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Case Report

# Caudal Superficial Epigastric Axial Pattern Flap and Stem Cell Therapy for the Management of Large Wound on Medial Aspect of Thigh in a Dog

Madhu Doddhadasarahalli Nanjappa[1*], Raja Aijaz Ahmad[1], Amarpal[1], Mudasir Bashir Gugjoo[1], Abhijit Motiram Pawde[1], Prakash Kinjavedkar[1], Hari Prasad Aithal[1], Matin Ansari[2], Vikash Chandra[2], Gutulla Taru Sharma[2]

[1]Indian Veterinary Research Institute, Izatnagar, Uttar Pradesh, India; [2]Division of Surgery and Department of Physiology and Climatology
*Corresponding author: madhu63vsr@gmail.com

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## ABSTRACT

An 11 year non–descript dog was presented with the history of severe dog bite injuries on left thigh, tibial and paw region with loss of large area of skin. The treatment was initiated and continued until the appearance of healthy granulation tissue and the skin grafting was planned. To make a caudal superficial epigastric axial pattern flap, a midline incision was given beginning just behind the last mammary teat incorporating the base of the prepuce and continued in a cranial direction to include three mammary teats. Thus a flap of 15x6cm was made and rotated to cover the medial thigh defect. The graft was anchored with subcutaneous tissue using 3–0 PGA and then apposed with the surrounding skin with 2–0 polyamide. A large wound was still left uncovered on distal tibial and paw region. Blood examination revealed that the dog was diabetic and uncovered wound didn't show signs of healing, however, the grafted area showed signs of healing. The open wound was treated with local injection of $5x10^6$ mesenchymal stem cells given twice at 12 days interval. The animal made an uneventful recovery in 50 days.



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The caudal superficial epigastric axial pattern flap is a highly versatile pedicle graft for closure of major skin defects of the caudal abdomen, flank, inguinal area, prepuce, perineum, thigh, and rear limbs. Axial pattern flaps incorporate a direct cutaneous artery and a vein, the terminal branches of which supply blood to the sub–dermal plexus (Pavletic 1999). The advantages of this method of reconstruction over other methods include the ability to close a large defect, early closure without extended open wound management, coverage of areas with less than optimal wound healing conditions, and excellent flap survival rates (Remedios, 1999).

An 11 year old non–descript dog was presented with the history of severe dog bitten injuries 4 days back. Anamnesis revealed that the animal was completely anorectic and unable to stand up on its limbs thereby attaining a prostatic posture. Clinical examination revealed open mouth respiration along with bite injuries on left thigh, tibiotarsal and paw region. Apart from large area of skin loss physical examination also revealed injury to the muscles on the medial and caudal aspect of femur and tibia which were severely contused and macerated but not transected (Figure 1).

Figure 1: Severe dog bitten injuries upon presentation



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Figure 2: Appearance of wound on the day of operation (before and after surgery)

Aggressive fluid therapy was initiated along with systemic antibiotics and corticosteroids. The various wounds at different sites were debrided and lavaged with 0.9 per cent saline after initial stabilization. Broad spectrum antibiotics ceftriaxone and tazobactum combination at a dose of 25 mg/kg intravenously and analgesic meloxicam at a dose of 0.5 mg/kg intramuscularly were administered.

Wet–to–dry bandage was applied with the contact layer consisting of sterile moistened gauzes for the first three days for aiding in mechanical debridement of necrotic tissue. After the appearance of granulation tissue, dressing was done with non–adherent semipermeable paraffin–impregnated gauze for three days. In addition, the positions of left caudal superficial epigastric vessels were assessed. Blood examination revealed that the dog was mildly diabetic (125 mg/dl) and treatment was initiated. The wound was debrided and dressed with povidone iodine solution. Broad spectrum antibiotics were continued for seven days. The treatment continued until the appearance of healthy granulation tissue (7 days) and the skin grafting was planned (Figure 2). On the day of operation the glucose level was within the normal limits (85 mg/dl).

Surgical procedure was carried out under general anesthesia and with routine aseptic precautions. The dog was pre–medicated with atropine–diazepam–pentazocine combination and general anesthesia was induced and maintained with 2.5% solution of thiopental sodium. Pre–operatively amoxicillin and sulbactum combination at a dose of 10 mg/kg was administered.

To elevate the flap, a ventral midline incision was given beginning just behind the last mammary teat incorporating the base of the prepuce and then along the midline extending cranially up to and including the third mammary gland. Laterally, the skin was incised along a line, 3 cm lateral to the nipples. Flap was elevated starting cranially, just above the external abdominal oblique muscles and external rectus sheath fascia. Flap was dissected caudally, gradually elevating the flap towards the inguinal ring. The flap of 15x6 cm was made and then rotated (about $180^0$) to the recipient site (medial thigh defect). Donor site was temporarily closed with sterile moistened sponges. Several interrupted skin sutures were placed to hold the flap to the farthest edges of the recipient site. Continuous suction drain under the flap was placed, exiting the tubing through healthy skin at a site. The subcutaneous tissue along edges of the flap and recipient site was apposed with interrupted sutures using 3–0 PGA. Skin edges of the flap and recipient bed was apposed with an interrupted suture using 2–0 polyamide (Figure 2). Anesthesia and recovery were uneventful. A large wound was still left uncovered on distal tibial and paw region which was allowed to heal by second intention healing. Non–adherent semipermeable paraffin–impregnated gauze was applied to the wound surface and bandaging was done. The bandaging was done daily for 12 days post–operatively.

Drain exit sites was covered with non–compressive bandages to reduce the risk of contamination. Elizabethan collar was placed to prevent self–mutilation. Broad spectrum antibiotics amoxicillin and sulbactum combination at a dose of 10 mg/kg was administered for 9 days along with analgesic meloxicam at a dose of 0.5 mg/kg for 3 days.

Figure 3: Injection of stem cells around wound margin on $12^{th}$ post–operative day

The dressing was changed 48 hourly and the drain was removed on seventh day post–operatively. The flap exhibited some congestion and swelling for the first three days and by fifth day the swelling was significant which started reducing from seventh day onwards. The 100 per cent flap survival was seen as the flap appeared to be normally perfused and adhered to the underlying granulation tissue with no dehiscence. Skin sutures were removed on tenth postoperative day. The healing of the lateral margin of the flap where it had been sutured to the edges of the hind limb skin was satisfactory. There were no signs of any flap necrosis. Even after twelve days the uncovered wound didn't show any signs of healing and therefore stem cell therapy was initiated. The open wound was then treated with local injection of $5x10^6$ /ml allogenic


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Figure 4: Epithelisation around wound margins started to cover the defect by 16th day post–operatively

Figure 5: Second injection of stem cells around wound margin was given to further stimulate epithelisation on 23rd post–operative day

Figure 6: By 38th days the entire defect was closed apart from a small area on the medial aspect of thigh

mesenchymal stem cells along the epithelial margin (Figure 3). The improvement was drastic which was indicated by faster rate of coverage of the defect by epithelisation around wound margins (Figure. 4). The second injection of stem cell was given on twenty third day post–operatively (Figure 5). By thirty eight days, the entire defect was closed apart from a small area on the medial aspect of thigh (Figure 6).

Recovery in the form of wound healing by second intention was complete and the entire defect was covered with skin along with the appearance of hairs on the flap surface at fifty days post–operatively (Figure 7).

There are few reports of the use of the caudal superficial epigastric arterial flap as a means for covering the large wound defects. The bulk of the underlying associated mammary tissue may result in a poor cosmetic result and the size of the caudal superficial epigastric artery and vein prolong surgery times (Lewin and Smith, 2010). It is feasible to elevate caudal superficial epigastric axial pattern flaps for closure of large skin defects located on the flank, medial and lateral thigh areas of dogs. In the present case, we chose to use caudal superficial epigastric axial pattern flap for reconstruction of the defect as the flap could easily be rotated into the defect and second intention healing could


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Figure 7: By 50 days the entire defect was covered with skin along with the appearance of hairs on the flap surface

have resulted in severe scar formation with possible contracture leading to poor limb function. The use of this flap allowed almost 80 per cent of the defect to be covered and with only small defects remaining it was feasible to allow the remainder of the wound to close by second intention healing. In the present case, 100 per cent flap survival occurred. The flap showed purple discolouration and oedema but this was temporary and no specific treatment measures were taken. A closed suction drain placed helped to avoid seroma formation.

Clinical trials in human beings suggested that direct application of bone marrow derived cells leads to dermal rebuilding and closure of non–healing chronic wounds of more than 1 year duration (Badiavas and Falanga, 2003). Injection of bone marrow derived mesenchymal stem cells around wound and their application to the wound bed in an excisional wound model enhanced healing significantly in normal and diabetic mice (Wu *et al*., 2007). In the present case which was in line with the findings of Wu and co–workers (2007), injections of mesenchymal stem cells around the wound margins resulted in faster epithelial covering over the defect and healing. It is concluded that mesenchymal stem cells can be used to accelerate the healing of large skin wounds, not amenable to conventional treatment.

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