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Axial Pattern Flap from the Caudal Superficial Epigastric Artery for the Correction of Surgical Defects Created by the Resection of Tumors or Traumas in Cats and Dogs: 16 Cases (2012-2015)

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Abstract

The reconstruction of large skin defects originated from the excision of large tumors or trauma may require the use of reconstructive techniques given the possibility of there not being enough skin to cover the skin wound in some situations. Axial pattern flaps from the caudal superficial epigastric artery are skin flaps supplied by a large artery and, therefore, have a larger chance of survival. They are the most versatile flaps for closing defects in the caudal part of the body and may be employed to close defects on the lateral abdomen, sacrum, dorsal pelvis, base of the tail, perineum, penile sheath, inguinal region, proximal pelvic member, knee, shin and metatarsal region in cats. This study aimed at reporting 16 cases of repairs of defects originated from tumoral resection and trauma employing axial pattern flaps from the caudal superficial epigastric artery in dogs and cats.

Keywords: reconstructive surgery, axial pattern flap, dog, cat

1. Introduction

The reconstruction of large skin defects originated from the excision of large tumors or trauma may require the use of reconstructive techniques given the possibility of there not being enough skin to cover the skin wound in some situations.

Among these techniques are the axial pattern flap technique and the subdermal flap technique, the former of which may present vascular supply (Moores, 2013). Axial pattern flaps may be seated in low vascularization sites, such as regions with bone, tendon and nerve exposure (Tobias, 2010).

Axial pattern flaps from the caudal superficial epigastric artery are skin flaps supplied by a large artery and, therefore, have a larger chance of survival. They are the most versatile flaps for closing defects in the caudal part of the body and may be employed to close defects on the lateral abdomen, sacrum, dorsal pelvis, base of the tail, perineum, penile sheath, inguinal region, proximal pelvic member, knee, shin and metatarsal region in cats (Moores, 2013).

The viability of the artery may be established before the surgical procedure through ultrasound, with the caudal superficial epigastric artery being the most easily identifiable vessel according to Reetz et al. (2006). In a study conducted by Mayhew and Holt (2003), doppler ultrasound was also employed before closing the wound for confirming the blood flow in the left and right caudal superficial epigastric arteries.

The use of axial pattern flaps from the bilateral caudal superficial epigastric artery has been described in a male German Shorthaired Pointer with total survival of the defect. The large defect created in the donor region was primarily closed without dehiscence of sutures (Mayhew et al., 2003). Lewin and Smith (2010) have described the use of vascular microsurgery in the caudal superficial epigastric artery and vein, with the brachial artery and vein, without compromising the peripheral blood flow or flap necrosis in a Border Collie dog.

The caudal superficial epigastric artery originates from the external pudendal artery and vein in the inguinal ring, irrigating the mammary glands number 3, 4 and 5 in dogs and 2, 3 and 4 in cats, as well as the overlying skin. Vascular anastomoses with the cranial superficial epigastric vessels allow the employment of longer flaps (Moores, 2013). Aper and Smek (2005) have clinically assessed 10 patients in which flaps from the caudal superficial epigastric artery were used, with lengths varying between 18 and 30 cm and widths varying between 4 and 8 cm. In nine of these patients, they achieved complete flap survival, in some dogs reaching mammary glands one to three. In a single one of these, necrosis was observed in the extremity. Other complications observed in this study included seroma (n = 3), partial dehiscence (n = 3), edema (n = 9) and hematoma (n = 7), but the authors concluded that the observed complications were smaller than those observed with the conservative treatment were.

Ovariohysterectomy is indicated before performing the reconstructive surgery, in order to avoid a pregnancy with an inadequate lactation, as the tissue remains functional and may present lactation and/or mammary neoplasms. Both procedures may be conducted during the same surgery (Pavletic, 2010; Moores, 2013).

This study aimed at reporting 16 cases of repairs of defects originated from tumoral resection and trauma employing axial pattern flaps from the caudal superficial epigastric artery in dogs and cats.

2. Case Report

We have assessed 16 patients, cats and dogs, which received axial pattern flaps from the caudal superficial epigastric artery for lesion reconstruction in the inguinal region, abdominal region, penile sheath region and pelvic member regions. The procedures were conducted between January 2012 and January 2015 in educational institutions located in the cities of Maringá-PR, Curitiba, PR and Jaboticabal-SP, Brazil.

The clinical files of the patients were assessed and we have described the type of injury (wound or tumor), surgical treatment employed, flap pattern, location of the injury, post-surgery complications, anatomical region of the flap used and follow-up time. In patients with tumors (n = 15), we have also described the diagnosis, reached through cytology or histopathology, margin involvement (when assessed) and recurrence. This data is presented in Tables 1 and 2.

Before the surgical procedure, the patients underwent electrocardiography, complete blood test, renal biochemical test (creatinine and urea), liver test (ALP, ALT and AST), chest x-ray in three projections (VD, Right Lateral and Left Lateral) and abdominal ultrasound.

Table 1. Description of type of injury/diagnosis, surgical margin involvement, follow-up time and tumor recurrence

Cases	Injury/Diagnosis	Margin involvement	Follow-up time (months)	Recurrence (tumor location)
1	Squamous-cell Carcinoma	No	14	Penile Sheath
2	Squamous-cell Carcinoma	No	16	No
3	Trauma		20	-
4	Melanoma	No	12	No
5	Fibrosarcoma	Not Assessed	2	No
6	Mammary Cystadenocarcinoma	Not Assessed	2	No
7	Squamous-cell Carcinoma	Not Assessed	5	No
8	Hemangioma	Not Assessed	5	No
9	Carcinoma	Not Assessed	2	No/Unidentified death
10	Squamous-cell Carcinoma	Not Assessed	9	No
11	Undifferentiated Solid Carcinoma	Margin Involvement	13	Yes, inguinal margin Death by pulmonary metastasis
12	Squamous-cell Carcinoma	Not Assessed	14	Yes, caudal margin of the penile sheath
13	Carcinoma	Not Assessed	18	No
14	Hemangiosarcoma	Not Assessed	9	No
15	Soft Tissue Sarcoma	Margin Involvement	5	No
16	Mammary Carcinoma	Not Assessed	2	No

Table 2. Description of surgical cases employing axial pattern flaps from the caudal superficial epigastric artery. The table shows the flap pattern, the injury location, the donor anatomic location for the flap and post-surgery complications noted

Cases	Flap Pattern	Injury Location	Flap Anatomical Region	Complication	Species	Age
1	Rotational flap	Tumoral resection in the right-side abdomen, near the penile sheath	Left caudal superficial epigastric artery	Flap extremity necrosis	Canine	8 years
2	Transposition flap	Tumoral resection in the right-side inguinal region	Left caudal superficial epigastric artery	None	Canine	10 years
3	Transposition flap	Extensive wound in the cranial region of the right femur	Right caudal superficial epigastric artery	None	Feline	6 month
4	Transposition flap	Tumoral resection in the penile sheath, left side	Right caudal superficial epigastric artery	None	Canine	11 years
5	Rotational flap	Tumoral exeresis in left M4-M5	Right caudal superficial epigastric artery	None	Canine	7 years
6	Rotational and advance flap	Tumoral exeresis in left and right M2-M3	Right and left caudal superficial epigastric artery	Suture dehiscence and flap necrosis	Canine	9 years
7	Rotational and advance flap	Tumoral exeresis in M5, left side	Right caudal superficial epigastric artery	None	Canine	13 years
8	Rotational flap	Tumoral exeresis in the penile sheath, left side	Right caudal superficial epigastric artery	Suture dehiscence	Canine	10 years
9	Rotational flap	Tumoral exeresis in the penile sheath, left side	Right caudal superficial epigastric artery	None	Canine	11 years
10	Rotational flap	Inguinal tumoral exeresis, left side	Right caudal superficial epigastric artery	Flap extremity necrosis	Canine	6 years
11	Rotational flap	Inguinal tumoral exeresis in amputation stump	Right caudal superficial epigastric artery	Suture dehiscence	Canine	7 years
12	Rotational flap	Tumoral exeresis in the penile sheath, right side	Left caudal superficial epigastric artery	None	Canine	8 years
14	Rotational flap	Parapreputial tumoral exeresis, right side	Left caudal superficial epigastric artery	None	Canine	11 years
15	Rotational flap	Parapreputial tumoral exeresis, left side	Right caudal superficial epigastric artery	Suture dehiscence in the extremity of the flap	Canine	10 years
16	Transposition flap	Tumoral exeresis in the M2 and M3 mammary glands, bilateral	Left caudal superficial epigastric artery	Necrosis and suture dehiscence	Canine	15 years

Note. Total: 68.75% Rotational flap and advance flap; 31.25% Transposition flap. Were cats 6%; Dogs 94%.

3. Discussion

Of the 16 patients reported in this paper, 15 presented defects originated from an extensive tumoral excision and one presented defects originated from trauma, being these the most common causes for the use of reconstructive surgery according to study conducted to Trevor et al. (1992).

Rotational transposition flaps are performed with tissue transposition, the flap is created parallel to the higher stress lines, in order to facilitate the closure of the donor region. Rotational flaps are semicircular and are employed for the closure of triangular defects. The advanced flaps are used in larger defects, they can be made two unipedic flaps on each side of the defect (Pazzini et al., 2015).

We have employed transposition and rotational flaps from the caudal superficial epigastric artery for the reconstruction of injuries in the inguinal region, abdominal region, penile sheath region and pelvic member region according to the locations mentioned in the literature for the use of this type of flap (Pavletic, 2010; Moores, 2013). The employment of a subdermal flap from the iliac crest skin fold represents an alternative to the axial flap from the caudal superficial epigastric artery. This flap is useful in the transposition and coverage of injuries in the flank, abdomen and inguinal region, as well as in the medial and lateral aspects of the pelvic members (Hedlund, 2006; Mayhew, 2013). For patient 16, which underwent a bilateral resection in mammary glands 2 and 3, another option would be the use of a flap from the axillar skinfold for coverage of mammary

glands 1 and 2 and of a flap from the iliac crest skinfold for coverage of mammary glands 4 and 5. These flaps may be used on both sides to facilitate the closure of the surgical incision (Fossum, 2008).

Regarding post-surgery complications, 25% of the patients (n = 4) presented necrosis on the extremity of the flap, a similar result to the one reached by Trevor et al. (1992), which was 31.57% (n = 6). Of the 16 patients in our study, 31.25% (n = 5) presented suture dehiscence, the most common complication reported by Moore (2013), representing 1/3 of the cases, and by Trevor et al. (1992), representing 36.8% of the cases (n = 7). This complication is usually caused by excessive tension and movement. According to Pavletic (2010), coverage under excessive tension may compromise the local blood flow, hinder healing and result in dehiscence, possibly coupled with skin necrosis resulting from the blood flow obstruction caused by excessive rotation. Secretions, infections and edema may also occur during the post-surgery process, but such complications were not observed in our study. Pavletic (2010) mentions that the flap width may be increased to minimize tension at the receiving injury and, therefore, the dehiscence rate, given that the donor location be closed without excessive tension.

No post-surgery complications were observed in eight patients (50%), contrasting with the observations of Moores (2013), who reported success in surgery of 100% for flaps applied to dogs (n = 8) and cats (n = 8), and the observations of Trevor et al (1992), who observed success in surgery of 96%.

All patients received post-surgery follow-up for 2-20 months, all patients was being followed through annual clinical care. Three patients among the 15 diagnosed with neoplasms presented local tumor recurrence (20%). Such recurrence may be avoided through the removal of tumors with a large safety margin, aiming for margins free of tumoral cells (Ferreira et al., 2006).

4. Conclusions

The axial pattern flap from the caudal superficial epigastric artery presents high versatility and high success rate when employed in the caudal regions of the patient body. It is a simple flap of easy execution, being comparable to the surgical technique of a mastectomy, and, when unilateral, does not present difficulties in closing the donor area.

Oncologic surgical principles should be employed, avoiding excessive trauma, employing cautious dissections, achieving adequate hemostasis, achieving margins free of tumor cells and reconstructing tissue according the principles of reconstructive surgery. This minimizes the chance of tumor recurrence and post-surgery complications, which interfere in the success rate of the procedure and in the survival of the flap.

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