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- Support needs of patients with external fixator devices
- Salient points of UK consensus guidance on pin site care
- Multifaceted role of nurses in assessing and managing pin sites

Assessing and managing pin sites in patients with external fixation



Nursing Times
Self-assessment

Key points

External fixation is used in orthopaedics to manage complex fractures or limb deformity

Patients often struggle to cope with external fixator devices and need holistic assessment and support

Pin site infection is the most common complication seen with external fixator devices

To avoid complications, pin site infection must be recognised and treated before it becomes severe

Using a clinical assessment tool improves the reliability of pin site assessment

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Abstract External fixation is used in orthopaedics to treat complex musculoskeletal conditions. External fixator devices disrupt patients' activities of daily living and often have a negative effect on their psychosocial wellbeing. The devices are held in place by pins and wires, and the sites where these enter the skin are called pin sites. Pin site infection is a common problem and needs to be recognised and treated effectively to avoid serious complications (which include amputation). This article provides an overview of pin site assessment and management, describing the role of nurses in supporting patients, educating them in pin site care, and assessing and treating pin site infection.

Citation Walker J (2018) Assessing and managing pin sites in patients with external fixation. *Nursing Times* [online]; 114: 1, 18-21.

External fixator devices can cause substantial disruption to patients' daily lives and negatively affect their physical and psychosocial wellbeing. Patients will need nursing support throughout the treatment, including advice on pin site care, regular pin site assessment, and prompt recognition and treatment of pin site infection (PSI). This article provides an overview of the nurse's role in pin site assessment and management.

What is external fixation?

External fixation is a technique used to manage musculoskeletal conditions such as complex fractures or limb deformity (Jennison et al, 2014). External fixator devices are applied using a surgical procedure whereby pins and/or wires are inserted through the skin into the bone. The pins and wires are then secured using a system of clamps, connectors or circular rings to create a scaffold system (Fig 1). The sites where the pins or wires enter the skin are commonly referred to as pin sites.

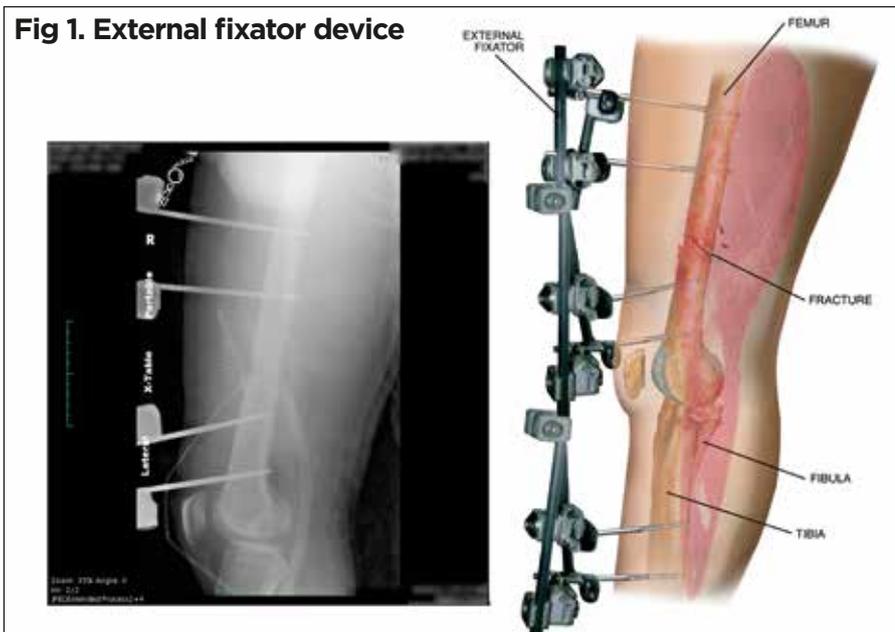
External fixation can be used to immobilise fractures if other methods of immobilisation, such as a plaster cast, are unlikely to be effective; for example, when there are multiple fragments of bone or when there has been extensive loss of skin or bone. It can also be used to help correct bone deformities or as part of limb lengthening procedures.

Halo immobilisation involves inserting pins in the outer part of the skull and attaching them to a rigid vest around the torso to create a frame that immobilises the cervical spine. It is used to prevent movement of the cervical spine when pathology (for example, cancer) or injury (for example, a fracture or ligamentous injury) have caused instability.

The length of time external fixator devices are used depends on the nature of the condition being treated and the presence of comorbidities or infection that may affect healing. Temporary fixators can be used to immobilise an injury until the patient is ready to undergo definitive surgery. Depending on the patient's injury

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Fig 1. External fixator device



and condition, they are typically used for several days. Definitive treatment of musculoskeletal disorders with external fixation, however, can last from several weeks to many months.

The most common complication associated with the use of external fixator devices is PSI (Lobst, 2017). Other common complications include nerve palsy, pin loosening and joint stiffness (Lee et al, 2017; Sabharwal et al, 2015).

Patients' support needs

Patients who need external fixation often have complex needs and require ongoing support, particularly in the initial stages of treatment. The presence of an external fixator device may cause difficulty with simple activities such as washing or mobilising, and patients will need to adapt their activities of daily living accordingly.

Patients can be embarrassed by the dependency induced by the frame and may be reluctant to seek help (Limb, 2004). Health professionals should initiate open discussions to help patients raise any concerns they have about coping with the frame and managing activities of daily living. As part of these discussions it is important to consider quality of life, depression and anxiety (Dheensa and Thomas, 2012).

Altered body image can make it difficult for some patients to accept external fixator devices (Patterson, 2010). Those who have trouble coming to terms with the device may find it difficult to engage with treatment and follow care regimens. Patients may experience anxiety

because of the changes in, and unpredictability of, their ability to undertake daily activities, as well as their feelings of diminished control (Dheensa and Thomas, 2012; Limb, 2003).

Nurses' role

The role of the orthopaedic nurse specialist includes identifying patients' concerns and responding to their expectations about care. The nurse specialist is able to expertly support patients through a period of change and adjustment, helping reduce the risk that they will not accept the frame and/or not adhere to treatment. Actively involving patients in care planning and evaluation contributes to a holistic, patient-centred approach where care is individualised. Appropriate involvement of the multidisciplinary team, both in the acute and community setting, helps provide patients with the skills and resources to self-care.

Factors, such as depression and destructive behaviour, need to be carefully considered when planning discharge from hospital, especially if patients are expected to manage their frame and pin sites themselves between outpatient follow-up visits (Patterson, 2006). Maladaptive coping is associated with depression, anxiety and poorer psychological and social wellbeing (Dheensa and Thomas, 2012). Patients who do not cope well once discharged may benefit from additional community support and more frequent follow-up. The use of self-management programmes may help them to develop coping strategies (Dheensa and Thomas, 2012).

Nurses are ideally placed to support patients with external fixator devices, in particular helping them look after the pin sites. Providing verbal and written information will help patients understand the importance of caring for pin sites effectively and identifying infection quickly.

Assessment

Patients with external fixator devices should be reviewed regularly by the orthopaedic team to assess the progress of healing and review the position and stability of the frame. Depending on the type of device used, elements may need tightening or struts may need to be changed. Patient-specific advice on managing the device can be obtained from the orthopaedic team and associated nurse specialists, who will oversee the patient for the duration of treatment.

Pin sites also need to be reviewed regularly and checked for signs of inflammation, irritation, infection or pin loosening. Assessment of the pin site and surrounding tissue is often subjective and can differ between clinicians (Ceroni et al, 2016). Clinical assessment tools (Clint et al, 2010; Patterson, 2005; Checketts et al, 1993), however, can be used to ensure a reliable and reproducible assessment.

Clear and consistent assessment and documentation will allow nurses to effectively monitor the condition of pin sites and differentiate between new and recurrent PSI. As patients are often the first to notice subtle changes in symptoms, their perceptions of the possible presence of infection should be a key part of the assessment (Timms et al, 2011). Based on patient accounts of changes experienced with PSI, Santy-Tomlinson et al (2011) have established a list of key features that help differentiate between 'calm', 'irritated' and 'infected' pin sites (Table 1).

Cleaning and dressing

A lack of strong evidence in the literature has resulted in inconsistent pin site management and a failure to reliably prevent or reduce the risk of PSI (Lobst, 2017). Many of the studies on pin site care were conducted more than 10 years ago, are of poor quality, or contain many variables, which make it difficult to directly link outcomes to single aspects of care (Kazmers et al, 2016). More research is needed on the effects of different management regimens on infection rates (Lethaby et al, 2013). To standardise and guide pin site care, the Royal College of Nursing has published consensus guidance (Timms et al, 2011).

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Table 1. Key features of pin site irritation and infection

	Pain	Redness	Discharge	Swelling	General symptoms
Calm	<ul style="list-style-type: none"> ● May be painless ● Only mild pain ● Reduces after application of fixator 	<ul style="list-style-type: none"> ● Often none ● Sometimes a little ● Not spreading 	<ul style="list-style-type: none"> ● Sometimes none ● Sometimes minor 	<ul style="list-style-type: none"> ● No swelling 	<ul style="list-style-type: none"> ● No other issues
Irritated	<ul style="list-style-type: none"> ● Mild to moderate ● Uncomfortable 	<ul style="list-style-type: none"> ● Some redness but not spreading ● No hot or taut skin 	<ul style="list-style-type: none"> ● 'Weepy' ● Begins to weep when it did not before/increased amount of discharge ● Remains the same consistency and colour ● Can be persistent in specific pin sites ● Sometimes bleeding ● No odour ● Dressing changes needed more often 	<ul style="list-style-type: none"> ● Swelling around pin site only, not spreading 	<ul style="list-style-type: none"> ● Skin movement around the pin ● Allergy to antiseptic ● Irritated upon physical activity ● Itchy (owing to reaction/allergy) ● Dry, flaky skin ● Does not respond to antibiotics ● May affect all pin sites or just one or two
Infected	<ul style="list-style-type: none"> ● Severe ● Sudden ● Increased intensity ● Throbbing/stinging ● Joints nearby may be painful ● Unable to weight-bear ● Unrelenting on rest ● Poor response to analgesia 	<ul style="list-style-type: none"> ● Deep red ● Angry looking ● Spreading ● Definite borders ● Associated with heat 	<ul style="list-style-type: none"> ● Increased ● Change in consistency ● Thicker/more viscous ● Sometimes unpleasant odour ● Change in colour ● Sometimes purulent ● Dressing changes needed much more frequently 	<ul style="list-style-type: none"> ● Localised swelling around affected pin site ● May spread ● May be severe 	<ul style="list-style-type: none"> ● Feeling unwell ● Fever ● Taut, shiny skin ● Loss of function/weight bearing ● Tired/lethargic ● Disturbed sleep ● Loss of appetite ● Responds to antibiotics

Source: Santy-Tomlinson et al (2011)

Pin site care should be undertaken as often as necessary to keep the area clean, and at least once a week (Timms et al, 2011). Any deterioration in the condition of the pin site or the surrounding tissues warrants more frequent assessment and care. The frequency of pin site care should also be increased if there is copious drainage or if infection is suspected (Timms et al, 2011). To clean pin sites, chlorhexidine in alcohol solution is normally used, but caution is needed as it can cause allergic reactions (Box 1).

The EPIC₃ guidelines (Loveday et al, 2014) present evidence that dressings have an important role in preventing infection related to the use of peripheral and central venous catheters. There is a lack of pin-site-specific research comparing the effects of different dressings on pin site outcomes and infection rates. Timms et al

(2011) recommend the use of sterile dressings made of a non-shedding material that keeps moisture and exudate away from the wound. When selecting dressings, factors such as levels of exudate, ease of use, cost, comfort and antimicrobial properties should be considered for each pin site.

Infection

Bacteria colonising the skin surface can cause superficial infection around the pin site. They can also travel down the pin or wire, increasing the risk of deep soft tissue infection or osteomyelitis (Ceroni et al, 2016). Deep infection is considered to be a serious complication, as it can delay or inhibit healing and can become difficult to treat (Jennison et al, 2014).

If infection is not recognised and treated promptly, this can result in visible drainage of pus, odour, advancing

cellulitis and osteomyelitis (Jennison et al, 2014; Fragomen and Rozbruch, 2007). Patients who have systemic symptoms of infection should be thoroughly investigated, as deep infection may not be apparent on the skin surface.

Factors known to be associated with an increased risk of PSI are listed in Box 2. The bacteria most commonly identified as being associated with PSI are *Staphylococcus aureus* and *Staphylococcus epidermidis* (Jennison et al, 2014).

Some bacteria are able to produce biofilm – a collection of bacteria attached to a foreign material (such as pins and wires) that has become surrounded by an extracellular matrix (Jennison et al, 2014). Biofilm is less likely to respond to the immune system's defences and to antimicrobial therapy than planktonic (free-floating) bacteria. This means that many antibiotics

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that are effective against planktonic bacteria are ineffective against biofilm, which makes it more difficult to treat infection (Ceroni et al, 2016; Kim et al, 2008).

Treating infection

If superficial PSI is suspected, pin site care should be performed more frequently to address issues such as increased exudate levels (Timms et al, 2011). A wound swab can be obtained for microbiological cell count, culture and sensitivity analysis, so that the appropriate antimicrobial treatment can be identified (Ceroni et al, 2016). While microbiological analysis can help identify causative organisms, it should be combined with clinical assessment to inform management strategies. Most superficial PSIs are treatable with increased pin site care and a short course of oral antibiotics (Ceroni et al, 2016; Kazmers et al, 2016). If the patient is experiencing increased levels of pain, analgesia may also be required.

Deep or severe infection may require advice from the clinical microbiology team and prolonged treatment with antibiotics. If infection is not successfully managed with antibiotics, it is possible that a biofilm has formed and the infected pins and wires may need to be removed (Jennison et al, 2014). Additional surgery may be required to debride the infection and re-site any removed pins or wires (Ceroni et al, 2016).

In some severe cases of infection, external fixation may need to be abandoned and amputation may be necessary. PSI can have a substantial negative impact on patient experience and clinical outcomes, and patients may potentially incur both diminished quality of life and financial costs due to additional treatment and prolonged hospitalisation (Walker, 2012).

Conclusion

External fixation devices engender complex issues that can have a negative impact

Box 1. Use of chlorhexidine for cleaning pin sites

To clean pin sites, Timms et al (2011) advocate the use of chlorhexidine in alcohol solution, except in patients with a known sensitivity to chlorhexidine or pre-existing skin conditions such as eczema. Caution is required when using chlorhexidine, as it is known to induce hypersensitivity, generalised allergic reactions and anaphylaxis (Medicines and Healthcare products Regulatory Agency, 2012); Davis et al (2005) have reported a 17.6% hypersensitivity to alcoholic chlorhexidine.

If irritation or allergy is observed with the use of chlorhexidine, Timms et al (2011) recommend using sterile saline. If chlorhexidine is contraindicated yet an antimicrobial cleansing solution is needed, advice on alternative antimicrobial solutions should be sought from the medical and infection prevention control teams.

Box 2. Infection risk factors

Factors known to be associated with an increased risk of pin site infection include:

- Multiple comorbidities
- Poor soft tissue structure
- Inadequate general hygiene
- Poor nutritional status
- Presence of systemic conditions such as diabetes
- Immunodeficiency

Source: Kazmers et al (2016), Britten et al (2013)

on patient experience and clinical outcomes. The use of clinical assessment tools and clear documentation will improve the effectiveness of assessment and continuity of care. Although UK consensus guidance is available to guide nursing practice (Timms et al, 2011), further research is needed to identify the most effective strategies to minimise the risk of PSI. Nurses have an important role in supporting patients throughout the treatment process, delivering effective education and supporting pin site care. **NT**

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