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Care of pin sites

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Summary

External fixation is a key component in orthopaedic management. However, the use of metal pins or wires may result in complications, such as pin site infections. To prevent infections pin site care must include effective assessment, monitoring and cleaning of the pin site. Differing methods of pin site management in clinical practice have resulted in inconsistencies in the literature relating to best practice. This article explores some of the variations in pin site care.

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External fixation; Infection; Pin site care

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METAL PINS ARE used to apply skeletal traction and external fixation devices in the management of orthopaedic fractures (Temple and Santy 2004). The pin site is the area where the pin meets the skin. The correct assessment, monitoring and care of pin sites are essential to ensure quality care and good patient outcomes. Pin site infection is the most common complication of external fixation (Bernardo 2001). Prevention of pin site infection is therefore an important aspect of the nurse's responsibility (McKenzie 1999). To ensure effective assessment and monitoring of pin sites, the nurse must be able to provide general care of the pin site and demonstrate an understanding of the difference between the normal healing process and the development of pin site infection to enable the appropriate response.

External fixation sites

An external fixator is a device used to stabilise bone fractures in adults and children following traumatic injury (Bernardo 2001). The device can

also be used to change bone position and correct cartilage deformities (Holmes *et al* 2005). External fixators are used to maintain the correct alignment of the broken bone until bone healing occurs. A simple fracture may take up to six weeks to heal, but a more complicated fracture may take more than a year.

Skeletal pins and wires are also used to correct the alignment of a broken bone. Pins or wires are inserted into the bone through skin incisions and connect the external fixator to the bone. Two or more pins are placed either side of the broken bone to hold the bone in place and to anchor the fixator securely. As the pins pierce the skin attention must be paid to the pin site to prevent complications such as infection.

Evidence for best practice

Recommendations for the care of pin sites are not necessarily evidence based (Temple and Santy 2004) and this has led to confusion and contradiction in the literature regarding best practice. Day-to-day clinical decision making for the care of pin sites often takes place by the nurse at the patient's bedside. It is therefore important to provide nurses with the best available evidence to support practice. In 2000, Birmingham University was host to a consensus conference of 54 orthopaedic nurses, which aimed to identify current best practice for pin site care to provide nurses with clinical guidelines (Lee-Smith *et al* 2001). Some of the evidence presented in this article is in line with these recommendations.

Assessment and monitoring There is a distinction between the normal healing process and the signs of pin site infection. In the assessment and monitoring of a pin site, the nurse must be able to recognise the difference between reaction, colonisation and infection. Holmes *et al* (2005) emphasised the importance of assessment parameters in differentiating between the normal healing process and the signs of colonisation and pin site infection, to ensure appropriate patient care was provided.

Reaction The consensus conference defined reaction as the normal changes that occur at the pin site after pin insertion. These are physiological responses, which should subside

after 72 hours (Table 1) (Holmes *et al* 2005). **Colonisation** Wound colonisation is common in pin site infection and is characterised by the presence of replicating microorganisms, which adhere to the wound. Most of these organisms are normal skin flora such as *Staphylococcus epidermis*, *Corynebacterium* species or *Propionibacterium acnes* (Collier 2004). Signs of colonisation are listed in Table 1.

Infection Wound infection occurs in the presence of replicating microorganisms in a wound. Pathogens such as *Staphylococcus aureus*, *beta-haemolytic Streptococcus* and *Pseudomonas* are of concern, as they are the most common organisms associated with wound infections (Collier 2004). Signs of infection are listed in Table 1.

It can be difficult for the nurse to identify when a wound is infected. There is a continuum that exists between when pathogens colonise a wound and when they start to cause damage. Table 1 illustrates the similarities between the colonisation and infection continuums. It is important to remember that a common feature of all infected wounds is the failure of the wound to heal and progressive deterioration of the wound. Wound infections are not the only reason for poor wound healing. Nutritional status, age, smoking, medication, the co-existence of diseases such as diabetes, poor patient understanding and adherence to cleansing regimens, social circumstances and level of hygiene have also been shown to have an adverse effect on healing (Lee-Smith *et al* 2001). It is therefore important for the nurse to consider the whole patient and be aware of the physical, social and psychological factors involved when assessing and monitoring the wound.

Classification of pin site infection

Pin site infections vary in severity and there is no uniformly accepted definition of infection. Clinicians should be aware of the distinctions between the normal healing process and the signs of pin site infection (Holmes *et al* 2005).

Classification systems have been developed to grade the level of pin site infection. These include the Saleh and Scott Classification System (Holmes *et al* 2005). This works by grading infections from 0 to 6, where grade 0 represents no problems and grade 6 indicates chronic osteomyelitis. Grades 1 to 5 determine how the infection reacts to treatment such as oral or intravenous antibiotics, removal of pins and surgical curettage. The Checketts-Otterburns Grading System (Checketts 2000) grades infections from 1 to 6, where 1 represents slight redness/little discharge and 6 represents the presence of infection after removal of the fixator. Ward (1998) provided a simple classification

system suggesting that pin site infections could be divided into two categories: minor infections and major infections. Ward (1998) defined minor infections as benign pin site infections, characterised by prolonged drainage, crusting, swelling or erythema, which can easily be treated with antibiotics. In contrast, major infections necessitate the removal of the affected pins or in some cases the entire external fixator system before the infection can be resolved.

Control of infection

The Department of Health (DH) (2003) stated that at any one time 9% of hospital inpatients had a healthcare-associated infection (HCAI). The National Audit Office (2000) estimated that the overall cost of HCAI is approximately £1 billion per year, with the cost of individual treatment around £4,000-£10,000. The DH (2003) guidance, *Winning Ways*, suggested that many HCAIs are preventable. It is imperative, therefore, that national guidance regarding control of infection is paramount in care delivery and that all nurses perform pin site care in line with strict aseptic technique guidelines (Pratt *et al* 2007).

Frequency of care The frequency with which pin site care should take place varies greatly in the literature. Frequency varies from four times a day to weekly care (McKenzie 1999). The Jones-Walton (1991) survey reported pin site care frequencies of once a day, twice a day, every shift, three and four times a day, and every four hours. Olson (1996) stated that a standard pin site care protocol that has been scientifically tested and is known to be significantly effective in preventing pin site reactions has yet to be reported in the nursing or medical literature. Olson (1996) recommended that a protocol, which is effective in infection control, cost effective and minimises skin irritation, needs to be developed based on systematic investigation.

Daily treatment has been advocated in studies

TABLE 1

Signs of pin site reaction, colonisation and infection

Reaction	Colonisation	Infection
▶ Redness	▶ Redness	▶ Redness
▶ Warmth	▶ Warmth	▶ Warmth
▶ Tenderness	▶ Increased discharge	▶ Increased discharge
▶ Swelling	▶ Pain at the pin site	▶ Increased pain
▶ Serous or blood-stained discharge	▶ Microbes present (cultures taken)	▶ Pus
		▶ Pin loosening
		▶ Increased microbial growth

(Adapted from Holmes *et al* 2005)

by Celeste *et al* (1984) and Behrens (1989), with others, including Sproles (1985), advocating twice-daily treatment. Trigueiro (1983) asserted that: 'the more a pin site is handled, manipulated or prodded, the greater the possibility of irritation'. However, a study by W-Dahl *et al* (2003) showed no difference between weekly and daily pin site care, in terms of frequency or severity of infection. The National Association of Orthopaedic Nurses (NAON) recommended that for sites with a mechanically stable bone pin interface, pin site care should be performed on a daily or weekly basis, after the first 48-72 hours (Holmes *et al* 2005).

Cleansing There is considerable debate regarding the practice of cleaning pin sites and evidence for best practice in relation to cleaning regimens varies in the literature. The frequency with which pin site care should be conducted and the cleaning solutions used vary between clinical areas (McKenzie 1999). Although the evidence for the frequency of cleansing regimens and the choice of cleansing fluid to be used is inconclusive, recommendations and guidelines produced by consensus from experts are used to guide practice. It is important that each individual hospital works within agreed clinical governance frameworks ensuring that guidance and/or protocols are produced and ratified, which advise on the type of solution used and frequency of cleaning regimens. Table 2 shows an example of a cleaning protocol, which might be adopted by a hospital trust. There is a variety of solutions that have been used in the cleaning of pin sites. These include sterile water, hydrogen peroxide, povidone-iodine solution, 0.9% sodium chloride, soap and water and chlorhexidine gluconate. McKenzie (1999) suggested that cleansing solutions such as soap and water, sterile water and normal saline were useful in performing pin site care because they softened crusts of the exudate so that they could be gently removed. Additionally, these solutions were generally not associated with any adverse reactions (McKenzie 1999).

The use of povidone-iodine has been discouraged because it has been reported to have a corrosive effect on stainless steel pins, and a reduced antibiotic effect when in contact with exudate (Ward 1998). Use of hydrogen peroxide has also been discouraged because of the damaging effect it can have on healthy tissue (Olson 1996).

Chlorhexidine gluconate is a rapidly acting antimicrobial cleansing solution. McKenzie (1999) stated that it was more effective against gram-negative bacteria than gram-positive bacteria. However, Ward (1998) emphasised that

its effectiveness against gram-negative bacteria was reduced by contact with blood, pus and soap, thus reducing its cost effectiveness. McKenzie (1999) also highlighted that chlorhexidine gluconate was ineffective against spores, viruses and some fungi, but was effective against *Pseudomonas* when left on the skin for five to ten minutes. The NAON suggested that chlorhexidine 2mg/ml may be the most effective cleansing agent (Holmes *et al* 2005). However, Olson (1996) reported that chlorhexidine gluconate, povidone-iodine and hydrogen peroxide were associated with increased infection rates, disruption of the healing process and disruption of the normal skin flora. Literature on the use of cleansing solution remains inconsistent and based on clinician preference rather than evidence.

Local guidance When there is insufficient evidence to recommend care, it is important to develop local guidance and protocols to ensure consistent and safe practice. Within the authors' organisation, a protocol has been agreed, which advises on the type of cleansing solution and frequency of cleaning regimen to be used for all patients who require pin site care within the trust. This protocol was devised following a review of the available evidence and consultation with orthopaedic surgeons. The protocol was subject to a ratification process, which included review by the trust's standards, guidelines and protocols group and final ratification by the orthopaedic directorate clinical governance group. As with all standards, guidelines and protocols within the trust, the guideline is subject to an internal ratification process on a two-yearly basis, allowing for new evidence to be incorporated. It is important the nurse continues to be up-to-date with new developments, reach consensus with colleagues about best practice and ensure consistency in treatment.

Pin site crusts McKenzie (1999) stated that the issue of whether or not to remove pin site crusts was just as confusing as the choice of which cleaning solution to use. Many authors advocate leaving the crusts in place (Trigueiro 1983, Paley and Jackson 1985, Sproles 1985) whereas Celeste *et al* (1984) and Ward (1998) advised that if crusts were to be removed, the clinician must demonstrate an understanding of the difference between crusts and scabs. Crusts at the pin site interface provide a barrier to the external surface and therefore should be removed, whereas a scab is an essential part of the healing process and for this reason should not be removed (Ward 1998). Bernardo (2001) recommended that crusts stay in place and should not be disturbed, as the chances of infection increase when the crusts are removed. It was suggested that crusts should only be removed in the presence of continuous drainage (Bernardo 2001). Likewise, the NAON

recommended that crusts should be left undisturbed unless signs of infection were observed (Holmes *et al* 2005).

Dressings Use of dressings in the management of pin sites is another aspect of care where there is little or no research and considerable variation in practice (Holmes *et al* 2005). Behrens (1989) recommended that pin site dressings should not be left undisturbed for too long in early post-operative stages, as this may prevent observation of the area surrounding the pins to ensure there is no vascular disturbance. Behrens (1989) also acknowledged that a balance must be struck between inadequate and too frequent pin care to prevent complications.

The use of gauze dressings to cover pin sites is generally recommended (Trigueiro 1983, Behrens 1989, McKenzie 1999), but Ward (1998) recommended that gauze should not be cut, as this can cause the filaments to penetrate the pin tract. Celeste *et al* (1984) recommended the use of iodine soaked gauze, however, as previously discussed the use of iodine has been discouraged because of its reported corrosive

effect on stainless steel pins and its reduced antibiotic effect when in contact with exudate (Ward 1998). There is some suggestion that pin sites should remain uncovered if no exudate is present (Trigueiro 1983, Sproles 1985, Behrens 1989). Ward (1998) states that pin sites that are left open could provide an entrance for infection and, therefore, require regular monitoring.

Showering Many practitioners consider showering to be part of hygiene maintenance rather than an aspect of pin site care, and as a result do not include it in pin site care protocols. Gordon *et al* (2000) reported no major infections as a result of showering in children with fixators. There appears to be some consensus that showering is acceptable once the pin site is dry and no longer oozing (Lee-Smith *et al* 2001). The NAON found that opinion was divided between showering using bactericidal soap and drying with a clean dry towel and covering the fixators with plastic while showering (Holmes *et al* 2005).

Patient discharge Nursing staff should carry out a full assessment before the patient is discharged

TABLE 2

Protocol for skeletal pin site care

Equipment:

- ▶ Pin site care pack.
- ▶ Dressing of choice to cover pin sites.
- ▶ Cleansing solution.
- ▶ Waste disposal bag.
- ▶ Liquid soap and paper towels.
- ▶ Sterile cotton buds.
- ▶ Dressing trolley.
- ▶ Appropriate protective clothing apron and gloves.

Action:

- 1) Wash and dry hands thoroughly.
- 2) Use aseptic technique. Clean the frame first with cleansing solution of choice, using cotton buds and swabs. Dry thoroughly using a sterile dressing sheet.
- 3) Using cotton buds and the cleansing solution of choice, clean each pin site individually. Using a new cotton bud for each stroke, place the bud where the pin enters the skin, and then make one stroke outward on the skin, moving away from the pin. Clean in a circular motion, always moving away from the pin. Using a new cotton bud for each stroke, clean until a complete circle has been made around the pin.
- 4) After all drainage is removed, dry the pin site with a clean cotton bud.
- 5) Clean the entire length of the pin with a sterile cotton bud and sterile gauze. Use a new cotton bud and gauze for each pin. Always clean away from the pin site.
- 6) Cover each pin site with dressing of choice. Pin sites may be left dry and uncovered when drainage stops, and if the sites are dry and no signs of infection are observed.
- 7) Wash and dry hands thoroughly.

Rationale:

- Hand washing is the most important factor in preventing the spread of infection.
- To prevent contamination of pin sites.
- To prevent cross-contamination between pin sites and to remove any crust. This will allow free drainage.
- This prevents the build up of moisture which may encourage colonisation.
- To prevent any debris dropping into the pin site.
- To try to reduce movement and to prevent tissue damage.
- To prevent cross-infection.

(Adapted from Bell and Bennett 2007)

to ascertain the patient and/or carer's ability to care for the pin site, and in particular, to be able to adhere to the strict aseptic technique required to limit complications while in hospital. The NAON recommended that patients and their families should be provided with education about pin site care before discharge and that this should be supported by the provision of written instructions (Holmes *et al* 2005). Information should be available in written, oral and visual formats and should be consistent (Lee-Smith *et al* 2001). In terms of risk, if it is considered that the patient and/or carer is not able to achieve the required competency to care for the pin site, then healthcare professionals with particular responsibility for pin site care should liaise with community nurses to maintain consistency and provide support (Lee-Smith *et al* 2001).

Nursing accountability

Medical staff often indicate their preference for carrying out pin site care. Healthcare professionals may include the pin site care regimen in the patient's notes. Following surgery it is the nurse who invariably provides subsequent treatment for the patient and the nurse who is expected to follow the plan of care

prescribed. Gerrish and Lacey (2006) stressed the importance of the nurse's actions, which must be research based when delivering care. Nurses need to be fully aware of up-to-date, relevant and creditable research to ensure patient safety. Nurses are accountable for patients and are therefore required to act in their best interests. If the nurse believes that the prescribed care is or may be harmful to the patient then he or she must discuss this with relevant medical staff. There is little research evidence on which to base the management of skeletal pin sites. However, to improve the assessment and management of pin sites and patient outcomes, there is a need to develop standardised and evidence-based protocols to minimise the inconsistencies in care that have been highlighted in the literature.

Conclusion

Pin site management varies greatly between hospitals and clinicians. To ensure quality care for all patients it is essential that robust evidence-based guidelines and/or protocols are in place and are adopted by all health professionals within the clinical environment. There is little evidence on which pin site care regimen best reduces infection rates, and there is a clear need for more research in this area to determine the best method of pin site management. Practice should be evidence based to promote best patient outcomes **NS**

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