Antibiotics vs an antimicrobial dressing for pin-track infection

Mayukh Bhattacharyya, Helen Bradley

Background: Pin-site infection is a common complication in the treatment of fragility fractures of the distal radius in the older population. There is a need for evidence-based practice guidelines for pin-site care as few studies have compared the associated infection rates of different treatment methods. Objectives: A clinical study was conducted over a 24-month period to record the clinical outcome in patients treated with Acticoat 7, a nanocrystalline silver-release dressing, and OpSite Post-Op, a barrier dressing, in the management of pin-site infection. A secondary objective was to compare these outcomes with those of patients treated with oral antimicrobials. Methods: Twenty-one outpatients with a K-wire fixation for osteoporotic distal radius fracture with established pin-track infection were studied. The first 10 patients were treated with a one-week course of an appropriate antibiotic determined by culture and the rest were treated with Acticoat 7 and OpSite Post-Op dressings. Results: All patients in both groups healed completely, although the healing time was variable. Conclusions: The results from this study confirm that a nanocrystalline silver-release dressing may be effective as an alternative to oral antimicrobials in treating postoperative pin-site infection in otherwise uncomplicated patients. Further randomised clinical study is, however, required. Conflict of interest: None

Abstract

Metal wires, commonly known as K-wires, are used as external-fixation devices in the management of orthopaedic fractures (Sims and Saleh, 2000). These wires protrude through the skin and are therefore described as 'percutaneous'. The wound around the K-wire may be an entry point for microbes which may result in a pin-track infection (Figure 1a and b).

There has been much discussion in the literature about the management of skin wounds associated with percutaneous pins (Checketts, 2000; Gordon et al, 2000; W-Dahl et al, 2003) and the incidence of pin-site infection, a common complication of external fixation (Moroni, et al, 2002). Sims and Saleh (2000) have stated that infection rates for these pins can be as high as 85%. Ahlborg and Josefsson (1999) reported a 21% rate of pin-track infection following external fixation for the treatment of distal radial fractures.

There is a need for evidence-based practice guidelines in relation to orthopaedic percutaneous pin-site care as there is little evidence relating to which management regimen best reduces infection rates (Temple and Santy, 2004; Patterson, 2005). Pin-site management practices are consequently inconsistent (Davis, 2003).

Research evidence

Williams and Griffiths (2004) state that there is still insufficient evidence to recommend no cleansing.

A small prospective, randomised study comparing seven methods of caring for skeletal pin sites (external fixation, traction and halo) found that half-strength hydrogen peroxide solutions and Xeroform-impregnated gauze dressings were superior to cleansing with soap and water in terms of reducing the incidence of infection (Patterson, 2005).

The clinical management of pin-site wounds will depend on the severity of infection. There is a distinction between the normal healing process and signs of infection. For example, pin-site reaction (which refers to the normal physiological changes at the pin and skin interface) is not a pin-site infection. Signs of pin-site reaction include changes in normal skin colour, increased warmth, and serous or slightly bloody discharge at the site; the condition should subside after 72 hours (Holmes et al, 2005).

Microbe colonisation and infection at the pin site increases the risk of the percutaneous fixation failing to stabilise the fracture (Moroni et al, 2002; W-Dahl et al, 2003).

KEY WORDS

Acticoat
Distal radius fracture
OpSite Post-Op
Silver-releasing dressing
Wound infection

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et al, 2003). Ward (1998) categorised pin-site infection as major or minor. Clinical features of minor infection manifest as prolonged discharge, crusting and swelling, and may be controlled with oral antibiotics. However, the major infection requires surgical drainage and removal of pins (Ward, 1998).

Pin-track infections are commonly classified according to Saleh and Scott’s (1992) (Table 1) or Checketts–Otterburns’ (Checketts, 2000) (Table 2) grading systems. The treatments for pin-track infections vary among surgeons. Formal pin-site care, with or without antimicrobial solution or use of oral or systemic antimicrobials, has been described in the literature (Saleh and Scott, 1992; Ward, 1998; Checketts, 2000; W-Dahl et al, 2003).

**Role of silver dressings**
Silver-containing or silver-releasing dressings offer one method of controlling the polymicrobial wound bioburden of chronic wounds (Hilton et al, 2004; Verdu Soriano et al, 2004; Fong et al, 2005; Lansdown, 2005; Meaume et al, 2005). Silver is effective against a broad range of bacteria including methicillin- and vancomycin-resistant strains (Jones et al, 2004; Strohal et al. 2005; Ulkur et al, 2005), yeast, fungi and viruses (Holder et al, 2003).

Antimicrobial silver dressings are gaining popularity in clinical practice because of the increase in antibiotic-resistant genotypes (Driver, 2004; Schaller et al, 2004). New silver-impregnated dressings, such as Acticoat 7 (Smith & Nephew Healthcare, Hull) have the capacity to serve as an antimicrobial barrier and are designed to overcome the limitations of the older silver-containing formulation (Dunn and Edwards-Jones, 2004). They reduce microbial contamination of wounds from environmental sources (Dunn and Edwards-Jones, 2004). Moreover, Acticoat 7, which is a nanocrystalline silver dressing, is cost-effective in chronic wound management in patients who are discharged from hospital as it can be left in place for up to seven days and patients do not need to attend hospital or community health care providers for wound checks (Dowsett, 2003).

Lansdown (2005) also reported that silver-release dressings are extensively used for chronic wounds requiring antibacterial treatment. However, Lee and Moon (2003), in an experimental study on rabbits, have shown that dermal regeneration may be impaired and the mechanical strength of dermal tissue may be decreased, which clinically may result in wound breakdown (Dunn and Edward-Jones, 2004).

There is some evidence that the use of chlorhexidine-impregnated dressings around the pin site of external fixators decreases the incidence of pin-track infection (Temple and Santy, 2004).

There is no report describing the use of silver-release dressings to combat pin-track infection. Clearly, there is a need for a large randomised controlled study to determine the best method of pin-track infection management.

### Study objectives
The objectives of this study were to investigate whether the silver-release dressing Acticoat 7 and OpSite Post-Op (Smith & Nephew Healthcare, Hull) would control the incidence of postoperative pin-track infection, and to compare these outcomes with those of patients treated with oral antimicrobials.

### Method
A clinical study of older patients (Table 3) undergoing skeletal pin fixation for fragility fractures of the distal...
radius between January 2003 and November 2005 was conducted in the Department of Orthopaedic Surgery at University Hospital, Lewisham, London. Only patients without any known allergy to silver who had undergone a K-wire fixation as the method of stabilisation of fracture fragments were included in the analysis.

Table 4 lists the inclusion and exclusion criteria. Patients who had undergone recent antibiotic therapy for an unrelated reason in the three months preceding the study, and with a history of skin disease or a wound requiring more than one suture because of open reduction of the fracture treatment, were excluded from the study. All the patients had given informed consent before treatment. This study did not require ethical approval as patients were not randomised and the regimens used in the study were the authors’ normal methods of treatment.

A sample of 26 patients with clinically and microbiologically confirmed pin-track infection (using the classification described previously) three weeks after the surgical stabilisation procedure for distal radius fragility fractures were included in this study. The first 15 out of the 26 were treated with oral antibiotics and the remaining 11 were allocated sequentially to postoperative management with Acticoat 7 as the primary dressing and OpSite Post-Op (5 x 6.5cm) as the secondary dressing. The study was limited to the procedures commonly performed by all junior trainee orthopaedic surgeons to control the variable of surgical technique.

All patients had the same type of anaesthesia and aqueous-based iodine as skin preparation. On completion of surgery, a single OpSite Post-Op dressing was used to close the pin-site wound. The operating surgeon applied the dressing along the longitudinal axis without creating any tensile force. A layer of wool and crepe bandage was applied. Eight layers of dorsal plaster slab were then put on the limb below the elbow.

All patients were treated with the same postoperative protocol. Patients were instructed not to remove the plaster or superficial wool and bandage and to perform finger mobilisation only after surgery. Patients were assessed at days four and 14, at three weeks and then at six weeks at the final check-up in the outpatient fracture clinic by the clinician and the specialist nurse practitioner (HB) who treated the pin-track wound after removal of the plaster slab and the primary dressings. At these visits, any clinical signs of wound infection at the pin site were recorded and, if an infection according to the criteria (Table 1) was confirmed, either therapy with a one-week course of antibiotics or the antimicrobial dressing was commenced. A photograph (Figure 1) was taken to provide an objective record of the wound and to measure its size and shape. Any signs of inflammation or pin-site reaction were also documented at this assessment.

Pin-site reaction usually subsides within three days (Holmes et al, 2005). Inflammation was defined as the presence of redness around the portal, pain, or discharge from the wound margin. Colonisation was defined as redness and discharge from the wound,
accompanied by presence of microbes by culture. If a local or superficial wound infection was suspected, a wound swab or pus was taken to obtain a microbiological report. Infection was also associated with signs of pin loosening (Checketts, 2000). In addition, the patients underwent haematological tests for white blood cell count, C-reactive protein, and erythrocyte sedimentation rate. Patients were also monitored during the course of the study for signs of allergic reaction, which was defined as a redness of skin without pain or inflammation.

Statistical method
Data were entered into Microsoft Excel 2000 for analysis to obtain simple statistical results.

Results
A total of 26 patients were eligible for inclusion in the study (Table 3). Five patients out of 15 treated with oral antibiotics were excluded from the analysis. In such cases, the antibiotic administration was continued for more than two weeks, or failure to attend a follow-up assessment led to exclusion. Ten patients in the antibiotic treatment group and 11 in the Acticoat dressing group were included in the final analysis.

Dressing-related morbidity
There was no difference between the two regimens in terms of failure to control wound infection. Three patients in the Acticoat group needed silver dressings for up to five weeks and the rest required less than three weeks’ treatment, with one requiring early removal of the pins as they were loose, which may have been as a result of surgical technique. No patients experienced systemic spread of wound infection. Figure 2 shows Acticoat 7 post-surgery and Figure 3 illustrates the resolution of infection at final follow-up of the patient.

Discussion
There is limited knowledge about the best method of treatment for pin-track infection following percutaneous K-wire fixation of distal radius fracture in older people. Surgeons adopt different methods of pin-site care to prevent infection (Ahlborg and Josefsson, 1999; W-Dahl et al, 2003; Temple and Santy, 2004). The local wound problem at pin sites has traditionally been treated with oral antibiotics (Checketts, 2000). In this clinical study, the effectiveness of silver-releasing dressings was compared with that of oral antibiotics in the treatment of pin-track infections following K-wire stabilisation for distal radius fractures in an older population. All patients were treated successfully as the local wound problems settled and healed completely. None progressed to systemic infection.

Older patients with multiple co-morbidities tend to develop pin-track infection after the insertion of pins. This infection can be of varying severity and the polymicrobial wound environment may necessitate use of antibiotics. Silver-impregnated dressings may offer an alternative to oral antimicrobials in the treatment of such an infection. Our results confirm the findings of other studies on the performance of silver dressings in the treatment of wounds infected with different pathogens (Fong et al, 2005; Meaume et al, 2005; Strohal et al, 2005).

This study has shown that silver-releasing dressings compare favourably with oral systemic administration in the management of percutaneous pin sites. The study did not show any clinical failure (as all infections healed) as a result of the small sample size, the small dimensions of the surgical

### Table 3
Demographic data

<table>
<thead>
<tr>
<th>Patient group, total 21/26</th>
<th>Antibiotic (n=10/15)</th>
<th>Acticoat (n=11/11)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excluded</td>
<td>n=5/15</td>
<td>n=0/11</td>
</tr>
<tr>
<td>Mean age (65–90 years)</td>
<td>67.5</td>
<td>66.8</td>
</tr>
<tr>
<td>Sex</td>
<td>F11: M4</td>
<td>F10: M1</td>
</tr>
</tbody>
</table>

### Table 4
Inclusion and exclusion criteria

**Inclusion criteria**
- Aged more than 65 years and less than 90 years
- Fragility fracture of the distal radius
- Treated with closed manipulation with K-wire fixation
- Operating time < one hour
- Patients with ASA 1 & 2
- Non-smoker
- No previous surgery in the distal radius
- Informed consent
- Patient will remain in the study until wound healed

**Exclusion criteria**
- Patients not willing to participate
- Open fracture fixation
- History of peripheral vascular disease
- Allergy to silver
- Skin disease, e.g. psoriasis
- Smoking history

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Antibiotics, which could reduce the incidence of microbial resistance in older patients. This aspect, however, was not investigated in the current study.

Cost is an important consideration. It is recommended that a robust pharmaco-economic evaluation is undertaken to explore the potential cost-effectiveness of Acticoat 7 and OpSite Post-Op dressings in the management of pin-site care after surgery. The potential association between Acticoat 7 and OpSite Post-Op and reduction in oral systemic antibiotic-related morbidity, such as nausea and gastrointestinal symptoms, may be important in older patients with co-morbidities undergoing fracture treatment, as their wounds are mainly managed in the home setting without the supervision of health-care personnel.

In this study, Acticoat 7 and oral antibiotics were equally effective in controlling pin-track infection. However, Acticoat 7 has the benefit of allowing the wound to heal while the dressing is in place without any systemic effects (Dunn and Edwards-Jones, 2004).

Limitations
This study was limited by the design of sequential allocation to treatment (i.e., the non-randomisation of the patients) and the fact that the evaluating physician was the treating physician, which may have introduced selection bias. Another limitation is the fact that the small sample size may have influenced the results. It is recommended that the findings of the study are confirmed in a clinical trial where patients are randomly allocated to a dressing or oral antibiotic regimen.

Conclusion
In summary, this prospective study provides information about a nanocrystalline silver-releasing dressing that may control wound infection. As a result of this study, the authors have now stopped using oral antibiotics to treat pin-track wound infection within their unit. They have also been studying the effect of Acticoat 7 treatment on larger wound sizes at their hospital. However, further clinical studies are needed to confirm the data presented in this article.

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Key Points

- Pin track infection is conventionally treated with antibiotic.
- This study showed it could be treated with a silver impregnated dressing.
- Nanocrystalline silver in controlling pin track infection offers comparable results with antibiotics.
- It may be more useful in elderly patients with established pin track infection as it reduces the use of oral antimicrobials.