Treating post-renal transplant surgical site infection with combination therapy: a case study

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ABSTRACT

Surgical site infection (SSI) is one of the most common and debilitating complications of surgery. The risk of SSI rises if the patient has underlying health-related risk factors. This article reports on the complicated case of 61-year-old female with a history of obesity and diabetes. She was diagnosed with end-stage renal disease (ESRD) and had been receiving haemodialysis since 2012. She underwent a kidney transplant and developed a multidrug-resistant *Pseudomonas aeruginosa* SSI following surgery. She experienced delayed wound healing with a partially dehisced incision. Despite conventional wound care, there was no progress in wound healing. The authors combined sharp debridement, irrigation and antibiotic therapy with a silver-containing antimicrobial dressing for 1 month. Her SSI improved significantly and she returned to theatre for wound closure. The patient recovered well and was discharged from the hospital after suture removal. Wound-care professionals can use combination therapies to manage SSIs effectively and reduce patient and healthcare costs.

Key words: Surgical site infection ■ Wound healing ■ Renal transplantation ■ Silver sulfadiazine ■ Wound debridement

Surgical site infection (SSI) is a common post-surgical complication. An SSI will prolong wound healing, and this may affect a patient's mobility and normal activities, leading to a reduced quality of life. There may be an increased length of hospital stay, with a higher risk of readmission and increased costs for the hospital and patient (Pujol et al, 2012; Abboud et al, 2014).

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Approximately 20–25% of Gram-negative bacteria, such as *Pseudomonas aeruginosa*, *Escherichia coli* and *Klebsiella pneumoniae*, account for the formation of SSIs (Inui and Bandyk, 2015). Along with diabetes, obesity, sex hormones and some medications, infection is reported as a risk factor that contributes to impaired wound healing (Guo and DiPietro, 2010). Owing to the increasing number of patients with risk factors such as diabetes, obesity and infection, the prevalence and costs of chronic non-healing wounds are growing (Järbrink et al, 2017; Farokhi et al, 2018). Thus, a combination of treatment strategies (such as debridement, antibiotic therapy, and using appropriate topical antimicrobial agents) would seem necessary for rapid and effective recovery (Schultz et al, 2017).

Today there are several different types of topical antimicrobial agents, such as povidone-iodine, polyhexamine, medical-grade honey, and silver sulfadiazine (Vowden and Vowden, 2017). In wound management, povidone-iodine has been used to kill both Gram-negative and Gram-positive organisms, and no bacterial resistance has been reported for iodine. It it said to improve both acute and chronic wounds (Bigliardi et al, 2017).

The liquid antimicrobial agent polyhexamine has been used to irrigate wounds. Polyhexamine has been found to be highly effective and clinicians use it for both acute and chronic wounds. It reduces both slough and necrotic tissue (Spruce et al, 2016).

Dressings containing medical-grade honey can be used for acute and chronic wounds as honey has been found to prevent and minimise bacterial infection (Yilmaz and Aygin, 2020). Honey includes a protease enzyme that triggers autolytic debridement of scar tissue. Its osmotic concentration attracts lymphatic fluid to the scar tissue, thus generating the wet conditions needed to automatically eliminate the infected, damaged or dead scar tissue (Yilmaz and Aygin, 2020).

The antibacterial properties of silver have been known for man years. However, its topical use in antimicrobial dressings to treat infection in a wide range of chronic non-healing wounds is relatively new (Ågren, 2016). There is no clear evidence regarding the effectiveness of silver or wound dressings containing silver for the prevention or treatment of SSIs (Percival and McCarty, 2015), and its efficacy remains controversial (Li et al, 2017).

The authors present a case report of a patient whose wound

was successfully treated using silver-containing antimicrobial dressings in combination with sharp debridement, irrigation, and antibiotic therapy.

Case study

A 61-year-old Azerbaijani woman was admitted to Imam Khomeini hospital in Urmia, in north west Iran. She had a kidney transplant on 5 October 2018. The patient had a history of end-stage renal diseases (ESRD) and had received haemodialysis three times a week since 2012. She had been diagnosed with type 2 diabetes in 2004 and was obese with a body mass index (BMI) of 30.5 kg/m^2. She had hypertension and mild coronary artery disease. Her transplanted kidney was donated to her by a 34-year-old living unrelated donor who had no underlying illness. The patient's medications included:

- Acetylsalicylic acid (aspirin) 100 mg for its anticoagulant properties
- Nitrocontin 6.4 mg for pain prevention/pain relief
- Carvedilol 3.125 mg for hypertension
- Neutral protamine hagedorn (NPH) insulin 12 units for her diabetes
- Cyclosporine 100 mg, an immunosuppressant to help prevent rejection of the transplanted kidney
- Prednisolone 5 mg, an immunosuppressant to help prevent rejection of the transplanted kidney
- Azathioprine 75 mg: an immunosuppressant to help prevent rejection of her transplanted kidney.

The patient's postoperative complications included surgical site hernia (which was repaired in the operating room by a surgeon), mild bilateral subsegmental atelectasis, and pleural thickening.

Postoperative wound complications

After the surgery, wound healing was impaired, and the patient suffered non-healing wound complications. The wound dehisced, and its size increased. A urine culture was positive for *E coli*, and a wound culture showed multidrug-resistant *P aeruginosa* infection. After consultation with an infectious disease specialist, broad-spectrum antibiotic therapy was initiated based on the antibiogram result. The patient had a low-grade fever (38.1°C), and her laboratory results were as follows:

- White blood cell (WBC) count: 1530/microlitre
- Neutrophils: 81.8%
- Erythrocyte sedimentation rate (ESR): 105 mm/hour
- C-reactive protein test (CRP): +2.

The patient was given intravenous antibiotics with an adjusted renal dose (ciprofloxacin 250 mg every 24 hours; metronidazole 500 mg every 12 hours; meropenem 500 mg every 12 hours).

There was no wound healing progress despite conventional wound care (irrigating with hydrogen peroxide and antibiotic treatment). This patient had a wound care consultation, and she was transferred to the wound management service on 31 December 2018.

Combination wound therapy

After co-ordination with the patient's post-surgical ward team, combination wound therapy was initiated. Sharp debridement was performed to remove necrotic tissue, and the wound was irrigated with normal saline. A silver-containing antimicrobial dressing was applied—Algicell® Ag Calcium Alginate Dressing with Antimicrobial Silver with 1.4% silver (Derma Sciences Company, Princeton, NJ, USA). The wound dressing was changed every 2 to 3 days and when needed. Intravenous antibiotic therapy was prescribed for 4 weeks.

The wound was heavily exuding and Zetuvit Plus (Hartmann International), a highly absorbent dressing pad, was applied over the silver Algicell dressing to manage the exudation and avoid frequent dressing changes.

After 1 month of treatment with the silver dressing and antibiotic therapy, the patient's wound culture was re-checked twice, and the results were negative. The patient was transferred to the operating theatre, and her abdominal wound was irrigated with normal saline and closed by the surgeon on 28 January 2019. A sterile gauze dressing was applied, which was changed every 7 days.

Nutritional care

As the patient had a history of high blood pressure, heart disease, and diabetes, she was evaluated by a nutritionist to ensure she followed her low-salt, low-fat, low-sugar diet while in hospital. The nutritionist added foods rich in vitamin C to her diet. The patient was encouraged to drink at least eight glasses of water every day and had no symptoms of dehydration during the hospitalisation.

Psychological aspects of care

Having a wound, plus a life-threatening illness and a long stay in hospital can affect a patient's psychological health. However, this patient showed no signs of depression or other mental health issues and her family were very supportive while she was in hospital.

Discharge and after-care

Twenty-three days after surgical wound closure, the patient's sutures were removed and she was discharged from the hospital.

The first author checked the patient's surgical site during a home visit 1 month after discharge. The patient had experienced no further problems with the wound site, and her general health had improved.

Discussion

A kidney transplant is one of the treatments of choice for patients with ESRD (Sánchez-Escuredo et al, 2015). Patients undergo kidney transplants for a variety of reasons, including:

- Polycystic kidney disease (Lam et al, 2019)
- Complications of diabetes mellitus (Cottrill, 2013; Lam et al, 2019)
- Complications of hypertension (Cottrill, 2013; Peneva et al, 2016; Lam et al,2019)
- Berger's disease (Lam et al. 2019)
- Glomerulonephritis (Markic et al, 2014; Peneva et al, 2016)
- Glomerulonephritis due to Wegener's granulomatosis (Markic et al, 2014).

This case study reported on a patient with a complex previous

KEY POINTS

- Surgical site infection (SSI) can be problematic if wounds become infected with multi-drug resistant *Pseudomonas aeruginosa*
- SSI can lead to sepsis and be fatal if it is not well managed
- Combination therapy is one of the strategies that can be used to manage SSIs effectively
- The silver-containing antimicrobial dressing has been shown to be an effective option used in combination with conventional treatments

medical history with ESRD who underwent a kidney transplant and developed a postoperative abdominal incisional hernia. An incisional hernia is one of the most common and expensive complications of open abdominal surgery, and patients who have a transplant are at higher risk because of taking postoperative immunosuppressive medication (Smith et al, 2015; Primus et al, 2018). Most patients improve with no adverse incidents; however, 15–20% of patients experience incisional hernias (Strik et al, 2016). Some of the risk factors for incisional hernia development include diabetes, SSI, morbid obesity and smoking (Smith et al, 2015; Primus et al, 2018).

Ho et al reported that the incidence of SSI in patients with first-time kidney transplants is 18.5% (Ho et al, 2010). The patient is this case study was especially susceptible to an SSI due to underlying health-related risk factors such as diabetes, obesity, and immunodeficiency secondary to immunosuppressant therapy (Abboud et al, 2014; Farokhi et al, 2018). A literature review showed that common microorganisms involved in SSI included *S aureus*, Corynebacterium, Enterococcus species, Prevotella species, *Klebsiella pneumoniae, Candida albicans* (Peneva et al, 2016; Lam et al, 2019), and meticillin-resistant *S aureus* (MRSA) (Peneva et al, 2016). The pathogenic bacterium isolated from the patient's surgical site was *P aeruginosa*, a leading cause of nosocomial infections (Pachori et al, 2019).

Despite all the therapies and wound-care interventions, no improvement was observed in the patient's SSI. A recent study by Pachori et al showed that pseudomonas infections in surgical sites are often the most severe, life-threatening and hard to treat (Pachori et al, 2019). Considering the patient's health condition and that she had developed a *P aeruginosa* SSI, using a single treatment strategy was considered to be ineffective. An antimicrobial silver dressing may be applied as a barrier to bacteria in wounds at high risk of infection or re-infection (Vowden and Vowden, 2017). Thus, it was decided to combine routine wound care with a silver-containing antimicrobial dressing to reduce bacterial colonisation (Siah and Yatim, 2011) accelerate wound healing and treat the infection (Walker et al. 2015). Wound irrigation and sharp debridement were first employed to clean the infected wound. Then a silver-containing antimicrobial dressing was applied and intravenous antibiotics were administered to promote wound healing. This combination treatment strategy effectively resolved the non-healing SSI in the patient.

In line with the practice reported in this case study, recent clinical studies and international practice have demonstrated that silver-containing antimicrobial dressings have a positive effect in reducing bacterial colonisation (Siah and Yatim, 2011), are safe to be used for SSIs (Li et al. 2017), and lead to significant wound improvements even in the hardest to heal wounds (Walker et al, 2015). Cottrill reported successful management of SSI with silver dressings in the post-renal transplant patient (Cottrill, 2013). Similar to this case study, recent studies have also shown that silver-containing antimicrobial dressings are a safe and effective method to enhance antimicrobial activity and accelerate the healing of SSIs (Inui and Bandyk, 2015; Salomoni et al, 2017; Primus et al, 2018).

Ethical considerations

All ethical principles were considered in conducting this case study. Patient confidentiality was maintained and consent for this case study was obtained.

Conclusion

The combined use of a silver-containing antimicrobial dressing with other treatment strategies can be beneficial and effective in treating non-healing *P aeruginosa* SSIs, especially in patients with underlying health issues such as diabetes, immunodeficiency disease, and so on. The authors recommend that medical teams and wound-care specialist nurses use combination wound-treatment strategies to improve the wound-healing process in wounds with SSIs and consequently reduce patient and healthcare costs. **BJN**

Declaration of interest: none

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CPD reflective questions

- Think about your clinical area's approach to surgical site infection (SSI). What approaches have you found most successful?
- With many bacteria resistant to antibiotics, what is your clinical area's approach to SSI?
- Consider the combination therapy approach used in this case study. What kind of therapies are combined in your clinical area?
- Identify the antimicrobial dressings available in your clinical area's wound dressing formulary