Bilateral caudal superficial epigastric skin flap and perineal urethrostomy for wound reconstruction secondary to traumatic urethral rupture in a cat

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Keywords
Caudal superficial epigastric flap, perineal urethrostomy, urine extravasation, wound, cat

Introduction
Extravasation of urine from the distal urethra of cats is reported in the literature as being an uncommon, but possible complication subsequent to urethral obstruction, iatrogenic perforation following urethral catheterisation, perineal urethrostomy and traumatic injury; including road traffic accident, gunshot, bite wound, and pelvic fracture (1–6). The primary problems to be considered with the management of urethral rupture are the correction of systemic metabolic imbalances, restoration of the urethral integrity, and the toxicity of urine to local tissues and subsequent tissue necrosis (1, 6, 7). Restoration of the integrity of the urethra may be achieved by anastomosis, primary urethral repair, primary realignment, and permanent urethrostomy; restoration may be assisted by the use of urinary diversion such as cystostomy tube or urethral catheter placement (4, 6). Extravasation of urine has been reported to lead to extensive skin necrosis requiring prolonged wound reconstructions using subdermal plexus flaps, axial pattern flaps, free skin grafting, and vacuum assisted wound closure (1, 5, 8).

Wound reconstruction using the caudal superficial epigastric skin flap (CSEF) has been reported for closure of major skin defects of the caudal abdomen, flank, inguinal area, prepuce, perineum, thigh, and hindlimb (9). The use of CSEF has been previously reported in cats (10–14). Similarly, the use of simultaneous bilateral CSEF to close extensive skin defects of the hindlimb of a cat and flank of a dog has been described (14, 15).

Despite the wide acceptance and use of unilateral and bilateral CSEF to close wounds of the distal limb and flank, to the authors’ knowledge, description of a staged bilateral CSEF to reconstruct the entire perineum following necrosis secondary to urine extravasation, including an urethrostomy stoma as part of the reconstruction, has not yet been reported.

Case report
A 10-month-old male neutered Domestic Shorthaired cat was presented because it exhibited signs of pain associated with the back and hindlimbs after being struck by a football 12 hours previously. The patient was treated with analgesic medications but was presented again 24 hours later with progression of signs of pain of the back and hindlimbs and anuria. Survey radiographs did not indicate any evidence of bony injury, bladder rupture or loss of serosal detail within the abdomen that could be suggestive of free fluid within the abdomen. Swelling, bruising and necrosis of the skin of the flank, perineum and hindlimbs were evident 48 hours later; there was also development of anorexia, polydipsia, lethargy and continued anuria. Blood sampling results indicated a marked azotaemia (urea 41.5 mmol/L, range 5.7–11.8 mmol/L, creatinine 298 μmol/L, range 53–141 μmol/L), hyponatraemia (132.1 mmol/L, 150–165 mmol/L), hyperkalaemia (5.88 mmol/L, range 4.5–5.8 mmol/L), leukocytosis (34.1x10⁹/L, range 5.5–19.5x10⁹/L) and neutrophilia (25.7x10⁹/L, range 2.5–12.5x10⁹/L).

Retrograde urethrography was performed, indicating a perforation of the distal urethra at the level of the ischiatic rim with subcutaneous extravasation of urine.
The urethra was catheterised in a retrograde manner, using a cat urinary catheter. The catheter was sutured in place and connected to a closed urine collection bag. Intravenous fluids were commenced and analgesia was provided with the administration of buprenorphine 0.03 mg/kg via the buccal mucosa q8h.

The patient was hospitalised to monitor the progression of skin necrosis and allow drainage of the bladder. Serum urea and creatinine concentrations were monitored and these returned to within normal limits in the subsequent five days. Urinalysis and sediment examination five days after admission indicated a urinary tract infection with a prevalence of cocci bacteria. Urine culture reported heavy mixed bacterial growth, and therapy with potentiated amoxicillin-clavulanate 20 mg/kg PO twice daily was commenced, pending the culture and sensitivity results.

Demarcation of the wound margins was evident by day seven, with obvious areas of full thickness skin necrosis. The patient was anaesthetised and the wound partially surgically debrided. Further mechanical debridement was achieved using wet-to-dry dressings of saline moistened gauze swabs that were held in place with tie-over sutures. An oesophageal feeding tube was placed to allow ongoing medication and nutritional support. A feeding chart was maintained to ensure adequate provision of the metabolic requirements. Wet-to-dry dressings were changed daily whilst the cat was under general anaesthesia until healthy granulation tissue was present within the wound bed (Fig. 1). Repeated retrograde urethrogram indicated persistence of the urethral tear.

On day 15, a left-sided CSEF, including the three caudal mammary glands, was elevated as an island flap. The CSEF was rotated laterally 180° to cover the wound defect of the left caudal aspect of the thigh and perineum, and then folded cranially and distally 180° to cover the lateral aspect of the thigh (Fig. 2). A subdermal plexus rotation flap using the left inguinal skin fold was also utilised by incising the skin along the cranial aspect of the thigh and rotating the flap laterally to relieve tension on the CSEF on the lateral aspect of the thigh. A triangular-shaped, 20 mm x 30 mm defect could not be closed on the caudal aspect of the left thigh. A 6 mm Penrose drain was placed within the dead space along the cranial aspect of the thigh, exiting on its medial aspect. The donor site and CSEF were closed using 1.5 metric polydioxanone in a simple interrupted suture pattern subcutaneously, and 1.5 metric nylon in a cruciate suture pattern in the skin.

A cystotomy tube was placed, using the same skin incision as the CSEF, exiting on the left dorso-lateral flank cranial to the CSEF. A closed urine collection bag was attached to allow continued drainage of the bladder.

A non-adherent primary layer dressing and bandage was placed over the wound to aid reduction of dead space, isolate the exit point of the Penrose drain and protect the CSEF. The Penrose drain was removed six days after surgery as fluid production was minimal. Absorbent, non-adherent dressings were used on the right perineal wound to allow further granulation and wound contraction with minimal debridement of the wound bed, and were changed q72h for a further 12 days. Partial thickness necrosis of the skin at the distal 5 mm portion of the CSEF and along a 20 mm section of the cranial aspect of the left thigh was noted, but wound healing of the CSEF was otherwise uneventful.

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References:

- Portex Jackson Cat Catheter 4Fr: Smiths, Folkstone, UK
- Urine drainage bag: Suru International, Dahanu, India
- Vetergesic: Alstoe Animal Health, York, UK
- Augementin: GlaxoSmithKline, Brentford, Middlesex, UK
- Penrose Tubing: Covidien, Tullamore, Ireland
- PDS II: Ethicon, St.-Stevens-Woluwe, Belgium
- Ethilon: Ethicon, St.-Stevens-Woluwe, Belgium
- Melolin: Smith & Nephew, Hull, UK
- Allevyn: Smith & Nephew, Hull, UK

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A right-sided CSEF was performed on day 28, elevating the CSEF to include the two caudal mammary glands. The CSEF was elevated along with the scar from the previous left-sided CSEF to allow direct appreciation of the caudal superficial epigastric artery and vein. The scar was sharply excised once the skin had been elevated to allow closure without the inclusion of the scar tissue. The CSEF was rotated laterally 180° to cover the perineum and caudal aspect of the right thigh. The medial edge of the flap was sutured in the caudal midline to the left CSEF, ventral to the anus, and prepuce (►Fig. 3). The wounds were closed in two layers using 1.5 metric polydioxanone sutures subcutaneously, and 1.5 metric nylon simple interrupted sutures in the skin. The healing was uneventful.

A perineal urethrostomy was performed on day 41, once the midline aspects of the CSEF had healed to allow formation of the urinary stoma by apposition of the urethral mucosa to the edges of the CSEF. A urinary cat catheter was placed in a retrograde manner to allow identification of the urethral tear and adequate dissection and excision of the urethra. The perineal urethrostomy was performed ensuring stoma formation proximal to the non-healed urethral tear. The wound defect on the left caudal aspect of the thigh, which was not able to be closed previously using the left CSEF, was closed primarily. Throughout the period of hospitalisation the provision of analgesia included the administration of combinations of ketamine constant rate infusions1 (0.6–1.2 mg/kg/h IV), meloxicam2 (0.1 mg/kg PO q24h), buprenorphine (0.03 mg/kg via the buccal mucosa q8h), methadone3 (0.2 mg/kg IM q4–6h), and gabapentin4 (5 mg/kg PO q12h).

On day 43, the cystotomy tube was removed while the cat was under sedation, and on day 46 the cat was discharged to the owners and care of the referring veterinarian for skin suture removal around the urethrostomy. There were not any complications pertaining to the skin reconstruction or to the urethrostomy, including urinary tract infection or stenosis of the stoma. Limb function and cosmetic appearance 12 months postoperatively were reported by the owner and referring veterinarian to be excellent, with no observed lameness or decrease in the range of motion of the hindlimbs, and no dysuria (►Fig. 4).

Discussion

The delay in initial presentation of this patient to a veterinarian and the diagnosis of urethral rupture, together with the slow progression of clinical signs in this case, indicate an insidious onset which appears consistent with that observed by other authors. Reported times from admission to surgery for traumatic urethral rupture and extravasation of urine in 29 cats range from zero to eight days (median 0.5 days) (6). Urethral catheterisation and retrograde urethrography at the time of referral were performed without complication or resistance on passing the urinary catheter, and no attempt of urethral catheterisation was performed prior to this, so iatrogenic injury was not considered possible. The occurrence of distal urethral tear following blunt trauma is rare, suggesting a mechanism of shearing or avulsion injury to the urethra. The development of the observed clinical signs is consistent with a gradual accumulation of urine subcutaneously with the development of skin necrosis, secondary to the hyperosmolarity of urine, resultant inflammatory response, and tissue necrosis (3). This confirms the slowly progressive nature of the clinical signs resulting from urine extravasation. A strong index of suspicion is therefore required for prompt diagnosis of urethral rupture, especially when urethral patency is preserved; in these cases contrast studies should be considered early.

The recommended management of distal urethral rupture has been dependent upon the aetiology, but urinary diversion and primary alignment using a urinary catheter has been advocated for traumatic perforation, with urinary catheters being left in situ for a period of five to 14 days (4). In the current case, management using primary urethral alignment was not successful despite the urinary catheter being in place for 15 days. Urine is toxic to the subepithelial tissues, causing periurethral inflammation, fibrosis and delayed healing (7). A cystostomy tube was subsequently placed to aid urethral healing by minimising contact of the subepithelium with urine, and also to prevent extravasation of urine under the transposed skin flaps. The cystostomy site was placed distant to the transposed CSEF and donor site margins without any complications observed from the concomitant use of tube cystostomy and CSEF. In spite of these measures, the urethral tear failed to heal by second intention and persistent leakage of urine from the distal urethra was documented on subsequent retrograde urethrography studies. One possible explanation is that urine persistently leaked through the urethral wound and impaired wound healing, in spite of the urine diversion by cystostomy. However, the authors hypothesise that this failure to heal resulted from the location of the wound within the granulation bed. Histopathology of the affected portion of the urethra may have helped confirm this hypothesis, but it was not performed in this case be-

1 Ketaset: Fort Dodge Animal Health, Southampton, UK
2 Metacam: Boehringer Ingelheim, Ingelheim am Rhein, Germany
3 Physeptone: Martindale Pharma, Romford, UK
4 Gabapentin: Sandos, Barleben, Germany
cause it would not have altered the course of treatment in our opinion. Primary surgical repair of the urethra was not considered appropriate due to the increased risk of stenosis and fibrosis associated with second intention wound healing, and the small diameter of the urethra in this location (18). Urethroscopy is a commonly performed procedure for reconstruction of the urethra following trauma. The formation of a urethral stoma, which is under minimal tension and with precise mucocutaneous apposition, is essential to reduce subsequent complications (16). In the current case, the distal location of the urethral tear allowed a perineal urethroscopy to be performed, thus preserving an adequate length of uroepithelium and the formation of a urethral stoma to the reconstructed perineum under minimal tension at the wound margins. The management of the wound in this case by second intention healing and wound contraction at the perineal urethroscopy site, instead of CSEF reconstruction, was not recommended because we considered this to be deleterious to the formation of a urethral stoma and the long-term outcome.

Another recent report described a cat with an area of necrosis of the skin and muscle of the thigh, secondary to urine extravasation due to traumatic urethral rupture, which was managed with vacuum-assisted closure and a simple, rotational subdermal plexus flap (5). Use of vacuum-assisted wound closure in the current case was not considered appropriate due to the extent and position of the wound, with regards to the proximity to the anus and prepuce, and the placement of a foam dressing for vacuum application being technically difficult. Similarly, contraction of the wound expected following vacuum-assisted closure was contraindicated in the current case due to the resultant tension at the caudal wound margin and site of the proposed urethroscopy stoma.

A simultaneous bilateral CSEF procedure was not chosen, as it was thought likely to result in compromise of aseptic technique due to difficulty associated with positioning of the patient for bilateral access to the dorsolateral aspect of the pelvic area. In addition, wide flaps were required, and it was feared that primary closure of the donor site may have proved difficult if both flaps had been harvested simultaneously.

Minor and major complications are commonly reported with the use of CSEF; these include wound discharge, seroma formation, partial incisional dehiscence, distal flap necrosis, infection, flap oedema, and bruising (15,17). The findings of these other reports are consistent with those observed in the current case, where partial thickness dehiscence of the distal margins of the CSEF and cranial margin of the thigh were observed and that these resolved without intervention. The 180° cranial folding of the distal portion of the flap in the current case, with only minor complications, confirms the versatility of the CSEF for extensive wound reconstruction.

The current case documents extensive bilateral perineal skin necrosis subsequent to extravasation of urine following urethral trauma and reconstruction using staged bilateral CSEF and a perineal urethroscopy. This reconstruction technique resulted in excellent functional and cosmetic outcomes. Combined bilateral CSEF and urethroscopy should therefore be considered as a satisfactory option for reconstruction of extensive perineal trauma in cats.

Acknowledgements

The authors would like to thank the owner and referring veterinarian for their assistance with the follow-up of the case, as well as the staff and colleagues involved with the patient’s care during hospitalisation.

References