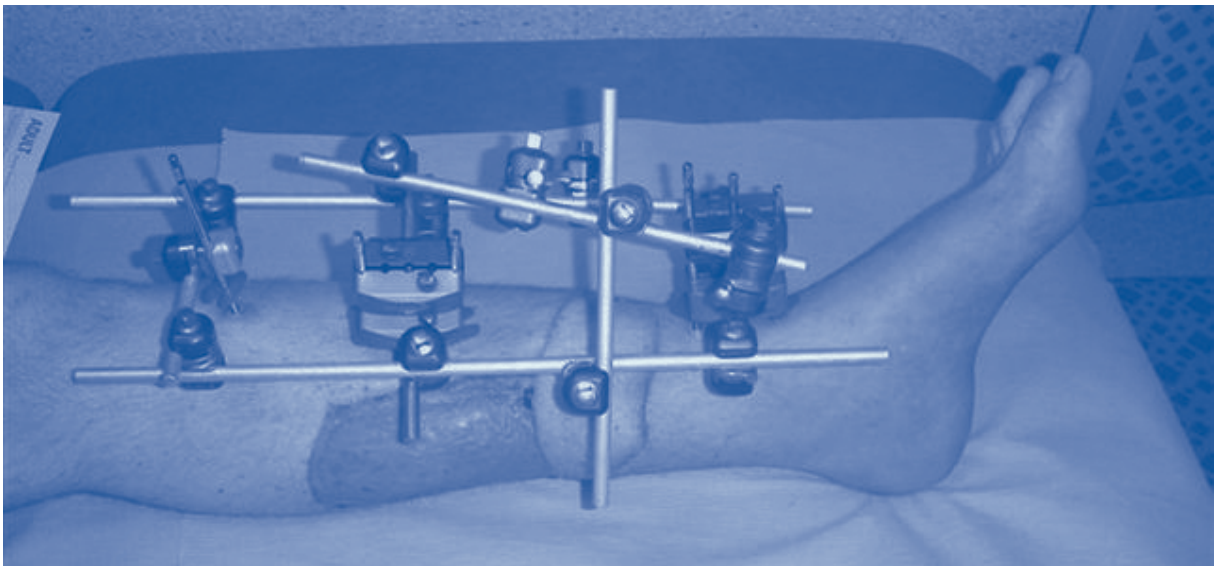
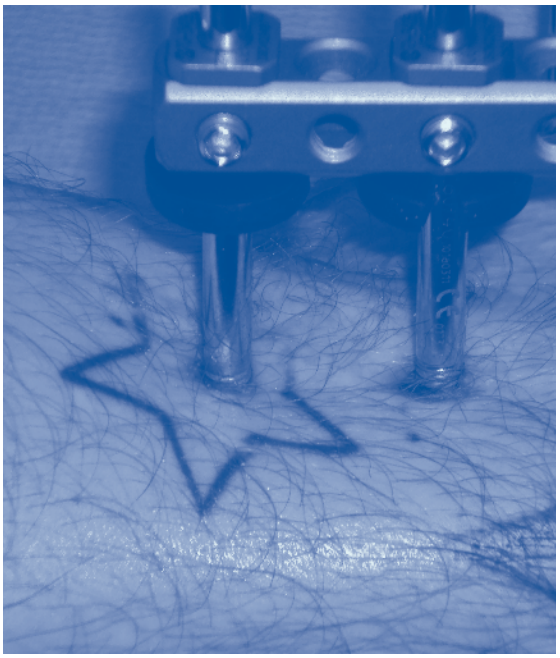
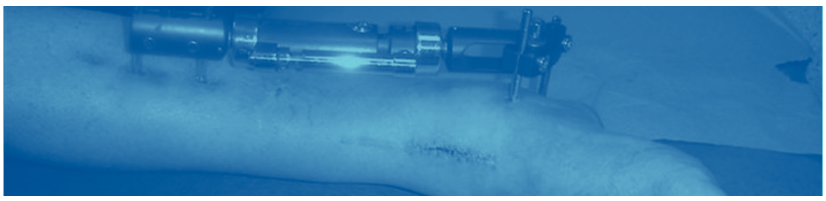
Royal College of Nursing

Guidance on pin site care

Report and recommendations from the 2010 Consensus Project on Pin Site Care







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Foreword

External fixation and limb reconstruction procedures are a vital part of trauma and orthopaedic treatment and care, and have a massive physical and psychological impact on the patient. There is a pressing need for research which can drive future practice in this area.

In recognition of this need, the RCN Society of Orthopaedic and Trauma Nursing was awarded funds to bring together a group of multidisciplinary clinical experts – drawn from a wide variety of units around the four UK countries – with significant collective expertise in orthopaedic settings in the public and private health care sectors.

Consensus methods are an important approach to developing guidelines for practice in the absence of clear research evidence – which is the case in this area of practice. The conduct of research is difficult due to the large number of variables involved, and difficulties in identifying valid outcome measures for pin site wound infection.

The outcomes the consensus has facilitated demonstrate how multidisciplinary approaches can bring together a document that commits to best practice in pin site care.

On behalf of the society I would like to thank all those who contributed to the production of a publication which can be used to support all clinicians in their day-to-day practice. The publication is not intended to be a set of rules, but is instead designed to be used as guidance for those wishing to ensure that their care delivery meets current views on practice, whether they care for orthopaedic patients with external fixation on a daily or intermittent basis.

Elaine Collins
Chair, RCN Society of Orthopaedic and Trauma Nursing, and Head of Clinical Services, Nuffield Health Bristol Hospital

Executive summary

This consensus project was conceived in the absence of strong evidence for the effective care of pin sites and prevention of infection. The consensus involved a one-day meeting which was used to devise a series of agreed statements. These statements were then used to develop an online questionnaire which enabled participants to express their level of agreement with each statement.

There was much discussion amongst those who attended the meeting. The following summary outlines the recommendations resulting from the meeting and subsequent survey:

- in the absence of skin sensitivity, pin sites should be cleaned weekly using alcoholic chlorhexidine solution and non-shedding gauze
- sites should then be covered with a wound dressing that keeps excess moisture and exudate away from the wound
- the dressings should be held in situ with a clip or 'bung' in order to apply light compression
- the frequency of dressing changes should be increased in the presence of an infection or if the dressing becomes saturated
- on the day of dressing change the patient may swim, attend hydrotherapy and shower (but not bath) the limb; the surrounding skin should be moisturised with an emollient as necessary
- patient reported symptoms and perceptions of the presence of infection should be taken seriously. Increasing pain at the pin/wire site and decreased movement, mobility or weight bearing along with spreading redness, increased swelling and discharge are indicators of the presence of infection. Frank drainage of pus is conclusive of the presence of infection but is not present in all cases of infection.

There is a need for multi-centre, prospective, randomised, controlled trials using a standardised validated pin site assessment tool. New dressings and cleansing solutions are constantly becoming available, so there should be regular review of these recommendations. It is important to remember that there are many variables which play a role in the prevention of pin site infection.

Glossary of main terms

External fixation

"External devices which hold wires or pins that are placed through one or both cortices of bone in order to hold the position of a fracture in proper alignment. These devices allow easy access to wounds, adjustment during the course of healing, and more functional use of the limbs involved." (MeSH, 2011)

Limb reconstruction

Functional and anatomical restoration of a limb following damage from disease or injury.

Percutaneous

Perforation through the skin, from the Latin words *per* meaning through and *cutis* meaning skin. Usually referred to in the context of medical devices such as canulae, catheters, and feeding tubes, as well as skeletal wires and pins.

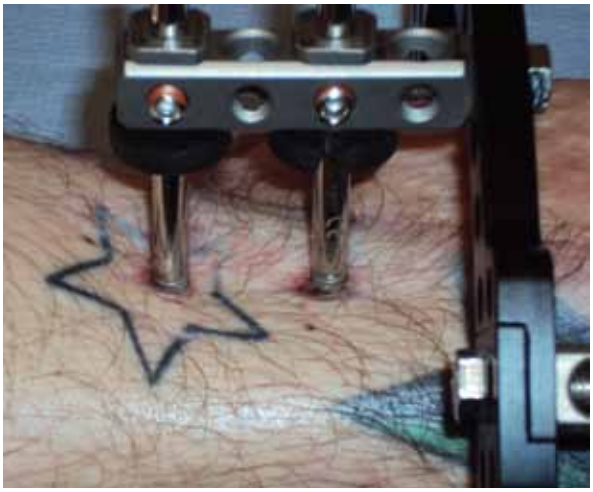
Pin

Threaded half-pins which require pre-drilling and are usually employed in monolateral external fixation.

Pin site, pin track, pin tract

The percutaneous wound or insertion site formed at the interface between a pin or wire and the skin.

Figure 1 – healthy pin site (half-pin)



Wire

Smooth (non-threaded) stainless steel wires normally 1.5 or 1.8mm in diameter, used in circular external fixation.

1

Background

1.1 Introduction

In the ten years since the *British consensus* on pin site care (Lee-Smith et al., 2001) the debate about how to care for these challenging wounds (which might be termed 'insertion sites') has continued. The debate is fuelled by the fact that there remains a lack of high quality randomised controlled trials which demonstrate potential best wound care practice for pin and wire sites (Lethaby et al., 2008).

It is widely acknowledged that large multi-centre trials are needed to rectify this issue. The significant problem when designing such studies, however, is the fact that so many dependent, independent and confounding variables exist within the practice of pin site care. A further problem is the lack of a validated outcome measure for pin site infection (Santy, 2010). This situation has resulted in the fact that studies which currently shape practice are often methodologically flawed.

In a Cochrane systematic review, Lethaby et al. (2008) identified only six randomised controlled trials investigating the prevention of infection in pin site wounds. All of these studies were shown to be flawed. In particular the review identified problems with the lack of validity of the outcome measures for infection used in the studies. In the review conclusion the authors argued that, in the light of the lack of randomised controlled trials, measures should be taken to control or prevent infection based on existing general knowledge about wound care and infection prevention.

This could be facilitated using existing standard guidelines for the prevention of infection (such as epic 2 Guidelines, Pratt et al., 2007, EWMA, 2006) relating to other types of wounds. However, one problem with this approach is that the percutaneous nature of pin site wounds results in a constantly open wound traversed by a foreign body. Standard wound care and infection prevention measures are potentially lacking specific details for wounds which are subjected to such extraordinary risk of infection (DH, 2003) and a constant inflammatory response.

There has been an understandable reluctance to use external fixation, particularly because of the risk of pin site wound infection. Much discussion in the literature over the last few decades has been centred on the necessity of identifying effective strategies for preventing and recognising pin site wound infection (Baird-Holmes and Brown, 2005; Celeste, 1984; Sproles, 1985; Jones-Walton, 1991; Rowe, 1997; Lee-Smith et al., 2001; Patterson, 2005; Lethaby et al., 2008; Timms and Pugh, 2010). Although this discussion acknowledges the ritualistic nature of existing practice, it still does little to provide reliable and valid guidance on which to base interventions aimed at the prevention of infection. More effective measures for preventing and managing pin site wound infections need to be developed and studied to enable effective care to be provided to patients with external fixation.

1.2 External fixation

Skeletal external fixation involves the surgical application of apparatus attached to percutaneous pins or wires that penetrate the bone and are attached to an external frame. MeSH (National Library of Medicine USA, 2011) currently defines external fixators as follows:

> *'External devices which hold wires or pins that are placed through one or both cortices of bone in order to hold the position of a fracture in proper alignment. These devices allow easy access to wounds, adjustment during the course of healing, and more functional use of the limbs involved.'*

External fixation is commonly used to treat complex fractures and limb deformity and its use has increased in recent years in line with the damage control orthopaedics approach (Tuttle et al., 2010) as well as a result of guidelines for the management of open fractures (BOA/BAPRAS, 2010).

The benefits of using external fixation, as opposed to other modes of treatment, include the provision of stability for severely comminuted fractures. This allows early mobilisation and weight-bearing on the affected limb. This in turn increases the rate of bone healing through axial loading of the fracture and other biomechanical effects of the device. Additionally, external fixation is considered less invasive surgery than internal fixation with less risk

surgically, and allowing easier access to traumatic and surgical wounds for their management. Such systems also facilitate limb lengthening, bone grafting and reconstruction where needed (Green, 1983; Sims et al., 1999; Sisk, 1983).

Wires or pins allow fixation of the apparatus to the bone. Some fixators (circular) involve inserting wires under tension which pass right through the limb (see Figures 2 and 3). Others employ 'half-pins' which screw into both cortices of the bone but do not have an exit wound, as the penetration stops at the second cortex (see Figures 1, 4 and 5). Such devices are commonly used in the management and 'reconstruction' of limbs following severe traumatic injury (Sims et al., 2000) as well as deformity correction (Speigelberg et al., 2010).

Figure 2 – Ilizarov fixator

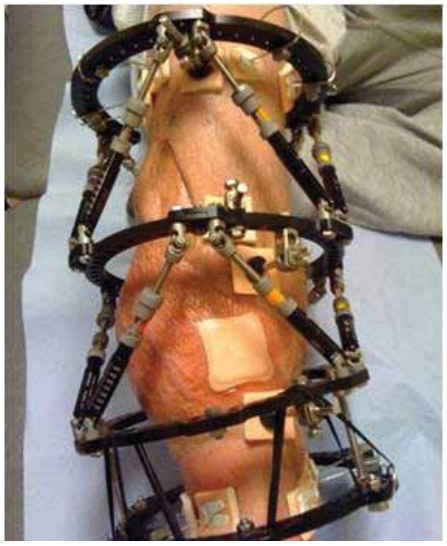


Figure 3 – Octahedral hexapod

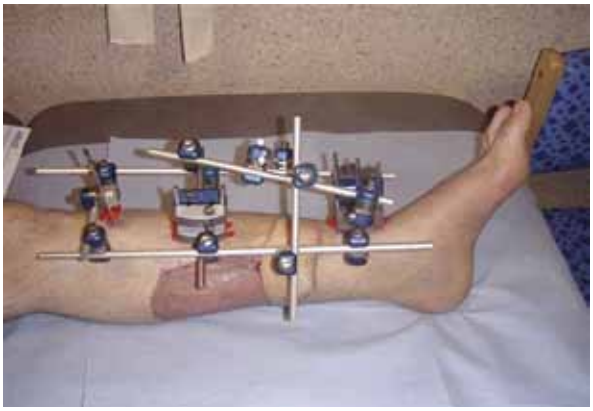


Figure 4 – Modular monolateral fixator

Figure 5 – Monolateral fixator

The long-term and invasive nature of external fixation and its impact on the surrounding tissues mean that complications are both common and well-documented. These include delayed union of fractures, nerve and vessel injury, loosening of half-pins, mechanical problems with the fixator and pin site infections (Green, 1983; Hargreaves, 2004; Sims, 1999; Bibbo and Brueggeman, 2010). Of these complications, pin site infection is reported to be the most common (Ahlborg, 1999; Antoci, 2008; Baird–Holmes and Brown, 2005; Dahl, 1994; W-Dahl, 2003; W-Dahl and Toksvig-Larsen, 2008; Santy, 2010) and is likely to be one of the main reasons why clinicians might be reluctant to use external fixation in spite of the benefits described above, particularly as these can be a cause of great distress for patients.

1.3 Wound infection

Because they are acquired through health care intervention, pin site wound infections fall under the category of health care associated infections (HCAIs). Aside from their impact on the quality of life for patients and the financial cost to both patients and health services, HCAIs are also a significant feature of quality in health care organisations. In England, for example, much discussion is focused on the poor performance of NHS organisations and the escalating antibiotic resistance that is making some infections very difficult to treat, posing significant risk to patients (Department of Health, 2003; Dohmen, 2008). HCAIs affect approximately one-in-ten patients in NHS hospitals in the UK every year (Department of Health, 2003). They are defined as:

> *'Any infection to which an individual may be exposed or made susceptible to, or more susceptible to, where the risk of exposure or susceptibility is directly attributable to the provision of health by an NHS body.'*
> (Department of Health, 2006, p.37)

These are costly complications of health care that cause pain and discomfort, complex and delayed recovery, and sometimes death. Surveillance and prevention of infection are currently a major focus in all aspects of health care and are seen as a quality indicator when reviewing health care services (Department of Health, 2003; Petherick, 2006). Unlike other HCAIs there is little data regarding the true incidence of pin site infections due to the lack of a validated, reliable assessment tool and no formal requests for such information.

The colonisation of any wound with micro organisms is unavoidable. The body is host to a large number of bacteria and fungi that are part of the normal homeostatic mechanisms that support human life and are essential to many physiological processes. Harmful organisms, however, are also ever-present on the human body, in the atmosphere and in the environment. Organisms that are normally relatively harmless can become a problem when conventional preventive mechanisms fail. Ordinarily, the human immune system prevents these potential pathogens from entering or multiplying in the human body and causing harm.

Wound infection is the outcome of complex interactions between a host (the patient), a pathogen and the environment (EWMA, 2006) and is defined as *'the deposition of organisms in tissues and their subsequent growth and multiplication along with an associated tissue reaction'* (Ayliffe, 2001). This more than adequately describes the events leading to pin site infection.

Intact skin is the body's first line of defence against wound infection. Exposure of subcutaneous tissue as a result of a wound provides a moist, warm and nutrient-rich environment that is ideal for the colonisation and proliferation of the micro organisms which cause infection (Bowler, 2002). Bacteria cannot penetrate intact skin, but can enter easily if the skin is damaged (Wilson, 2000) or any incision is made, such as in the case of external fixator pins or wires. In addition, the chronic inflammatory reaction created by the presence of the pin or wire may also add to the susceptibility of pin sites to infection (Burny, 1984; Van der Borden et al., 2007).

Infection is the most common and feared complication in all wounds. It is painful and distressing for patients, is known to impair the process of wound healing, and is instrumental in delaying recovery and lengthening treatment. If it is allowed to progress, it may also lead to death through the spread of infection, septicaemia and organ failure.

In external fixation, as in other types of orthopaedic surgery, the major risk from the spread of infection is osteomyelitis (bone infection) which is extremely difficult to eradicate (Sims, 2001; Brady, 2006). Any superficial infection in pin sites may track down the percutaneous wound as far as the bone and medullary cavity, potentially leading to osteomyelitis (Ward, 1997; Green, 1984; Bibbo and Brueggeman 2010). This is an extremely severe complication and is costly in terms of the time, expertise and resources required to manage it. The condition often becomes chronic and prevents the bone from healing, leading to long term pain and disability. The prevention of infections which may lead to osteomyelitis is central to the care of all orthopaedic patients.

1.4 Infection in percutaneous wounds

The goal of wound care for surgical sites and other acute and chronic wounds is centred on the healing of the wound. In percutaneous wounds, however, the presence of an implant means that the wound cannot heal until the implant is removed. The main aim, therefore, is the prevention of infection. Although the duration of percutaneous wounds means that these do not meet the criteria for an acute wound, it is not possible to employ the principles of chronic wound care either because of the presence of the pin or wire and the associated foreign body reaction.

Pin sites fall into the category of wounds often referred to as percutaneous – 'through the skin' – a term applied to wounds where a device or material is left in situ to provide access to underlying structures, organs or tissue for the administration or removal of fluids. These 'insertion site' wounds do not fit in with definitions of either acute or chronic wounds because of both their long-term nature and the presence of 'foreign' material that prevents closure of the wound. The intention of wound care cannot be healing until the 'foreign' material can be removed at the end of treatment.

In a strategic document *Winning ways* (DH, 2003), the Chief Medical Officer (England) identified one of the factors driving the worrying increase in HCAIs in the UK as *'the need for indwelling devices that breach the normal defence mechanisms.'* This highlights the high risk nature of such interventions, which includes external fixator pins and wires along with other types of percutaneous implants and devices such as intravenous catheters, percutaneous feeding tubes, and suprapubic catheters as examples.

1.5 Pin and wire site wound infection

Each wire or pin penetrates skin and soft tissue. Percutaneous wounds are formed at the interface between the pin or wire and the skin at its site of penetration. These wounds are sometimes known as 'pin tracks', 'pin tracts' or 'percutaneous pin sites', although the majority of the literature uses the term 'pin sites'. For the sake of clarity the terms 'pin', 'pin site' and 'pin site wound' will be used from this point forward to include all types of skeletal pin or wire wounds. There is some debate in the orthopaedic care community about whether these phenomena are really wounds at all, or whether they would be better termed 'insertion sites'.

Like all percutaneous implants and devices, external fixator pins or wires penetrate the skin and remain as a 'foreign body' in the tissue for the duration of the treatment with the fixator. This provides a conduit through the soft tissues from the external environment to the bone. If an external fixator device and associated pins and wires are not applied correctly the device is likely to be unstable and infection may be inevitable. It is important, therefore, to acknowledge that any guidance regarding pin site wound care must take this into account. The apparatus may be in situ for many months; usually between four months and one year, depending on the aims of treatment. Where there is severe infection which affects bone it may be necessary to abandon the fixation device. This is a significant problem when the use of the fixator may have been a last resort, or the only remaining option in a long line of interventions aimed at avoiding amputation of a severely damaged, deformed or painful limb.

1.6 Former and existing evidence base and guidelines for pin site care

The complexities of performing adequately powered, randomised research in this area are highlighted by the fact that this is the third consensus meeting discussing this matter. The first such meeting took place ten years ago and led to the adoption of the British Consensus method (Lee-Smith et al., 2001) by many centres around the UK. It concluded that, due to the lack of evidence regarding an appropriate cleansing solution, showering the limb on a daily basis was a safe. It was also suggested that a dressing should apply a small amount of pressure and only be changed infrequently. Although these guidelines are commonly associated with daily showering, other recommendations, such as dressing the pin sites, have been adapted over the years by individual centres. Varying rates of pin site infections are reported, but these cannot be relied upon as different definitions of pin site infection are used. Overall though, the incidence appears to remain high.
In 2004 a consensus meeting took place in the USA. The resulting guidelines from the National Association of

Orthopaedic Nurses (NAON) were based on a systematic analysis of research literature and discussion by an expert panel (Baird-Holmes and Brown, 2005). They concluded that there was scanty evidence but made four recommendations:

1. pins located in areas with considerable soft tissue should be considered at greater risk of infection
2. at sites with mechanically stable bone-pin interfaces, pin site care should be done on a daily or weekly basis (after the first 48-72 hours)
3. chlorhexidine 2mg/ml solution may be the most effective cleansing solution for pin site care
4. patients and/or their families should be taught pin site care before discharge from the hospital. They should be required to demonstrate whatever care needs to be done and should be provided with written instructions that include the signs and symptoms of infection.

Following the publication of the method of pin site care influenced by that of the Russian Ilizarov Scientific Centre for Restorative Traumatology and Orthopaedics in Kurgan (Davies et al., 2005), many specialist limb reconstruction centres in the UK chose to follow the methods described. Although there are reported methodological flaws in their study, which excluded it from the Cochrane Review (Lethaby et al., 2008) the surgeons in Kurgan report a low incidence of infection. This adaptation of the Russian method advocated the weekly use of chlorhexidine in alcohol to cleanse the pin sites and therefore the Davis et al. (2005) work was clearly at odds with the recommendation made by the British Consensus method.

Despite the NAON recommendations echoing similarities with the work of Davies et al. (2005) the lack of Level 1 evidence has led to a disparity in pin site care practice amongst individual specialist limb reconstruction units, orthopaedic wards and the community environment. Patients are often taught one method in hospital only to be shown an alternative upon transfer or discharge, causing confusion and worry.

1.7 Conclusion

Infections in pin site wounds are a common problem which cause pain and distress for the patient and can threaten the success of the treatment. There is an urgent need to develop strategies for which there is sound evidence that these prevent or reduce the incidence of infection.

It is also essential that infection is recognised and treated as quickly as possible to prevent its spread and the subsequent development of a chronic problem, especially given the devastating implications of the development of osteomyelitis.

Undertaking research in this field, however, is problematic because of the lack of a reliable and valid outcome measure and because of the large number of variables involved in this area of practice.

It takes time to resolve these complex issues and, in the meantime, it is important to provide up-to-date guidance for practitioners based on the limited evidence.

2

The consensus

2.1 Introduction

The aim of the project described in this report was to establish a consensus of opinion and offer guidance regarding the best methods of wound care aimed at preventing infection in external fixator pin site wounds. The ultimate aim is the provision of high-quality care and a seamless transition between the hospital and community environments.

Consensus approaches are designed to assist in developing clinical practice guidelines in areas of practice where research evidence is either scarce or of poor quality and does not provide sufficient certainty about the best approach to a given clinical need to enable effective decision making. Such an approach provides structure which enables experts to develop agreed guidelines based on in-depth knowledge and experience of the subject.

Clinical guidelines are an important aspect of clinical decision making in health care, and are increasingly relied upon by clinicians as a way of reducing variability in care and improving outcomes (Rycroft-Malone, 2002). In spite of the drive for evidence-based practice and a focus on systematic reviews of the evidence in directing practice, the lack of a strong evidence base constructed through well conducted randomised controlled trials is problematic when developing clinical guidelines for many aspects of care. Pin site care is one such area of practice where research has only been conducted to a limited degree and the quality of such research is questionable.

Consensus has been described as *'general agreement or collective opinion; the judgement arrived at by most of those concerned'* (MeSH, 2011). Using a consensus aims to give all the delegates the power to have their voice heard and enables them to listen to and consider each other's view points on individual and collective clinical practice. Although consensus is seen as the 'lowest' form of evidence – in other words, Level 4 (SIGN, 2008) – it is also considered necessary for the development of practice guidelines where there is a lack of high quality studies and meta-analyses. In spite of its lack of empirical basis it can be argued that guidelines based on expert opinion and consensus are clinically important and of potential benefit to the patient. It is important to consider the results of this consensus alongside the findings of the Cochrane review (Lethaby et al., 2008) and further evidence as it emerges.

A variety of methods are available through which to achieve consensus, including the Delphi technique and the nominal group technique (Nair et al., 2011). For the consensus reported here, a two-stage approach was adopted to dilute any impartiality, as consensus meetings have been criticised as being liable to bias (SIGN, 2008). The two phases involved the development of statements by delegates on the day of the meeting, followed by an opportunity to express an anonymous level of agreement or disagreement with the formulated statements after the event via an online survey.

2.2 The consensus meeting

The first stage of the consensus was a one day face-to-face meeting, which took place on 22 November 2010, at which delegates came together with the intention of developing draft statements that reflected their consensus on the most appropriate practice in pin site wound care. The second stage involved an online survey in which attendees were asked to rate their agreement with the statements developed at the meeting.

To ensure as robust an approach as possible, specialist practitioners working in the field of limb reconstruction and external fixation were identified and representatives from the main centres which use external fixation from around the UK were approached. This included a number of nurse specialists and two consultant orthopaedic surgeons specialising in external fixation. There was representation from paediatric and adult orthopaedic units as well as nurses based in trauma centres, district general hospitals and ward and outpatient settings and a representative from the private sector. Delegates were invited individually and via an announcement in *Bare Bones*, the RCN Society of Orthopaedic and Trauma Nursing newsletter. Practitioners who practice pin site care on a regular basis were asked to nominate themselves for the consensus. It was important to ensure that any recommendations reflected the realities of daily practice in this area (Farmer, 1993; SIGN, 2008). Patient involvement was also sought, but due to unforeseen

circumstances a patient representative was unable to attend on the day.

The initial developmental stage was consultative in nature. Delegates were asked, in groups, to develop statements relating to eight main aspects of pin site care. There are numerous other factors which may be relevant to the development and prevention of pin site infection such as surgical technique, compliance with wound care, patient characteristics and behaviour. However, there was a need to achieve a consensus for those factors most likely to impact on the incidence of infection whilst avoiding overcomplicating the discussion at the meeting. Hence, these eight factors were chosen because of their inclusion within the Cochrane review (Lethaby et al., 2008):

- cleansing of the wound – solution and method
- cleansing of the wound – frequency and timing
- whether to dress the wound
- type of dressing
- compression
- crusts and scabs
- bathing and showering
- recognising infection.

At the start of the conference each of the eight topic areas were covered briefly in a 10-minute presentation to all delegates. The individuals chosen to make the presentations were clinicians and researchers with specific expertise or knowledge in relation to the topic area. After each presentation delegates were given the opportunity to ask questions of the presenter and make comments.

Summaries of each of the presentations are given below.

Presentation 1: The best solution for pin site care

Historically, many solutions have been used for pin site care including water, saline, hydrogen peroxide, povidone iodine, alcohol and alcoholic solution of chlorhexidine. Much has been written about pin site care but there is only limited evidence for it. Pin site care is difficult to research as there are so many variables in the process from the time of insertion, to care on the ward and post discharge management. Patients also have different risk factors and not all pin sites are the same. For example, half pins in the femur are considered to be at greater risk of infection than the sites of wires in the tibia.

In order to look at the effectiveness of the different solutions, each one needs to be considered individually. Water, be it boiled and cooled or from a shower, provides general hygiene but has no antibacterial action. Saline has a similar effect to water. Hydrogen peroxide gives the impression of being very effective as it is suggested that it kills gram positive bacteria and debrides the wound. Conversely, it also damages good tissue which potentially increases scarring. Povidone iodine has an antibacterial affect but becomes inactive when in contact with blood. The evidence currently available supports the use of alcohol or alcoholic chlorhexidine solution for pin site management.

Rose Davies, Orthopaedic Nurse Specialist, Alder Hey Childrens NHS Foundation Trust, Liverpool

Presentation 2: Pin site care – how often?

The frequency of pin site care is scantily evaluated, as is the length of time a theatre dressing should be left undisturbed to best prevent pin site infections during treatment with external fixation. The most commonly recommended frequency of pin site care varies from every four hours immediately postoperatively, to once a week. However, the most common recommendation is daily pin site care. In the available literature there are several different recommendations for when the first post-operative pin site care should be carried out, ranging from four hours to one week postoperatively.

One randomised study has been performed (W-Dahl et al., 2003) evaluating daily versus weekly pin site care without finding any difference regarding pin site infection, use of antibiotics and other complications. In a cohort study (W-Dahl and Toksvig-Larsen, 2009) patients had undisturbed theatre dressings during the first postoperative week. The results indicated that leaving the theatre dressing undisturbed during the first postoperative week is beneficial. Increased use of antibiotics during treatment with external fixation was shown to be significant in patients with disturbed theatre dressings during the first week. Few patients with undisturbed theatre dressings had positive bacterial cultures one week post-operatively compared to most of the patients with disturbed theatre dressings. This suggests that leaving the theatre dressing undisturbed decreased the risk of wound contamination.

Studying the literature regarding risk of surgical site infection and post operative care in general gained no additional information. The few studies performed are insufficient to provide evidence of how often pin site care should be carried out to best prevent pin site infections.

Annette W-Dahl, Researcher, The Swedish Knee Arthroplasty Register, Department of Orthopaedics, Lund University Hospital, Sweden

Presentation 3: To dress or not to dress

To date, there is a lack of evidence available to demonstrate whether dressings should or should not be used in routine pin site care. The Cochrane review (Lethaby et al., 2008) supports this, suggesting that there are no studies that specifically focus on whether or not to use dressings. There are a handful of studies which involve dressings but these usually set out to measure the entire pin site care regime rather than this specific aspect. A study of note would be Davies et al. (2005) which suggested that pin site dressings should be used at all times and that this, along with several other actions, reduced the incidence of infection in the study centre in Liverpool.

These methods are supported by the limb reconstruction centres in both Sheffield and Leeds. Egol et al. (2006) end their controversial paper with the statement 'we do not recommend additional wound care beyond the use of dry, sterile dressings for pin-track care after external fixation for the treatment of distal radial fractures'. This study, however, was not a direct comparison between dressed pin sites and those left open to the environment.

In the earlier British Consensus, Lee-Smith et al. (2001) advocated the use of dressings and advised that a dressing that applies a small amount of pressure to prevent tenting of the skin along the pin should be used and kept continuously in place. At that point, as now, quality evidence was sparse and this conclusion was mostly drawn from the experiences of those involved. Perhaps the most constructive evidence can be drawn, from a more general source in the EPIC 2 guidelines (Pratt et al., 2007) which concern the care of indwelling peripheral and central venous access devices. Interesting parallels have been drawn between the care of these percutaneous insertion sites and pin sites, and substantial evidence exists to show that dressings have an extensive role to play in the prevention of bacterial ingress. It is clear from looking at the available evidence that more research and analysis is required into this specific area of pin site care, but the general consensus between clinicians who specialise in this area is that pin sites should remain dressed at all times throughout the entirety of treatment.

Hannah Pugh, Trauma Sister, University College London Hospitals NHS Foundation Trust

Presentation 4: Dressing type

Although four pieces of research were eligible to be included in the Lethaby et al. (2008) Cochrane review (Egol et al., 2006; Grant et al., 2005; Camillo and Bongiovanni, 2008; and Patterson, 2005), no conclusions about dressings could be drawn due to heterogeneity and methodological problems with the studies.

Gauze is frequently used as a pin site dressing due to it being inexpensive and readily available. It may, however, shed fibres into the pin site. Gauze absorbs exudate but is easily saturated, so if not changed allows rapid bacterial ingress. Staphylococcus aureus, known to be the main cause of pin site infection (Davies et al., 2005) has cell dimensions smaller than the pores in gauze (Gunning, 2009). When exudate dries in gauze it can become hard and can lead to irritation, inflammation and pressure ulceration.

Different types of foam dressing exist, which vary in cost and mode of action. These all have the benefit of being non-shedding and comfortable for the patient if compression is applied, and are effective at removing exudate away from the surface of the skin. Triple action foams enable excess exudate to evaporate in addition to possessing an upper layer impermeable to bacteria. However, these will still become saturated in the presence of excessive exudate.

Tulle gras dressings structurally comprise a gauze cloth impregnated with soft paraffin for non-traumatic removal or antiseptics, such as chlorhexidine or povidone iodine, for the prevention or management of infection. Non-absorbent, these therefore require a secondary dressing. In the author's experience with non-medicated types the pin sites become macerated and wet, predisposing the wound to infection.

Silver-coated dressings are increasingly used due to their known antimicrobial action. They can remain in situ depending on the manufacturer and type for up to seven days. As with other types of dressing, sensitivity to the antimicrobial agent may occur and future resistant organisms may be an issue. Dressings must also be removed should the patient require an MRI scan, leading to further expense.

The types of dressing available for use are constantly evolving, not only in the development of each individual type, but also with new products emerging. Since the earlier consensus meeting took place, new silver-impregnated dressings specifically designed for use with external fixators have become available in the US. The importance of continued research which includes a cost analysis to assess such products is clearly of prime importance.

Anna Timms, External Fixator CNS, Barts and the London NHS Trust

Presentation 5: The role of crusts in fine wire fixator pin site care

Evidence-based pin site care includes keeping pin sites covered at all times and cleaning weekly with alcoholic chlorhexidine. Doubt has remained over how to deal with the dried exudate – crusts – which often form at the pin site during treatment with fine wire fixators. In a study at Leeds Hospitals two groups being treated with a fine fixator were looked at. Both groups had identical pin site care, except that in the first group adherent crusts were removed, while in the second group crusts were retained. The rate of pin site infection and severity of such infections were significantly reduced in the group in which crusts were retained. Adherent crusts form a physical barrier to the development of pin site infection. It is possible that such crusts may also form an immunological barrier to infection, but more work is needed this area.

Simon Britten, Consultant Trauma and Orthopaedic Surgeon, Leeds Teaching Hospitals NHS Trust

Presentation 6: The role of compression in pin site care

Dressings, when used, need to be held in place by something. If a bung, clip or bandage is used this also has the added benefit of applying slight compression to the pin site; this compression cannot be achieved by using adhesive tape. Compression achieves a number of things; it reduces the amount of movement at the skin/pin interface when the patient mobilises or uses the affected limb and also helps to prevent the tenting of pin sites, which may occur if distraction of the fixator is taking place.

During application of the fixator there is bleeding at the pin/wire insertion sites, and this sometimes causes small haematomas which can be a focus for infection. Peri-operative compression prevents the haematoma formation.

Maria Vincent, Nurse Specialist Limb Reconstruction, Sheffield Teaching Hospitals NHS Foundation Trust

Presentation 7: Showering/bathing with an external fixator in situ

There is little or no published evidence regarding bathing and showering practices in circular frame treatment. Practice is often implied through local pin site protocols and frequently conflicts between different units and consultant preference. However, there is general evidence to suggest that a patient's skin is a major source of bacterial infection, contributing to post-operative wound infections (Florman and Nichols, 2007). It would seem pertinent, therefore, to ensure the affected limb is kept clean. Debate about the choice of method for keeping the limb clean is focused on bathing versus showering. An important consideration when bathing is that it loosens skin squamous cells containing bacteria (Larson et al., 2004), thus submerging the limb in stagnant bath water may increase the risk of pin site infection.

Showering is a preferable alternative, but is affected by aspects of patient safety and the practicalities of getting in/out of the shower. Other factors that affect cleaning choice include: other wounds or injuries, who changes the dressings (patient, relative or community nurse) and lastly, patient compliance. In addition to cleansing, there is the issue of skin moisturising, which is deemed beneficial to skin health, reducing microbial dispersion.

Discussion points surround how the limb should be washed, how often it should be washed, whether cleaning does actually impact upon risk of infection, and how health care professionals can influence patient lifestyle.

Claire Longhorn, Nurse Specialist, Limb Reconstruction Unit, University Hospitals Bristol NHS Foundation Trust

Presentation 8: Recognising pin site infection

The diagnosis of wound infection is problematic in all wounds, but it is particularly problematic in percutaneous wounds such as pin and wire sites because there is no valid diagnostic tool. A wound swab is not useful in diagnosing

pin site infection because it can only inform the clinician on what organisms are growing on the area of skin the swab was taken from, and this is not necessarily the organism causing an infection. Wound biopsy is problematic and unethical as it potentially leads to further infection and pain for the patient.

Existing tools (see Checketts et al., 1993; Dahl, 1994; Patterson, 2005; Saleh and Scott, 1992; Clint et al., 2009) for identifying pin site infection are not shown to be valid or reliable since these cannot be tested for diagnostic accuracy, as there is no gold standard diagnostic test against which to compare it. These existing tools are mostly based on health professional generated data and not patient-orientated data about symptoms.

A healthy or 'static' pin site should resemble a piercing. In a recent study (Santy-Tomlinson et al., 2011) 16 interviews were conducted with patients who had recently experienced a pin site infection. Patients were asked what 'made them suspect' they had an infection. Three pin site states were described: calm, irritated and infected. The respondents experienced some or all of the following when infection was present: increasing severe pain in and around the pin site, sudden inability to weight-bear, spreading redness, spreading swelling, increasing discharge (sometimes purulent) and general symptoms which included feeling unwell, feverishness and loss of appetite. This suggests that these are the most important symptoms which denote infection but further work is required in ascertaining the specificity of such symptoms.

Julie Santy-Tomlinson, Senior Lecturer, The University of Hull Faculty of Health and Social Care

Following the presentations, delegates were divided into groups and asked to discuss each topic area presented, producing a statement for each that they all agreed with. To avoid any potential bias the presenters were not involved in these group discussions.

The delegates were then divided into larger groups, each taking a copy of their produced statements into the second group. At this point they were all asked to discuss their statements again, coming up with a combined statement for each factor that they all agreed with. These statements were written up and collated.

2.3 The survey

In the weeks following the meeting the statements were posted to an online survey site. Delegates were invited to rate their agreement with each statement as 'strongly agree', 'agree', 'disagree', 'strongly disagree' or 'not sure'. The results were then analysed using the survey site's integral software (www.surveymonkey.com).

The statements included in this second stage reflect how they were written by delegate groups at the end of the consensus meeting. The statements can be considered to apply to all wounds surrounding skeletal wires or pins. It is important to note, however, that halo traction pins were not considered as there may be separate issues which need to be considered for these.

The participants in the survey were all of the delegates who attended the consensus meeting. They were asked to consider each statement and rate their agreement or preference.

3

Results

This section contains the results of the consensus, bringing together the statements produced at the end of the consensus meeting and the results of the survey in which participants expressed their agreement with those statements. Of the 34 delegates and speakers attending the conference, 30 responded to the questionnaire with one questionnaire missing some data.

3.1 Pin/wire cleaning

The cleansing of pin sites is an important consideration because general and specialist wound care literature suggests that the antimicrobial activity of cleansing solutions may be beneficial in preventing infection (Timms and Pugh, 2010; Atiyeh et al., 2009; Khan and Naqvi, 2006). Even so, current evidence which demonstrates that this is true in pin sites is scanty. The available literature in both pin site care and wound care generally suggests that antimicrobial activity is potentially useful in both components of the current most popular solution of choice – alcohol and chlorhexidine – suggesting that alcohol acts as a drying agent and chlorhexidine acts as a long acting source of antimicrobial activity (Atiyeh et al., 2009; Timms and Pugh, 2010).

Tables 1 and 2 show the statements developed by delegates at the consensus conference relating to pin and wire cleaning, and the results of the questionnaire completed following the conference.

This was an area in which there was considerable agreement at the consensus meeting. In the survey, there was 73.3 per cent agreement that chlorhexidine should be used to clean pins and wires. Greater agreement (90 per cent) was indicated for cleansing pin sites with a solution of chlorhexidine and alcohol. The difference between these two responses indicates improved agreement when the two substances are combined. There was 96.7 per cent agreement that cleansing should be performed using a non-shedding material and 93.3 per cent agreement that the solution of choice should be saline if chlorhexidine in alcohol is contraindicated (for example because of a skin condition, in the presence of open wounds surrounding half pins or wires or known/suspected sensitivity/allergy to the alcohol/chlorhexidine solution/presence of dermatitis).

The concentration of chlorhexidine in alcohol was not fully discussed. However, it was reported in conversation that some delegates used two per cent w/v chlorhexidine gluconate in alcohol in practice whereas others used 0.5 per cent w/v chlorhexidine gluconate in alcohol. This is an area for future clarification, as higher concentrations are more effective in destroying the cytoplasm of the bacterial cell. Lboutounne et al. (2002) showed that the lowest effective concentration needs to be used to balance its toxicities with its benefits.

Table 1 – Results of questionnaire regarding the method of cleansing pin sites

	Strongly agree	Agree	Disagree	Strongly disagree	Not sure	Response count
1a. Chlorhexidine should be used to clean pin sites.	40.0% (12)	33.3% (10)	13.3% (4)	6.7% (2)	6.7% (2)	30
1b. Pin/wire sites should be cleaned with a solution of chlorhexidine in alcohol (for example, Hydrex or similar) unless contraindicated by skin condition, open wounds or known or suspected sensitivity.	76.7% (23)	13.3% (3)	3.3% (1)	0.0% (0)	6.7% (2)	30
1c. If chlorhexidine in alcohol is contraindicated saline should be used.	70.0% (21)	23.3% (7)	6.7% (2)	0.0% (0)	0.0% (0)	30
1d. Cleansing should be performed using a non-shedding cleansing material (not standard gauze or cotton wool).	80.0% (24)	16.7% (5)	3.3% (1)	0.0% (0)	0.0% (0)	30

Should there be open wounds surrounding a half-pin or wire, normal saline is recommended as a cleansing agent combined with an appropriate dressing to encourage granulation, remove slough and excess exudate and provide protection from particle and bacterial ingress. Significant numbers of patients may be allergic or sensitive to chlorhexidine gluconate in alcohol, which can result in an intense urticarial reaction (see Figure 6) and potential anaphylaxis. Care should be taken to ensure it is not used in cases of known or suspected sensitivity. If a reaction occurs, normal saline should be used to cleanse the pin sites.

Figure 6 – Reaction to chlorhexidine gluconate solution in alcohol.

Table 2 – Results of questionnaire regarding the timing and frequency of pin site care

	Strongly agree	Agree	Disagree	Strongly disagree	Not sure	Response count
2a. Pin/wires sites should be cleansed and dressed every seven days.	56.7% (19)	26.7% (6)	10.0% (3)	3.3% (1)	3.3% (1)	30
2b. Pin site care should be performed daily.	0.0% (0)	10.0% (3)	26.7% (8)	56.7% (17)	6.7% (2)	30
2c. If there is copious discharge and the dressing is wet, it should be changed earlier.	90.0% (27)	10.0% (3)	0.0% (0)	0.0% (0)	0.0% (0)	30
2d. If infection is suspected dressings should be conducted more frequently.	80.0% (24)	20.0% (6)	0.0% (0)	0.0% (0)	0.0% (0)	30
2e. The first post-operative dressing should be conducted at between one to three days postoperatively.	23.3% (7)	43.3% (13)	20.0% (6)	6.7% (2)	6.7% (2)	30
2f. The first post-operative dressing should be conducted after 48 hours.	20.0% (6)	30.0% (9)	20.0% (6)	13.3% (4)	16.7% (5)	30
2g. The first postoperative dressing should be conducted after 48 to 72 hours.	20.7% (6)	27.6% (8)	20.7% (6)	13.8% (4)	17.2% (5)	30
2h. Pin/wire site care should be performed 48 hours post-operatively, then weekly.	23.3% (7)	33.3% (10)	23.3% (7)	10.0% (3)	10.0% (3)	30

3.2. Cleaning timing and frequency

The majority of respondents (83.4 per cent) agreed that pin site care should be performed every seven days. It was the opinion of the group that pin site care should not be performed daily (83.4 per cent disagreement with statement). It was agreed (100 per cent) that if an infection is suspected, or should the dressings be saturated (100 per cent), the pin sites should be cleansed and dressed more frequently. An exact time scale for this was not described, but in discussion it was suggested that the dressings should be changed as soon as these become saturated with exudate. This will vary considerably between individual pin sites and patients.

The first postoperative cleansing and dressing timings were not considered by all groups as they were not asked to do this. This has been added here for completeness of representation of discussion, as some of the groups identified this without being asked to do so. A number of differently worded statements were included in the questionnaire to reflect the statements generated. There was 66.6 per cent agreement that the first post-operative dressings should be conducted at between one to three days postoperatively, and

less agreement that the first dressing should be conducted after 48 hours (30 per cent), 48-72 hours (48.3 per cent), and performed 48 hours postoperatively and then weekly (56.6 per cent). In these cases there were a considerable number of responses that suggested participants were not sure which was the best approach. This may reflect the lack of evidence on this issue as well as the unintended consideration of this aspect of care in the consensus. Hence, a lack of consensus is reflected here.

3.3 Dressing

Two factors were examined with regards to dressings. Firstly, whether to cover the wound with dressings at all and, secondly, what type of dressing should be used. Most literature relating to wound dressing generally suggests that covering wounds is a logical approach to reducing contamination of the wound and preventing particles of dust etc. from entering the wound as well as soaking up any moisture and exudate (Timms and Pugh, 2010). The results of the consensus in this respect are shown in Table 3. Seventy six per cent agreed that wounds should be dressed, but a number of respondents disagreed (10 per cent).

Equally, there was some disagreement (56.6 per cent) with pin site wounds being left exposed (without any dressing) if they were dry or comfortable. There was 96.7 per cent agreement that the dressing must be constructed of non-shedding material. Views on whether the pin site should be dressed with chlorhexidine impregnated gauze was divided, with a stronger tendency towards disagreement with this statement (30 per cent) with some agreement (strongly agree and agree 36.7 per cent) and 13 per cent of participants unsure.

There was also a lack of agreement about whether a foam dressing should be used. Equally, there was no consensus about whether a dry gauze dressing should be used. This is likely to reflect the lack of evidence on this topic, and the fact that common practice is different around the UK in this respect. There was, however, strong agreement that the dressing material should be able to keep excess moisture and exudate away from the wound (86.7 per cent).

It was agreed that pin site dressings should be changed once weekly unless there is an infection or copious discharge/ soaked dressing, reflecting the work of W-Dahl et al. (2003). In such cases the dressings should be changed when

Table 3 – Results of questionnaire regarding the wound dressing practice including timing and type of dressing

	Strongly agree	Agree	Disagree	Strongly disagree	Not sure	Response count
3a. Pin/wire sites should be covered with a (initially sterile) dressing at all times.	63.3% (19)	13.3% (4)	6.7% (2)	3.3% (1)	13.3% (4)	30
3b. The dressing must be constructed of non-shedding material.	76.7% (23)	20.0% (6)	0.0% (0)	0.0% (0)	3.3% (1)	30
3c. Pin/wire sites should be dressed with chlorhexidine solution impregnated gauze.	26.7% (8)	10.0% (3)	30.0% (9)	20.0% (6)	13.0% (4)	30
3d. Pin sites should be dressed with a foam dressing.	26.7% (8)	16.7% (5)	26.7% (8)	6.7% (2)	23.3% (7)	30
3e. Pin/wire sites should be dressed with a material that keeps excess moisture and exudate away from the wound.	46.7% (14)	40.0% (12)	10.0% (3)	0.0% (0)	3.3% (1)	30
3f. Dress with a chlorhexidine dressing or (if there is exudate) a foam dressing.	3.4% (1)	34.5% (10)	31.0% (9)	10.3% (3)	20.7% (6)	29 (*)
3g. Pin sites should be dressed with a 'triple layer' foam dressing.	20.0% (6)	23.3.% (7)	20.0% (6)	10.0% (3)	26.7% (8)	30
3h. Pin sites should be dressed with dry gauze.	6.9% (2)	27.6% (8)	31.0% (9)	31.0% (9)	3.4% (1)	29 (*)
3i. Dressings should only be used if the wound is oozing.	13.8% (4)	17.2% (5)	13.8% (4)	55.2% (16)	0.0% (0)	29 (*)
3j. Pin site wounds can be left exposed (without any dressing) if dry/comfortable.	20.0% (6)	16.7% (5)	13.3% (4)	43.3% (13)	6.7% (2)	30

*one response missing

saturated. This was in stark contrast to the previous consensus (Lee-Smith et al., 2001) which advocated daily showering. There was no consensus about the time at which the postoperative dressing should be removed; this was not discussed by all the delegates who attended and would be an area for future research.

As stated in the most recent Cochrane review (Lethaby et al., 2008), there are no studies comparing pin site dressings with no dressings. However, delegates agreed that pin sites should be covered at all times in order to prevent the ingress of bacteria, in line with the recommendations for the prevention of infection in percutaneous insertion sites.

Soiled dressings provide useful information about the exudate and the suitability of the dressing for the wound. Ultimately, the practitioner should review any saturated dressings and if necessary change to a more appropriate dressing in line with local guidelines.

3.4 Crusts and scabs

In a statement which defined crusts as dried exudate (4e), 90 per cent agreed that only the crusting above the level of the wound should be gently removed when cleansing. There was also agreement (73.4 per cent) that dried exudate sealing the pin site should be left in place unless there is evidence of infection, despite concern about the likely effect of the skin adhering to the pin. There was almost universal agreement amongst the delegates (96.6 per cent) that if there is suspected or confirmed infection then crusts/plugs should be gently removed during cleansing.

There remains some confusion over the nature of crusts, plugs and scabs and how they are defined and described, with there also being agreement that crusts should be removed but scabs left in situ (66.7 per cent) and also that crusts should be removed gently during cleansing (62.6 per cent). This clearly indicates the need for work to define these phenomena in more detail and for there to be further investigation of their role or otherwise in preventing or causing infection.

Table 4 – Results of questionnaire regarding the management of crusts and scabs

	Strongly agree	Agree	Disagree	Strongly disagree	Not sure	Response count
4a. Crusts/plugs should be left in situ.	44.8% (13)	10.3% (3)	13.8% (4)	13.8% (4)	17.2% (5)	29 (*)
4b. Crusts should be removed but scabs left in situ.	26.7% (8)	40.0% (12)	13.3% (4)	16.7% (5)	3.3% (1)	30
4c. Crusts should be removed gently during routine cleaning.	17.2% (5)	44.8% (13)	6.9% (2)	31.0% (9)	0.0% (0)	29 (*)
4d. If there is suspected or confirmed infection, crusts/plugs should be gently removed during cleansing.	53.3% (16)	43.3% (13)	0.0% (0)	0.0% (0)	3.3% (1)	30
4e. Dried exudate (crusts) above the level of the wound should be gently removed when cleaning.	40.0% (12)	50.0% (15)	6.7% (2)	3.3% (1)	0.0% (0)	30
4f. Dried exudate sealing the pin site should be left in place unless there is evidence of infection.	46.7% (14)	26.7% (8)	16.7% (5)	3.3% (1)	6.7% (2)	30
4g. Crusts should be left in situ but dry scabs should be removed.	3.4% (1)	20.7% (6)	34.5% (10)	34.5% (10)	6.9% (2)	29 (*)

*one response missing

3.5 Compression

Movement at the skin/pin interface when the wires/pins transfix a large area of soft tissue or when the fixation is near to a joint contributes to irritation and the patient's discomfort (see Paley and Jackson, 1985) and it is suggested that compression around the pin sites reduces this movement.

Skin tenting is a complication that can occur when the patient is adjusting the fixator, or when the initial swelling subsides as the wire/pin is lying in tension against the skin as described by Hart (1994). The patient identifies the tenting by increased tenderness in the skin surrounding the pin site. The traditional method for relieving the tenting is by releasing the skin with a scalpel using local anaesthetic. Compression helps prevent tenting of the skin by helping the wire to 'cheese wire' through the soft tissues.

Compression can be achieved by a variety of methods; clips, bungs or bandages. Many units have developed their own practice preferences. Clips (see Figure 7) are available which fit onto the pin or wire, and are specifically designed to be placed on top of the dressing to provide gentle compression around the pin and prevent the tissue from tenting as well as holding the dressing in place. These can be removed and replaced easily but are considered an expensive option as they often become loose with wear and need replacing regularly. They also are very stiff and do not accommodate intermittent soft tissue swelling, so may put the patient at risk of pressure necrosis if things become too tight. If they are used with foam dressings instead of simple gauze the risk of pressure damage may be lessened.

Bungs from sterile 20ml syringes are a cheap and easily available option; they are quite flexible, allowing for soft tissue swelling. Bungs must be applied onto the wire/pin in theatre whilst the fixator is being applied. They can be moved up and down the wire to allow pin site care, but they cannot be replaced. Bungs need to be cleaned as part of the wound care process and potentially act as a source of infection if they begin to disintegrate or dirt and bacteria are allowed to build up on them.

Bandages applied in a figure of eight around the pin sites can also be used. These are quite difficult to apply in circular frames as there is not always enough space between the ring and the skin to accommodate a bandage.

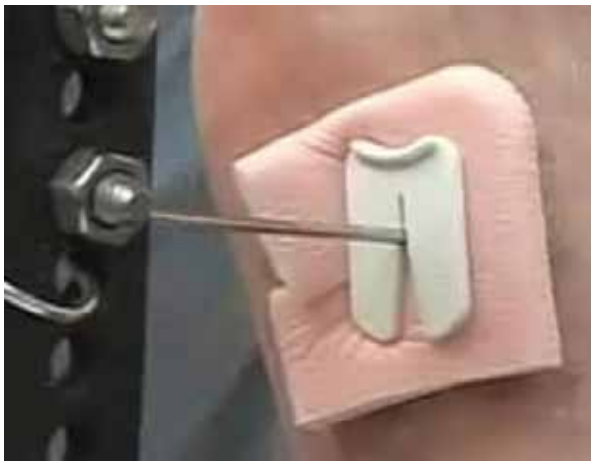
There is some debate about whether there is true compression with a bung or a clip and this matter has not been studied. In the example shown in Figure 7, a foam dressing has been secured using a clip available from one of the fixator manufacturers.

There was agreement (96.7 per cent) that compression should be applied around the pin or wire immediately post-operatively, as well as agreement (86.7 per cent) that any dressing should be pushed down with a bung or clip. It was also agreed that any compression should be light compression (90 per cent) although the meaning of light compression may need further definition. There was agreement that the compression should be maintained throughout the treatment (70 per cent) with less agreement (53.3 per cent) that compression should be applied for 48 hours post-operatively. This possibly reflects a view that compression should, in fact, be maintained for longer than this as reflected in the previous statement.

Table 5 – Results of questionnaire relating to compression

	Strongly agree	Agree	Disagree	Strongly disagree	Not sure	Response count
5a. Any dressing should be pushed down with a bung or clip.	50.0% (15)	36.7% (11)	10.0% (3)	3.3% (1)	0.0% (0)	30
5b. Compression should be applied around the pin or wire immediately post operatively.	66.7% (20)	30.0% (9)	0.0% (0)	0.0% (0)	3.3% (1)	30
5c. Any compression applied should be light compression.	56.7% (17)	33.3% (10)	3.3% (1)	0.0% (0)	6.7% (2)	30
5d. Compression should be maintained around the pin/wire site throughout the treatment.	43.3% (13)	26.7% (8)	13.3% (4)	6.7% (2)	10.0% (3)	30
5e. Compression should be applied for 48 hours post-operatively.	23.3% (7)	30.0% (9)	20.0% (6)	16.7% (5)	10.0% (3)	30

Figure 7 – Compression using a clip



3.6 Bathing and showering

There was agreement (70 per cent) that bathing should not be allowed, whilst there was 75.8 per cent agreement that showering should be allowed but not bathing. Just over 86 per cent of respondents agreed that showering should be allowed immediately prior to dressing changes but otherwise the dressing should be kept dry and, equally, that showering should be allowed on the day of dressing changes (90 per cent). There was also agreement that the frame and skin should be dried following showering and the pin and wires cleaned and dressed (96.7 per cent). There was agreement (90 per cent) that emollient should be applied to the surrounding skin. There is some debate about the use of hydrotherapy as well as whether bathing may or may not be suitable for children. Bathing for children and hydrotherapy for all patients were not considered in detail in this consensus. These, along with the other issues raised here, are in need of deeper exploration.

Table 6 – Results of questionnaire regarding bathing and showering

	Strongly agree	Agree	Disagree	Strongly disagree	Not sure	Response count
6a. Bathing should not be permitted.	60.0% (18)	10.0% (3)	13.3% (4)	16.7% (5)	0.0% (0)	30
6b. Showering should be allowed but not bathing.	51.7% (15)	24.1% (7)	10.3% (3)	10.3% (3)	3.4% (1)	29 (*)
6c. Showering should be allowed immediately prior to dressing changes otherwise the dressing should be kept dry.	60.0% (18)	26.7% (8)	6.7% (2)	6.7% (2)	0.0% (0)	30
6d. Showering should be allowed on the day of dressing changes.	66.7% (20)	23.3% (7)	0.0% (0)	6.7% (2)	3.3% (1)	30
6e. Once showered the frame and skin should be dried, then the pin/wire sites cleaned/dressed.	70.0% (21)	26.7% (8)	0.0% (0)	3.3% (1)	0.0% (0)	30
6f. Emollient (non-scented moisturiser) can be applied to the surrounding skin, avoiding a margin around the pin/wires.	56.7% (17)	33.3% (10)	0.0% (0)	6.7% (2)	3.3% (1)	30

*one response missing

3.7 Recognising infection

Table 7 – Results of questionnaire regarding the recognition of infection

	Strongly agree	Agree	Disagree	Strongly disagree	Not sure	Response count
7a. Infection should be diagnosed using patient-reported signs and symptoms.	60.0% (18)	36.7% (11)	0.0% (0)	0.0% (0)	3.3% (1)	30
7b. Patient perceptions of the presence of infection should be taken seriously.	83.3% (25)	16.7% (5)	0.0% (0)	0.0% (0)	0.0% (0)	30
7c. Please indicate whether you think the following symptoms indicate pin/wire site infection (answer yes or no)						
	Yes		NO		Response count	
i) Frank drainage of pus (but not in all cases.)	96.7% (29)		3.3% (1)		30	
ii) Increasing pain at the pin/wire site.	100.0% (26)		0.0% (0)		30	
iii) Decreased movement/mobility/weight bearing.	90.0% (27)		10.0% (3)		30	
iv) Spreading erythema (redness).	100.0% (30)		0.0% (0)		30	
v) Increased swelling.	80.0% (24)		20% (6)		30	
vi) Increasing discharge (although there may be none).	80.0% (24)		20.0% (6)		30	

There was strong agreement that infection should be diagnosed using patient reported signs and symptoms (96.7 per cent) and that patient perceptions of the presence of infection should be taken seriously (100 per cent) as patients are most likely to be the first to notice any subtle change in symptoms. In relation to the symptoms of infection, there was strongest agreement that frank drainage of pus, increasing pain at the pin/wire site and decreased movement, mobility or weight bearing along with spreading redness were highly indicative of infection. There was slightly less agreement that increased swelling and discharge also represented infection. It is essential that patients are given detailed information about how to identify infection.

4

Recommendations for practice

The following recommendations for practice are offered in relation to those issues on which some degree of consensus was achieved:

- pin sites should be cleaned with a solution of chlorhexidine in alcohol
- if chlorhexidine in alcohol is contraindicated (due to known sensitivity, pre-existing skin conditions of psoriasis and eczema or skin reaction) saline should be used for cleansing
- cleansing should be performed using non-shedding material (not standard gauze or cotton wool)
- pin sites should be cleaned and dressed every seven days unless there is copious discharge or the dressing is wet (when it should be changed earlier as soon as these are noted)
- if infection is suspected dressing changes should be conducted more frequently
- pin sites should be covered with a (initially) sterile dressing at all times
- this dressing must be constructed of non-shedding material which keeps moisture and exudate away from the wound
- light compression should be applied to the wound using a bung, clip or other device immediately postoperatively and maintained around the pin or wire throughout treatment
- patients with pin sites should not be allowed to bathe but may shower immediately prior to dressing changes (which should normally be once weekly) otherwise the dressing should be kept dry
- infection should be diagnosed using patient reported signs and symptoms and patient perceptions of the presence of infection should be taken seriously
- frank drainage of pus (but not always), increasing pain at the pin/wire site and decreased movement, mobility or weight bearing along with spreading redness and increased swelling and discharge are indicators of the presence of infection.

This guidance is offered to clinicians working in all settings where patients with external fixators receive care, including both community and hospital settings. The adoption of such guidance locally, should be conducted using an approach which includes all clinicians in deciding what practice best suits a given unit. It is feasible that individual patients may require care which is adapted from this guidance where there are specific needs. There is also a need for education of clinicians, patients and carers – particularly where external fixator pin site care is not a common practice or is being conducted for the first time. This document has attempted to offer some rationale for the recommendations made and these should be taken into account when planning care.

5

Further work

Where consensus has not been reached further work is required in order to identify recommended practice in the future. As further research is undertaken it may be necessary to reconsider some of the issues raised here and revise any guidance. It is important, therefore, that this document is revised at such a time as practice and evidence have moved forward.

It is important to note that this guidance is based on very little empirical evidence. All of the issues considered still require in-depth study. In addition, there were some significant issues about which there was no agreement. These include:

- the benefits and disadvantages of different dressings need much greater exploration
- disparity between individual practitioner's definitions led to a lack of clarity over whether crusts/plugs and scabs should be left in situ or gently removed; this issue requires further definition and investigation
- there was no real level of consensus regarding the timing of the first post-operative dressing; this issue requires further discussion and investigation.

One factor which needs additional consideration is the potential differences between children and adults. Good surgical technique is of prime importance, influencing the potential for infection. Manufacturers of the hardware and dressings are also involved in the quest to reduce the incidence of pin site infection. As with any new products, compatibility with the cleansing solution should be assessed prior to use.

6

Limitations

The consensus participants stressed the importance of clinical judgment and common sense in the implementation of any guidance for practice.

This is a UK-focused consensus which may not necessarily meet the needs of clinicians working in other parts of the world where practices and resources differ. It is also important to remind the reader that consensus is the weakest form of evidence and that, although this was the only available option at the present time, it is essential that practitioners adapt their practice based on new evidence or guidance as it emerges.

Sources of disagreement are common in consensus methods and may be related to participants' level of comfort with their own practice and reluctance, therefore, to agree with group generated statements. Until a stronger evidence base is achieved this is likely to remain the case. It is very uncommon for there to be 100 per cent consensus agreement and the guidelines here are based on majority agreement at different levels – not full agreement. As with many aspects of practice, a lack of full agreement may also be the case amongst practitioners in specific units.

7

Conclusions

Infection in pin and wire site wounds remains a significant problem for patients being treated with external fixation. Many factors play a part in the prevention of pin site infection. Surgical technique is of prime importance as well as other risk factors for infection, which include patient habits and compliance with prevention measures.

This publication offers some guidance for the practice of pin site care based on expert opinion. Although the consensus was not fully conclusive and underpinning empirical evidence is currently weak, the guidance is grounded in clinical experience and logic and offers some rationale for care.

There remains a pressing need for multi-centre, prospective, randomised, controlled trials examining each aspect of pin site care specifically. It is important to know which aspects of this care make a difference to infection rates. Research must be conducted using a standardised validated pin site infection assessment tool as an outcome measure. As yet, such a measure does not exist and this is in need of urgent development.

New dressings and cleansing solutions are regularly becoming available, so there should be a regular review of both practice and these recommendations. In the meantime, this consensus provides some guidance for practice.

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