. J Am Vet Med Assoc 180:921–926.
6. Schmidt, K., C. Bertani, M. Martano, E. Morello, and P. Buracco. 2005. Reconstruction of the lower eyelid by third eyelid lateral advancement and local transposition cutaneous flap after “en-bloc” resection of squamous cell carcinoma in 5 cats. Veterinary Surgery 34:78–82.
7. Pavletic, M. 1997. Skin flap and skin grafting techniques in small animal surgery. Veterinary Quarterly 19(Suppl. 1):24–25.
8. Mustarde, J. C. 1983. Reconstruction of the eyelids. Annals of Plastic Surgery 11:149–169.
9. Dubielzig, R. 2012. Ocular and periocular tumors in cats. Available at https://www.vetmed.wisc.edu/pls/dubielzig/pages/coplow/PowerPoints/_FelineTumorsKSU2012.pdf. Kansas State University.
10. Lew, L., S. Lew, and A. Rozicka. 2010. Upper eyelid and medial canthus reconstructive surgery after histioctoma resection in a dog : a case report. Veterinari Medicina 55:137–143.
11. Whittaker, C., D. Wilkie, D. Simpson, et al. 2010. Lip commissure to eyelid transposition for repair of feline eyelid agenesis. Veterinary Ophthalmology 13:173–178.