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Surgical repositioning with omentalisation of an exposed subcutaneous ureteral bypass shunting port in a cat

Shi Min Lee and Jayson Tuan

Abstract

Case summary A 9-year-old, spayed, female domestic shorthair cat presented with an open wound approximately 1 cm in size with exposure of the left subcutaneous ureteral bypass (SUB) shunting port that was placed approximately 11 months before presentation. Primary closures were attempted twice before local wound management with omentalisation and repositioning of the port. The exposed port was lavaged topically with a polyhexanide and propylbetaine wound irrigation solution before omentalisation and repositioning, resulting in successful retention of the implant. Five months after revision and omentalisation, there was complete coverage and healing of the wound. *Relevance and novel information* Adequate topical treatment, repositioning and omentalisation could be a successful treatment option for the uncommon complication of SUB shunting port extrusion secondary to resistant local infection originating from the urinary tract.

Keywords: SUB device; clinical bacteriuria; ureterolithiasis; omentalisation; ureteral obstruction

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Introduction

Ureteral obstruction in feline patients is an increasingly recognised condition, with ureteroliths being the most common cause of obstruction.[1,2] Traditional surgical treatment options, such as ureterolithotomy, ureteral reimplantation, and ureteral resection and anastomosis, have been described but have also been associated with high rates of complications and mortality.[3,4] In comparison, the subcutaneous ureteral bypass (SUB) device (Norfolk Vet Products) may improve clinical outcomes and lower mortality rates in benign ureteral obstructions in cats compared with traditional therapy.[3,5,6] Complications of SUB devices include blockage due to mineralisation, blood clot formation, urine leakage, infection, kinking of the tubing and transmural migration into the gastrointestinal tract.[3,7,8] Previously reported management of such complications have included SUB device exchange or removal, use of tissue plasminogen activator for obstruction from blood clots and tetra-EDTA solution for infections and mineralisation.[3,7,9]

The aim of this case report was to describe a novel technique for the successful management of an exposed SUB shunting port, which involved topical treatment, repositioning and omentalisation of the device.

Case description

A 9-year-old, spayed, female domestic shorthair cat weighing 2.78 kg with body condition score 4/9 presented with a wound approximately 1 cm in size near its left subcutaneous ureteral bypass shunting port, with implant exposure. The cat had undergone surgery 1 year before for acute kidney injury secondary to bilateral ureteral obstructions from ureterolithiasis. At the initial presentation, the cat had non-regenerative normocytic normochromic anaemia (haematocrit 17.2%, reference

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interval [RI] 30.3–52.3), elevated renal parameters (creatinine 7.7 mg/dl, RI 0.8–2.4), blood urea nitrogen (BUN; 90 mg/dl, RI 16–36) and elevated phosphorus levels (>16.1 mg/dl, RI 3.1–7.5). An abdominal ultrasound examination by an imaging specialist demonstrated a ureteral obstruction secondary to a ureterolith on the left, and diffuse ureteral echogenic material causing pelvic dilation and obstruction on the right. Urinalysis revealed mild proteinuria (trace), marked haematuria (3+), urine specific gravity (USG) of 1.010 and a pH of 6. The cat was started on amoxicillin–clavulanic acid (20 mg/kg PO q12h, Pet-Amox Plus; Pharmanex) while pending urine culture results. The cat received supportive care, including antibiotic therapy, for 3 days with no improvement of azotaemia; a repeated abdominal ultrasound examination revealed no resolution of obstruction. Bilateral SUB 2.0 shunting devices were placed, and culture and sensitivity results were not available at time of surgery. The left kidney was noted to be extremely enlarged and congested. An 18 G over-the-needle catheter was placed in the left kidney for the collection of urine from the renal pelvis as well as a pyelogram, as described in the surgical technique for SUB placement. Urine culture and sensitivity obtained via cystocentesis preoperatively was positive for *Klebsiella pneumoniae*, which has intermediate sensitivity to amoxicillin-clavulanic acid. The intraoperative urine and purulent material had a positive culture of *K pneumoniae* with the exact sensitivity as the preoperative culture. A postoperative injection of contrast material, iohexol (Omnipaque; GE Healthcare), in both ports and radiography confirmed the patency of the devices with no leakage. The cat was started on nitrofurantoin (5 mg/kg PO q8h for 2 weeks, Apo-nitrofurantoin; Apotex) and amoxicillin-clavulanic acid (20 mg/kg PO q8h for 3 weeks, Pet-Amox Plus; Pharmanex) based on the culture and sensitivity results. The immediate postoperative creatinine level reduced to 4.7 mg/dl (RI 0.8–2.4) and gradually decreased and maintained at a plateau of 3.7 mg/dl (RI 0.8–2.4) from day 5 to day 8. The cat was discharged on postoperative day 8.

The SUB device was routinely checked and flushed with tetrasodium ethylenediaminetetraacetic acid (T-FloLoc; Norfolk Vet Products) at 3 weeks, 10 weeks, 3 months and 4 months postoperatively. At the 3-week postoperative recheck, the cat did not present with any clinical signs of urinary tract infection, and urine culture and sensitivity performed yielded a positive culture of *K pneumoniae* with a similar antibiotic sensitivity as before. The cat received another course of nitrofurantoin and amoxicillin-clavulanic acid (same dose and length as aforementioned). A urine sampled collected via cystocentesis was submitted 5 days after completion of the antibiotics course. The urine culture yielded a significant amount of *K pneumoniae* 10^4–10^5 colony-forming units (CFU)/ml with a similar antibiotic sensitivity pattern. At that point, the clinical decision was to cease antimicrobial therapy as the cat was asymptomatic and because of concerns of increased risk of antimicrobial resistance due to prolonged therapy.

At approximately 11 months postoperatively, the cat was presented with an exposed left SUB shunting port visible within a wound to the left of the midline (Figure 1a), with no reported trauma. The physical examination was unremarkable, with stable renal parameters (creatinine 3.6 mg/dl, RI 0.8–2.4; BUN 70, RI 16–36; and phosphorus 4.9 mg/dl, RI 3.1–7.5). Urine was collected from the SUB device for urinalysis, culture and sensitivity followed by a routine SUB flush with T-FloLoc solution. Urinalysis revealed a USG of 1.016, pH of 7.0, trace proteinuria and blood in the urine. The cat was sedated and primary wound closure performed with 3/0 Nylon (Dermalon; Covidien). The urine culture and sensitivity had a significant number of bacteria (*Klebsiella oxytoca*; 10^5 CFU/ml in a SUB port urine sample). The bacterial culture and sensitivity wound swab taken from the wound yielded the same microorganism. The cat was started on amoxicillin-clavulanic acid (20 mg/kg PO q12h, VedAmox C-50) pending wound culture results.

The cat managed to remove the Elizabethan collar 5 days after wound closure and licked the wound, which led to re-exposure of the left SUB device. A second attempt at primary closure of the wound was performed. The wound culture and sensitivity results came back revealing a heavy growth of *K pneumoniae* with immediate sensitivity to amoxicillin-clavulanic acid. The cat's amoxicillin–clavulanic acid was increased (20 mg/kg PO q8h for 10 days, VedAmox C-50).[10] Despite the appropriate antibiotic regime, the wound failed to heal and, notably, increased in size. The wound was managed as an open wound with topical polyhexanide and propylbetaine (PHPB) wound irrigation solution (Prontosan solution; B Braun) and padded dressings.

A CT with contrast flushing of the SUB device documented no convincing evidence of left ureteric patency, prompting that SUB device removal was not an adequate option. Preoperative bacterial culture indicated multidrug-resistant (MDR) *Pseudomonas aeruginosa* and *K pneumoniae*, which were no longer sensitive to amoxicillin–clavulanic acid. The cat was anaesthetised and received preoperative pain relief with methadone 0.2 mg/kg IV (Methadyne; Jurox). The cat was placed on dorsal recumbency. The implant was already exposed so the subcutaneous tissue was dissected (Figure 1b). The left SUB port and its associated tubing were then soaked in PHPB solution for approximately 5 mins. The superficial defect was also copiously lavaged with the same solution. A routine midline incision was then made to retrieve the cystotomy and nephrostomy tubes located within the

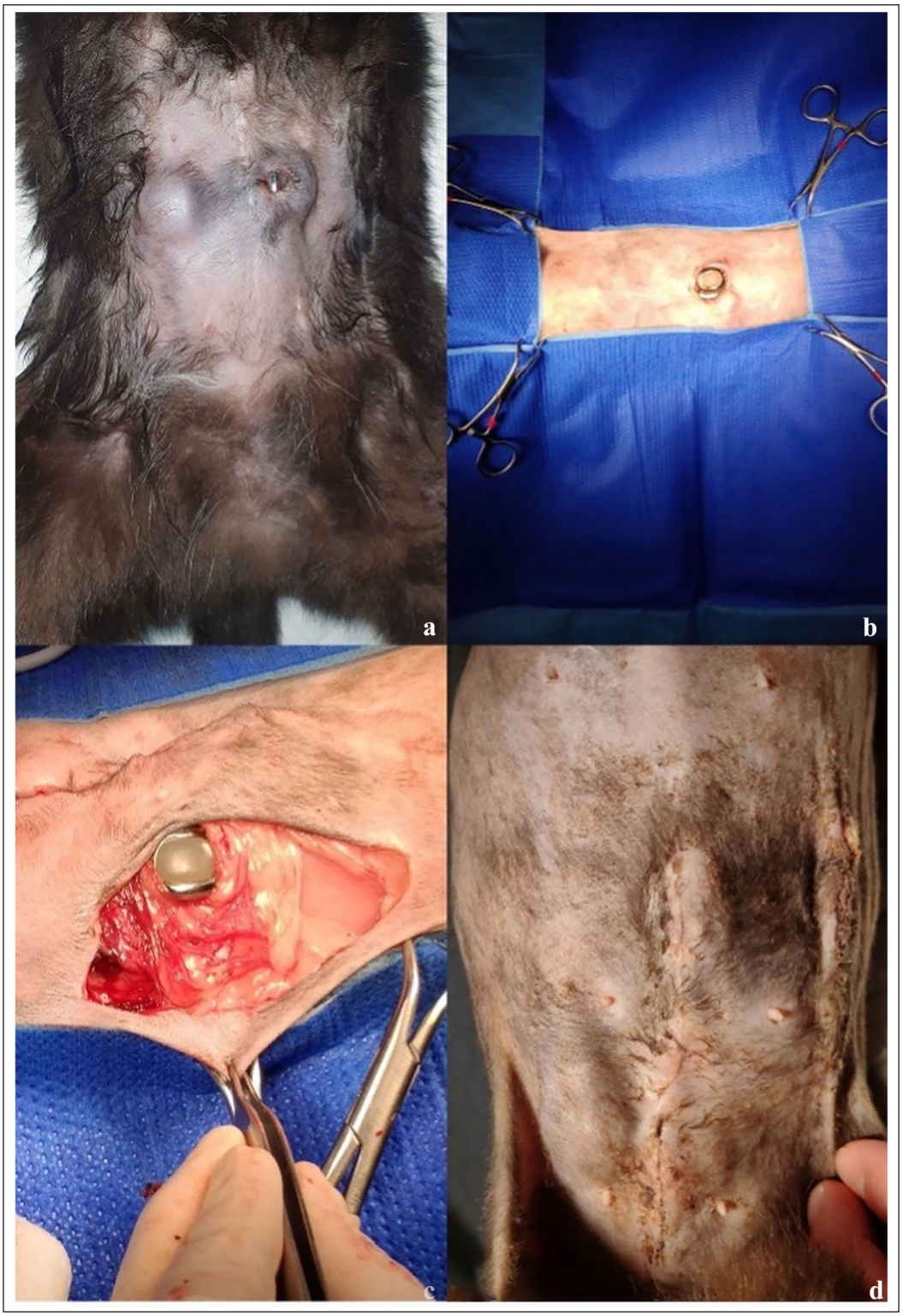

Figure 1 (a) Image of the left subcutaneous ureteral bypass (SUB) shunting port implant exposed; (b) intraoperative photo after draping; (c) omentalisation of the SUB shunting port before routine wound closure; and (d) 2 weeks postoperative review that documented adequate wound healing

abdomen. An intraoperative urine sample was obtained and submitted for culture and sensitivity, which came back positive for *K pneumoniae*. The tubes were detached and patency was confirmed. A more dorsolateral position was selected for the port and new exit points were created adjacent to the port site. A new skin incision abaxial to the original port location was made to facilitate that. The ends of the tubes were trimmed before reattachment. Device leakage was evaluated intraoperatively and confirmed no leakage. The shunting port was sutured to the body wall using 3/0 Nylon (Dermalon; Covidien). In addition, the bursa portion of the greater omentum was passed through a separate body wall incision and used to cover the SUB shunting port (Figure 1c). The wound was routinely closed in the following layers: external rectus sheath with 2/0 polyglyconate (Maxon; Covidien); subcutaneous with 3/0 polyglyconate (Maxon; Covidien); and intradermal with 4/0 Gylcomer 631 (Biosyn; Covidien). The cat was then discharged to the owner's care with buprenorphine (Buprelieve; Jurox) sublingually 0.015 mg/kg q8h. The cat was sent home without oral antibiotic therapy.

The cat was seen for a review 2 weeks and approximately 4 months postoperatively, and the left SUB port wound has healed without any concerns and the port remained covered (Figure 1d).

Discussion

In this case report, we introduce a novel technique for the successful management of an exposed SUB shunting port in a feline patient. To our knowledge, only one case of an exposed SUB shunting port has been reported previously, which was managed using diluted chlorhexidine solution to clean the port.[11] Our case innovatively addresses the management of an exposed SUB shunting port with the use of topical PHPB solution, repositioning and omentalisation, offering an alternative approach for such complications.

Positive urine cultures have been documented in 13% of cases after surgical interventions for ureteral obstruction using SUB shunting devices.[3] There is a potential risk of localised infection around the SUB port when accessing the port in cases of urinary tract infection. An ultrasound-guided cystocentesis can be performed but iatrogenic damage to the cystostomy tube of the SUB system needs to be taken into consideration. The dual antibiotic decision was made by the attending clinician; however, antibiotic combinations have been used in human medicine to increase the antimicrobial spectrum and produce a synergistic effect.[12] Moreover, combination therapies in human medicine have also been proven to be effective against MDR infection.[13] Nevertheless, the authors of this paper cannot convincingly extrapolate the data for dual antibiotic therapy to the feline patient and recommend this treatment practice. Our case report also underscores the importance of bacterial culture and sensitivity testing to guide antibiotic therapy and highlights the growing awareness of antimicrobial stewardship and the increasing preference for alternative topical antimicrobial solutions over systemic antibiotics to treat localised infections. In the present case, urine culture at the time of revision surgery was an MDR infection, with both bacteria sensitive to amikacin and meropenem. The use of such antibiotics should be reserved for life-threatening infections in humans to mitigate the risk of antibiotic resistance and preserve the effectiveness of these crucial drugs. Furthermore, there is no consensus on systemic antibiotic therapy in an exposed SUB port and a lack of clinical signs of urinary tract infection; therefore, the cat was not prescribed systemic antibiotics upon discharge. The use of topical PHPB solution is indicated to cleanse and hydrate acute and chronic wounds to aid in wound management. A previous human study has demonstrated that the combination of these active ingredients promotes wound bed preparation and supports the reduction of inflammatory signs.[14] Furthermore, previous human studies have demonstrated that the combination of these two active ingredients are effective in significantly reducing bacteria biofilm concentrations, including *Pseudomonas aeruginosa* and methicillin-resistant *Staphylococcus aureus*.[15,16]

Omentalisation involves using the greater omentum to cover the exposed SUB shunting port. The omentum is a rich source of angiogenic and neurotrophic factors.[17] It acts as a reservoir for peritoneal immune cells while playing a pivotal role in peritoneal lymphatic drainage. Its adhesive properties aid in providing vascularisation and tissue coverage.[18–20] Because of its considerable size and adaptability, the omentum has found wide application in various procedures, including hepatic, prostatic and pancreatic cysts and abscess management.[18,20,21] In this case, omentalisation was employed to aid in resolving the infection. To our knowledge, omentalisation has not been previously described for managing exposed SUB shunting ports and represents an innovative approach to addressing this complication. Nevertheless, further studies are required to better understand whether omentalisation may result in adhesions surrounding the SUB device port, potentially causing flushing difficulty in the future. Omentalisation also increased the difficulty of identifying the port. Other possible complications with omentalisation include abdominal contents herniated through the abdominal exit wound with subsequent strangulation. Ascending infection along the omental pedicle and secondary peritonitis is also a possible complication; however, a previous study suggested that the fibrin seal formed at the abdominal exit hole acts as a mechanical barrier to bacteria.[18]

During the follow-up period, the cat showed successful wound healing without any signs of infection, port

re-exposure and complications. This demonstrates the potential effectiveness of omentalisation as a treatment option for exposed SUB device ports.

Conclusions

Our case report introduces omentalisation as an innovative technique for managing exposed SUB device ports in feline patients. This approach may prove valuable for clinicians encountering similar complications in the future. Our case contributes to the expanding body of knowledge on the treatment of complications associated with SUB devices and underscores the importance of ongoing research and innovation in this field to improve patient outcomes.

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Ethical approval The work described in this manuscript involved the use of non-experimental (owned or unowned) animals. Established internationally recognised high standards ('best practice') of veterinary clinical care for the individual patient were always followed and/or this work involved the use of cadavers. Ethical approval from a committee was therefore not specifically required for publication in *JFMS Open Reports*. Although not required, where ethical approval was still obtained, it is stated in the manuscript.

Informed consent Informed consent (verbal or written) was obtained from the owner or legal custodian of all animal(s) described in this work (experimental or non-experimental animals, including cadavers) for all procedure(s) undertaken (prospective or retrospective studies). For any animals or people individually identifiable within this publication, informed consent (either verbal or written) for their use in the publication was obtained from the people involved.

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