CASE REPORT

Use of an axial pattern flap and nictitans to reconstruct medial eyelids and canthus in a dog

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Abstract

A 10-year-old male neutered Boxer presented with recurrence of a mast cell tumor at the right medial canthal area. Following excision including 2 cm margins, the medial one-half of the upper and lower eyelids and the medial canthus were reconstructed using an axial pattern flap based on the cutaneous branch of the superficial temporal artery. The bulbar conjunctiva of the nictitans was preserved and sutured to the medial flap edge, thus creating a conjunctival lining to the deep aspect of the flap, protecting corneal epithelium. This is a valuable surgical technique for closing a large skin defect and reconstructing the medial eyelids, thus preserving the globe.

Key Words: axial pattern flap, eyelid reconstruction, medial canthus reconstruction, mast cell tumor, nictitans

INTRODUCTION

Defects involving more than one third of the eyelid margin generally require a blepharoplastic procedure to restore adequate function.[1] Procedures described to reconstruct large eyelid defects include one-step techniques such as a rotating pedicle graft,[2–5] semicircular (rotational) flap,[6,7] H-plasty,[1,3,4,6,8] split eyelid flap,[9] and mucocutaneous subdermal plexus flap from the lip for lower eyelid restoration.[10] Described two-step procedures for restoration of large eyelid defects are the bucket handle technique[11] and the sliding skin flap with placement of a tarsoconjunctival graft.[1] A technique using free grafts of the oral mucosa to reconstruct the eyelid margins in a dog has also been described.[12] Axial pattern flaps based on either the cutaneous branch of the superficial temporal artery or the caudal auricular artery have been described for reconstruction of the maxillofacial region in dogs and in cats.[13–15] As far as the authors are aware, there is no previously described technique to restore the medial half of the palpebral fissure in a one-step procedure. This case report presents reconstruction of the medial one-half of the upper and lower eyelids and medial canthus using the superficial temporal axial pattern flap combined with the use of the nictitans to reconstruct lid margins, medial canthus and provide a conjunctival lining to the reconstructed area.

CASE REPORT

A 10-year-old-neutered male Boxer presented to the Michigan State University Veterinary Teaching Hospital for evaluation of a skin mass involving the right medial canthus. Six months prior to referral, the referring veterinarian removed a mass at the same location. Histopathology at that time revealed a grade 2 mast cell tumor with incomplete excision.

Physical examination was unremarkable with the exception of a round, raised, hairless, 2.5 cm × 3 cm cutaneous mass present at the medial canthal aspect of the right eye, adjacent to the eyelid margin (Fig. 1). Palpebral blink reflexes and Schirmer tear test values were normal OU (24 mm/min OD, 20 mm/min OS). Corneal surfaces were normal OU with no fluorescein uptake. The remaining ophthalmic examination was within normal limits.

Complete blood count, serum chemistry and urinalysis revealed no significant findings. Thoracic radiography revealed no significant findings. Abdominal ultrasonography revealed a mottled appearance of the spleen.

Fine needle aspiration and cytology of the eyelid mass confirmed mast cell neoplasia with marked eosinophilic inflammation. The neoplastic cells displayed moderate anisocytosis, anisokaryosis, and nuclear pleomorphism. Contrast-enhanced CT scan of the head revealed a contrast enhancing soft tissue mass at the medial canthal aspect of the right eye, which did not appear to involve nasal bone or maxilla, but extended to the medial aspect of the orbit. Fine-needle aspiration of the spleen revealed mild to moderate extramedullary hematopoiesis and a mild increase in number of plasma cells consistent with immune stimulation. No evidence of neoplasia was found. The dog was current on vaccinations and was receiving heartworm prevention. A diagnosis of a solitary MCT of the right medial canthus was made.
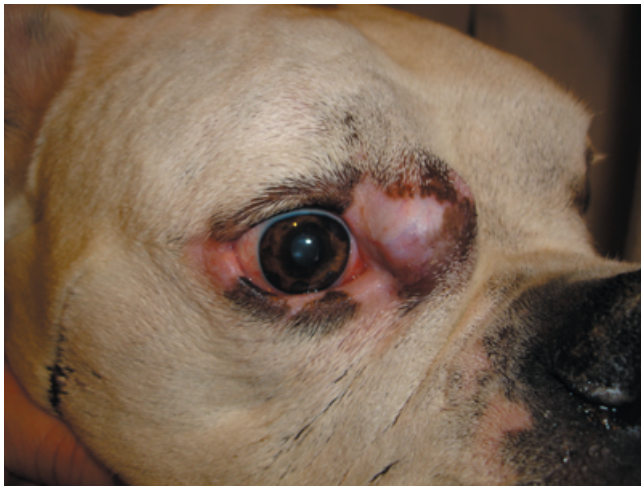
Figure 1. Appearance of the lesion at the time of presentation (photograph).

Initial treatment consisted of a single administration of intralesional triamcinolone acetonide (Kenalog®, Bristol-Myers Squibb Company, Princeton, NJ) and adjunctive chemotherapy (50 mg/m² q48 h po cyclophosphamide, Roxane Laboratories Inc., Columbus, OH) in an attempt to decrease the size of the lesion. At recheck appointment two weeks later, no measurable response was noted (the size of the eyelid mass was unchanged). At this point, wide surgical excision with curative intent combined with enucleation of the globe was recommended. The owners indicated that they would not tolerate loss of the right eye, and declined this option. A surgical treatment plan was then developed in which the goals were to resect the mass with 2 cm margins, reconstruct functional lids capable of complete closure to maintain corneal health, and maintain functional lacrimal drainage. This plan, albeit with higher chance of leaving residual microscopic disease, was agreeable to the owners. The dog was prepared for surgery two weeks after initial presentation.

Diphenhydramine (1 mg/kg iv, Baxter Healthcare Corp., Deerfield, IL) was given at time of premedication, to prevent clinical signs of mast cell degranulation. General anesthesia was induced using 4 mg/kg propofol (Teva Pharmaceuticals, North Wales, PA) intravenously and maintained on Isoflurane (Forane, Baxter Healthcare Corp.) carried in oxygen, delivered via a semiclosed circle system (Matrix medical inc., Forth Worth, TX). Routine surgical preparation of the facial area was performed. Cefazolin (20 mg/kg IV, West ward, HIKMA FARMACEUTICA, Portugal) was administered at anesthetic induction and every 2 hours during surgery. The nasolacrimal duct was cannulated via the upper punctum with a silicone tube per a technique described by Bistner et al.[16] A Jameson caliper (STORZ instruments, Bausch & Lomb, Rochester, NY) was used to measure 2 cm margins around the mass and a sterilized marking pen (KENDALL, DEVON®, Chicopee, MA) was used to demarcate the area. The landmarks for the width of the axial pattern flap were the caudal aspect of the left zygomatic arch caudally, the lateral orbital rim rostrally.
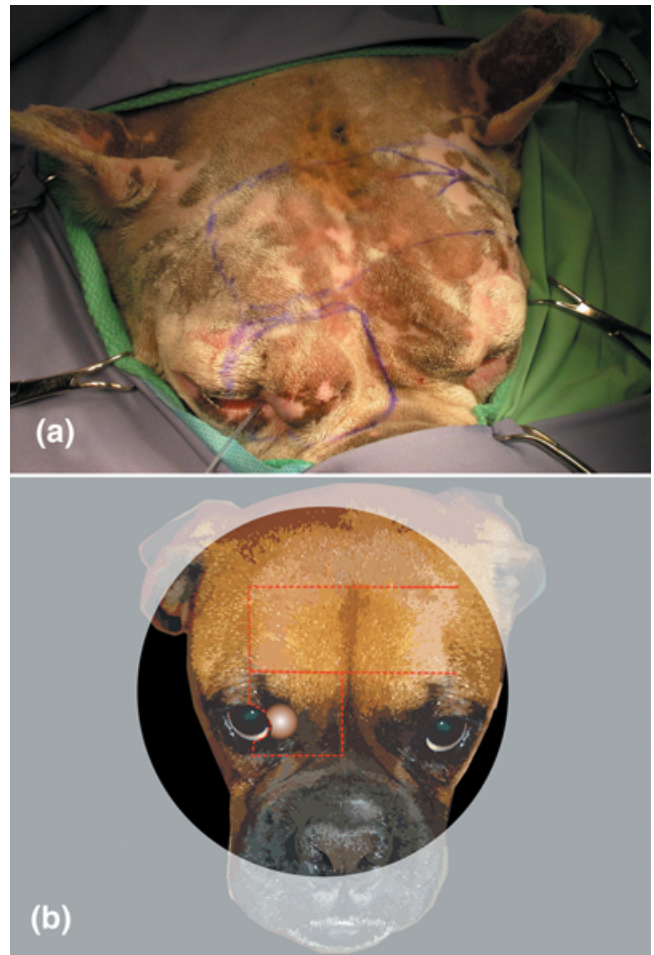

Figure 2. (a) Two centimeter margins around the mass and the landmarks for the axial pattern flap are delineated with a sterilized marking pen (photograph). (b) Two centimeter margins around the mass and the landmarks for the axial pattern flap are delineated with a sterilized marking pen (graphics).

The landmarks for the length of the flap extended to the middle of the dorsal orbital rim of the right eye. The proposed flap was also marked with a sterile pen (Fig. 2). A Jaeger lid plate (STORZ instruments, Bausch & Lomb) was used to support the lids and to protect the globe, and the demarcated area was sharply excised, including all subcutaneous tissues and underlying muscles. This involved resecting the medial half of the upper and lower lids, medial canthal area, caruncle, and lower and upper puncta (dissecting around the silicone cannula). The palpebral conjunctiva of the nictitans was included in the resection, preserving a 2-mm strip at the free border, the cartilage, and the bulbar conjunctiva of the nictitans (Fig. 3).

All margins of the excised tissue were stained (Design Higgins®, Black India 4415, Sanford®, Bellwood, IL) to facilitate margin identification for histopathologic examination.

The periosteum underlying the dissected area was removed using a periosteal elevator, and additional bone was removed from the orbital rim using rongeurs. The surgical field was
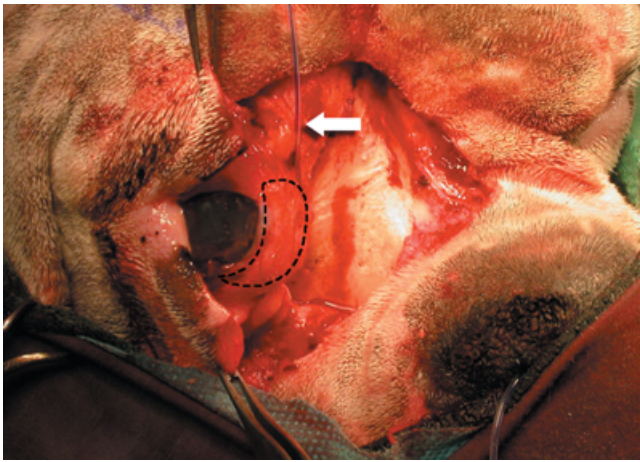
Figure 3. Appearance of surgical wound following tumor resection. Delineated is the area of the palpebral conjunctiva of the nictitans that was included in the resection, preserving a 2-mm strip at the free border, the cartilage, and the bulbar conjunctiva of the nictitans. Note the silicone cannula in place (arrow).
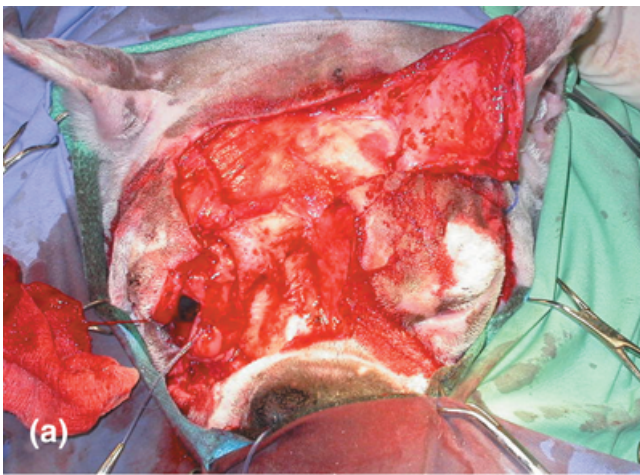

Figure 4. (a) Development of the superficial temporal axial pattern flap based on the left vascular pedicle (photograph). (b) Development of the superficial temporal axial pattern flap based on the left vascular pedicle (graphics).
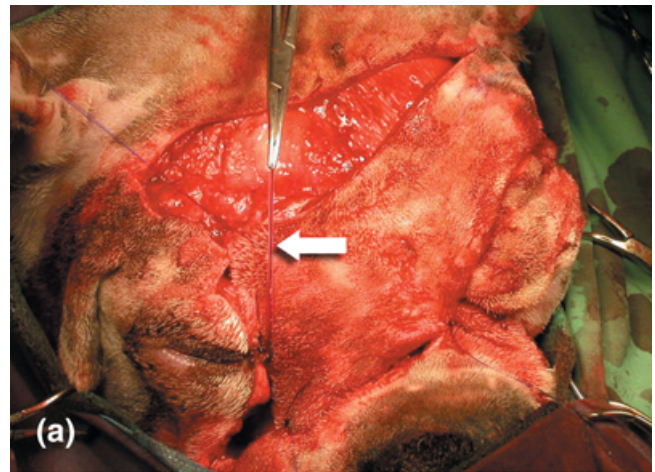

Figure 5. (a) Transposition of the superficial temporal axial pattern flap into the defect, with minimal tension (photograph). Note preservation of the silicone cannula (arrow). (b) Transposition of the superficial temporal axial pattern flap into the defect, with minimal tension (graphics).

lavaged, re-draped and fresh gloves and instruments used for the reconstruction, to minimize any seeding of tissues with neoplastic cells. The superficial temporal axial pattern flap based on the left vascular pedicle was developed and transposed into the defect, with maintenance of the cutaneous pedicle (Figs. 4 and 5). The remaining free border of the nictitans was sutured to the flap with 4-0 PDS (ETHICON Inc., Somerville, NJ) in a continuous pattern to form the palpebral conjunctiva of the reconstructed canthus. A 10 Fr closed suction drain (BLAKE, ETHICON Inc.) was placed, exiting caudal and dorsal to the reconstructed area in between the ears. Subcutaneous tissues were approximated with several interrupted sutures of 3-0 PDS (ETHICON Inc.), followed by a simple continuous pattern of 4-0 PDS. The skin was apposed with 3-0 Ethilon (ETHICON Inc.) using both cruciate and Ford-interlocking suture patterns (Fig. 6). The silicone tube in the nasolacrimal duct was sutured in place, exiting between the nictitans and the flap, to allow epithelialization around the tubing to reform a patent nasolacrimal
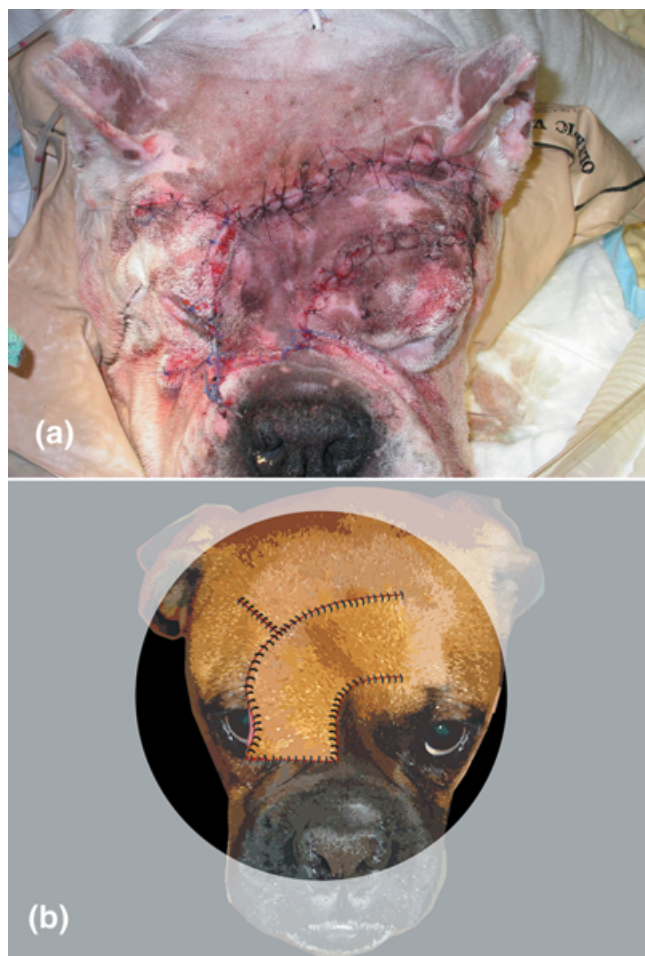
Figure 6. (a) Appearance after apposition of the skin with 3-0 Ethilon using both cruciate and Ford-interlocking suture patterns (photograph). (b) Appearance after apposition of the skin with 3-0 Ethilon using both cruciate and Ford-interlocking suture patterns (graphics).

Figure 7. Appearance at 10 months after surgery.

duct system. Finally, a temporary tarsorrhaphy, leaving a gap medially for application of the topical medications, was performed.

Analgesia was provided through a constant rate infusion of hydromorphone/lidocaine (20 mL 2% lidocaine (Lidoject, Butler Animal, Health Supply, Dublin, OH) and 3 mL of hydromorphone (Hospira Inc., Lake Forest, IL) at 3 mL/h for 7 h, and recovery from anesthesia was uneventful. A minimal amount of fluid was recovered from the closed suction drain, and it was removed two days postoperatively. At this time the dog was discharged with an Elizabethan collar. Carprofen (2.2 mg/kg BID po, Rimadyl®, Pfizer, New York, NY), amoxicillin trihydrate/clavulanate potassium (13.75 mg/kg BID po, Clavamox®, Pfizer Animal Health, Exton, PA), and enrofloxacin (3 mg/kg BID po Baytril®, Bayer Health Care, Shawnee Mission, KS) for 10 days, tramadol hydrochloride (1.2 mg/kg TID po, Akyma Pharmaceuticals, Glasgow, KY) as needed for pain, an artificial tear gel (Lubrithal®, VetXX A/S, Uldum, Denmark) for long-term us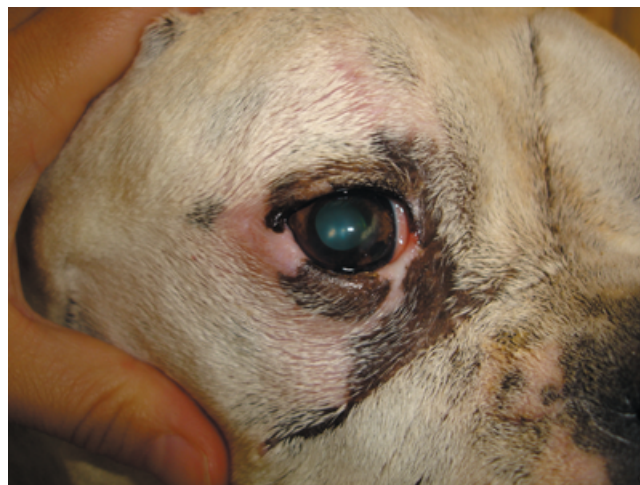e, and an ophthalmic ointment containing neomycin sulfate, polymyxin B sulfate, and bacitracin (E. Fougera & CO. Melville, NY) for 10 days were prescribed to address postsurgical pain, inflammation, and infection risk.

Histopathologic examination of the removed mass revealed an unencapsulated, well demarcated neoplastic cell proliferation located within the dermis. Neoplastic cells were round with abundant basophilic granular cytoplasm. Nuclei were mildly pleomorphic and mitosis was rare. The mass appeared completely excised with no evidence of neoplastic cells at the inked margins. Histologic findings were most suggestive of a high-grade (grade 3) mast cell tumor.

At recheck 10 days after surgery, the surgical site was healing well and the temporary tarsorrhaphy suture was removed. At the 5-week recheck, skin sutures and the nasolacrimal duct indwelling cannula were removed. The surgical site continued to heal well with regular rechecks until 6 weeks after surgery, at which time the dog moved out of state for the winter months. Topical artificial tear gel was continued by the owners as needed. At recheck 10 months after surgery, the cosmetic and functional outcome were excellent (Fig. 7). The palpebral fissure was of adequate size and corneal health was excellent. The nictitans lacked mobility as it formed part of the reconstructed medial canthus. Schirmer tear test values remained normal, and fluorescein stain remained negative throughout the follow-up period. No epiphora was present at any time.

Seven months after surgery, the dog presented with metastasis to the right submandibular lymph node and ataxia in his hind limbs. He underwent chemotherapy and radiation, and is alive and free of detectable metastatic MCT disease today, over 2 years after surgery.

DISCUSSION

The treatment of choice for solitary grade two cutaneous MCTs, remains surgical excision with surgical margins of 2 cm laterally and one fascial plane depth.[17,18] A number of

procedures have been described to reconstruct eyelid defects caused by trauma, surgical resections or congenital anomalies.[1–15,19] With such procedures it is critical to restore eyelid function to maintain corneal health. Our goal was complete tumor resection with curative intent, taking margins of 2 cm.[17,18] Distances were measured with a Jameson caliper and marked, to ensure that accurate and adequate margins were adhered to in surgery. The resultant defect necessitated a plan to reconstruct not only the skin, but also the medial upper and lower lids and the medial canthal area of the right eye. Axial pattern flaps have superior perfusion compared with subdermal plexus flaps of similar dimensions, as they incorporate a direct cutaneous artery and vein.[20,21] This robust vascular supply percolates through anastomotic 'choke' vessels on the midline to perfuse an adjacent angiosome, allowing the development of a relatively large flap, for single-staged reconstruction of cutaneous defects.[22] Fahie *et al.* previously investigated the cutaneous vascular supply to the canine and feline temporal region, showing that the cutaneous branch of the superficial temporal artery could potentially support an axial pattern flap.[23]

In this case, a flap large enough to close the defect without tension was created, while still allowing tension free closure of the donor site. The bulbar conjunctiva and free border of the nictitans were incorporated into the constructed medial canthus to prevent corneal irritation and damage due to trichiasis.

Cutaneous mast cell tumors (MCT) comprise 7–20% of the neoplasms affecting the skin of dogs.[24–26] They occur more frequently in older dogs, with the mean age being 8.5 years.[26] There is no sex predilection, but certain breeds seem to be predisposed to develop MCTs including Boxers, Boston terriers and Labrador Retrievers.[27,28] Biologic behavior of canine cutaneous MCTs varies from benign to highly malignant.[17] Several prognostic factors have been investigated, but the histologic grade of the lesion appears to be the most important.[29,30] Dogs with well differentiated and moderately differentiated MCTs have longer survival times after complete tumor excision than dogs with undifferentiated tumors.[28,31] Growth rate of the tumor may be an important predictor of biologic behavior, with rapid growth relating to a poor prognosis.[32]

After excision it is recommended to determine the histological grade of the MCT and the completeness of the surgical margins.[17] These findings are important for prognosis and determination of the need of adjunctive therapy. In this case histopathologic examination of the excised mass revealed a grade-III MCT. This finding is inconsistent with the previous diagnosis for the mass by the referring veterinarian, which was graded a grade II MCT. The presurgical intralesional injection with triamcinolone could have changed the behavior or the microscopic appearance of the tumor. Complete surgical excision was confirmed by histopathology. However, our oncology sections were concerned over the apparent grading disparity, and advised continuing with the previously instituted chemotherapy protocol.

The axial pattern flap based on the cutaneous branch of the superficial temporal artery is a valuable surgical technique for closing defects created by large oncologic resections around the eye. Combining this flap with the bulbar conjunctiva of the nictitans provided a useful technique to enable preservation of the globe in this case. The elected surgical procedure proved curative for local malignant neoplasia, and provided an excellent cosmetic outcome. Despite the lack of nictitans movement, good corneal health was maintained using topical artificial tears as needed.

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