Implant infection caused by dermatitis: a report of two cases

CT Lim, KJ Tan, F Kagda, KC Ang
Department of Orthopaedic Surgery, National University Hospital, Singapore

ABSTRACT
We report 2 cases of implant infection with Staphylococcus aureus associated with dermatitis. In both cases, the skin at the surgical site was normal and full antiseptic measures were taken. One patient had a history of chronic asteatotic eczema complicated by cellulitis; the other had generalised exfoliative dermatitis with an atopic aetiology. Dermatitis at sites remote from the operative site may be a contributing factor in implant infection.

Key words: dermatitis; infection; methicillin; prostheses and implants; Staphylococcus aureus

INTRODUCTION
Aseptic technique, laminar airflow in operating theatres, prophylactic antibiotics, and the duration of surgery are major factors affecting implant infection, as are local skin and soft-tissue conditions. In open fractures, bacterial contamination of the surrounding soft tissue increases the risk of infection. The condition of the skin at distant sites may also influence implant infection rates. We report 2 patients with methicillin-resistant Staphylococcus aureus (MRSA) implant infection associated with dermatitis at distant locations.

CASE REPORTS

Case 1
In November 2002, a 58-year-old man presented with severe right hip pain after a fall. The trochanteric region was tender and the right leg shortened. Plain radiographs revealed a displaced right femoral neck fracture, which was reduced and fixed with 3 cannulated screws. The patient was well for one year but subsequently developed swelling and erythema of the right leg. He had a history of chronic asteatotic eczema complicated by cellulitis. Intravenous cloxacillin and penicillin were administered, with clindamycin added later because of a poor clinical response. Plain radiographs of the hip showed non-union at the fracture site and degenerative changes in the acetabulum (Fig. 1a). He underwent a total hip arthroplasty 6 weeks later, after the cellulitis had resolved. Pre-induction cefazolin (1 g) and gentamicin (80 mg) were administered prophylactically. Cefazolin
(1 g/8 hours) was continued for 2 days after surgery. The operation took about 180 minutes. The wound remained clean and healthy for the first week, but one week later became erythematous and indurated. A series of wound debridements were performed and deep tissue cultures isolated MRSA. It was decided to retain the implant as the wound was clean during re-exploration, and inflammatory markers such as the erythrocyte sedimentation rate (ESR) and C-reactive protein (CRP) were falling. Intravenous vancomycin was added. The patient was discharged after 42 days of antibiotic treatment. There was no evidence of implant infection, lucency, periosteal thickening, or elevation (Fig. 1b).

Case 2
In January 2004, an 86-year-old man presented with severe left hip pain and inability to bear weight after a fall. His left leg was shortened and externally rotated. Plain radiographs revealed an intertrochanteric fracture. He had a history of generalised exfoliative dermatitis and was being treated with topical steroids (betamethasone valerate ointment 0.05% and betamethasone valerate cream 0.25%) and liquid paraffin. His fracture was managed with a closed reduction and internal fixation with a dynamic hip screw. Pre-induction cefazolin (1 g) and gentamicin (80 mg) were administered prophylactically. The operation took about 50 minutes. Four days after surgery, the patient developed fever and blood cultures grew MRSA. A septic workup revealed no specific source of infection. His wound remained clean and dry. He responded well to vancomycin and completed a 42-day course of antibiotics but was readmitted 4 months later for fever. His surgical scar was erythematous and indurated. Plain radiographs showed a united intertrochanteric fracture. Deep implant infection was suspected and a decision was made to explore and debride the wound. Intra-operatively, turbid fluid and a small amount of pus were noted and the dynamic hip screw was removed. The united fracture was stable and the screw holes and wound were debrided and drained. Deep tissue cultures isolated MRSA. The wound was irrigated with 9 litres of pulsatile saline lavage and gentamicin beads were inserted. Intravenous vancomycin was commenced postoperatively. Serial monitoring of inflammatory markers showed improving ESR and CRP levels. The patient was discharged after a wound inspection under anaesthesia. The wound was clean and the gentamicin beads were removed. He completed 18 days of intravenous vancomycin and was discharged with antibiotics administered as an outpatient for 6 weeks. At the 2-year follow-up there was no further evidence of infection.

DISCUSSION
With the use of systemic antibiotics, laminar airflow operating theatres, and aseptic techniques, surgical infection rates have been reduced to as low as 1 to 2%.3,4 Dermatitis at sites remote from the operative site may be a contributing factor in implant infection. One of our patients had a history of chronic asteatotic eczema complicated by cellulites; another had generalised exfoliative dermatitis with an atopic aetiology. Skin biopsies were not performed, as dermatitis is common in the elderly and can be managed according to the
clinical findings.

In patients with atopic dermatitis, the affected skin has a higher count of total aerobes and S. aureus per unit area.\(^5\) S. aureus colonisation in affected skin can reach \(10^7\) colony-forming units (CFU)/cm\(^2\), and such patients are at higher risk of prosthetic infection.\(^6\) Even when the incision is made in normal skin, the risk of implant infection remains high, as the normal skin of atopic dermatitis patients is more heavily colonised with aerobic bacteria than the skin of healthy patients.\(^5\) In people with atopic dermatitis, the mean total aerobic count of the normal skin has been calculated as 3548 CFU/cm\(^2\) and the S. aureus fraction as 0.7, compared to 33 CFU/cm\(^2\) and 0 in healthy individuals. Non-atopic dermatitis is also associated with higher levels of skin colonisation. In one study, 24% of normal skin samples from patients with non-atopic eczema were colonised with S. aureus, compared to 3% in healthy controls.\(^7\) Although haematogenous seeding of the surgical site and implant may be possible, both our patients had no active sources of haematogenous infection peri-operatively. In addition, both patients developed symptoms in the early postoperative period, which suggests intra-operative contamination.

Patients with dermatitis have increased S. aureus colonisation. The protective function of the skin is impaired by a disturbance of the quantity and quality of lipids in the stratum corneum due to increased levels of stratum corneum chymotryptic enzyme,\(^8\) low expression of beta-defensin-2,\(^9\) deficiency of cis-6hexadecenoic acid,\(^10\) and reduced levels of sphingosine.\(^11\) There is a significantly lower level of cis-6hexadecenoic acid in the normal skin of dermatitis patients, correlating with the number of S. aureus cultured.\(^11\) Sphingosine, a sphingolipid, known to exert a potent antimicrobial effect on S. aureus, is significantly down-regulated in both the affected and normal skin of dermatitic patients when compared to healthy controls.\(^10\)

**CONCLUSION**

Patients with dermatitis are at higher risk of implant infection, especially when the dermatitis is atopic. They have higher levels of bacterial colonisation on both the affected and normal skin. Further studies are needed to better understand the relationship between implant infections and dermatitis, and to implement new preventive measures.

**REFERENCES**

9. Ong PY. Is/are pattern recognition receptor(s) for Staphylococcus aureus defective in atopic dermatitis? Dermatology 2006;212:19–22.