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Pin-site care: can we reduce the incidence of infections?

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KEYWORDS

Pin-site care
Pin-site infection rate
Ilizarov ring fixator

ABSTRACT

Background: This study was conducted to determine the pin-site care protocols currently in use and to analyse their effectiveness and outcomes.
Methods: PubMed, the Cochrane Library and Embase databases were screened for manuscripts that described comparative studies of different methods of pin-site care and referred to complications related to any kind of external fixator application.
Results: A total of 369 manuscripts were screened and only 13 of these met the inclusion criteria evaluating different protocols of pin-site care. This review is based on a total of 574 patients. Infection rates were very variable depending on the type of implant used and the protocol of pin-site care applied.
Conclusions: None of the different protocols of pin-site care that were evaluated in this study were associated with a 0% infection rate. There is currently no consensus in the international literature about which protocol should be applied universally. Meticulous surgical technique during pin insertion and implementation of one of the existing protocols of pin-site care are the mainstay of prevention and/or reduction of the incidence of pin-site infections.

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Introduction

Fine-wire fixators and external fixators are common orthopaedic devices that use half-pins for the treatment of long-bone fractures and pelvic fractures in adults and children [1-9]. External fixator devices are also used to span joints in complex intra-articular fractures where resuscitation of the surrounding soft tissue envelope is essential before definitive reconstruction [10,11]. The insertion of pins into the affected bone segment requires good knowledge of the local anatomy, and established safe corridors of pin insertion must be used to avoid iatrogenic damage to the important underlying neurovascular structures [12].

The application of an external fixator device is considered to be straightforward; however, several complications have been reported during this procedure, including pin migration, pin breakage, loss of reduction, nerve damage, skin infection (superficial) and osteomyelitis (deep). Pin-site infection usually starts as cellulitis around the pin; it may also start as a localised form of osteitis. Pathogens such as *Staphylococcus aureus* and *Pseudomonas aeruginosa* have been reported to be most frequently associated with the manifestations of these infections [13].

There has been considerable attention from clinicians on the definition of pin-site infection [14]. Two classification systems were developed to grade the level of pin-site infection (Checketts 1999 and Sims 1996), but neither system has published validity. The Checketts-Otterburn classification, see Table 1, is more commonly used and provides valuable information regarding treatment [15]. According to this system, pin-site infections are classified into two groups, minor (Grades 1-3) and major (Grades 4-6); the significant difference between the two groups is that the external fixation pin has to be removed in major infections [15].

The pin-site infection rates reported in the literature range from 10% up to 100% [1,10,16-18]. The treatment protocols that have been used varied widely in terms of antiseptic material (saline, iodide solution, ointment, cream, sterile gauzes, impregnated gauzes) and frequency of inspection (daily, twice daily, weekly, non-treatment) [19-22].

This study was conducted to determine the pin-site care protocols currently in use and to analyse their effectiveness and outcomes.

Materials and methods

A literature search was conducted using PubMed, the Cochrane Library, and Embase databases using the key words “pin site care”

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Table 1
Checketts-Otterburn classification

Grade and Characteristics		Treatment
Minor infection		
1	Slight redness and little discharge	Improve pin-site care
2	Redness of the skin, discharge, pain and tenderness in the soft tissue	Improve pin-site care and oral antibiotics
3	Grade 2, but no improvement with oral antibiotics	Affected pin or pins resited and external fixation can be continued
Major infection		
4	Severe soft tissue infection involving several pins, sometimes with associated loosening of the pin	External fixation must be abandoned
5	Grade 4, but radiographic changes	External fixation must be abandoned
6	Infection after fixator removal. Pin track heals initially, but will subsequently break down and discharge in intervals. Radiographs show new bone formation and sometimes sequestra	Curettage of the pin tract

(143 manuscripts), "pin site infection rate" (80 manuscripts), and "Ilizarov ring fixator" (146 manuscripts). Manuscripts were eligible for inclusion if they described comparative studies of different methods of pin-site care and referred to complications related to any kind of external fixator application. Studies that did not clearly describe the pin-site protocol or did not report outcomes were excluded.

The following details were retrieved and analysed: the treatment protocol for pin-site care, type of external fixator used, number of patients and pins inserted, and the use of antibiotics for prophylaxis or treatment. Complications were divided into major and minor according to the Checketts-Otterburn classification and the outcomes included the incidence of infection (%).

A total of 369 manuscripts were screened and only 13 of these met the inclusion criteria for the study and formed the basis of this review [23-35]. Eleven of the manuscripts were of comparative studies, see Table 2 [23-33]. Two manuscripts (case series) were included as they referred to a successful pin-site protocol [34,35].

Description of protocols

Henry in 1996 investigated three pin-site care protocols: use of saline 0.9%, use of alcohol 70% and no cleansing (control group) [23]. All three groups had crust removal, gentle massage, spraying with povidone iodine and dressing with dry gauze. There were 30 participants and the pins were in the femur and tibia. The infection rates with the three different protocols were 25%, 17.5% and 7.5%, respectively [23].

W-Dahl et al. in 2003 randomised patients into two groups using the same solution (0.9% saline and dry dressing and bandage), but with different frequency: cleansing was daily in the first group and weekly in the second group [24]. The patients underwent an elective procedure for knee osteoarthritis and correction by hemicallotasis technique; hydroxyapatite-coated pins were used. A total of 50 patients were enrolled and the pins were inserted in the tibia. The infection rate for the first group was 7.4% and for the second was 12%. Overall minor and major complications were 2.8% and 0%, respectively [24].

Camilo et al. in 2005 proposed a protocol for patients who received the Ilizarov (fine wires) fixator device. The control group had the skin around each pin site cleaned with sterile gauze soaked in 0.9% saline solution to remove all 'dirt'; the sites were then dried with sterile gauze and each site was covered with folded gauze. The experimental group followed the same protocol except that, in addition to all other aspects, gauze soaked in polyvinylpyrrolidone-iodine (PVPI) was applied to each site. There were 30 participants in the study. The infection rate was 66.7% in the control group versus 46.7% in the experimental group [25].

Patterson in 2005 explored the differences in infection rate and reaction rate between seven different pin-site care protocols that varied both the cleansing agent (half-strength peroxide, saline, or antibacterial soap and water) and type of dressing used (stable gauze or sponge, or Xeroform/Xeroflo) [25]. The patients were divided as follows:

(i) Twice daily: 1/2 strength peroxide, rinse with saline, apply stable gauze/sponge;
(ii) Same cleansing; apply Xeroform/Xeroflo dressing;
(iii) Twice daily; saline cleansing, apply stable gauze/sponge;
(iv) Same cleansing; apply Xeroform/Xeroflo dressing;
(v) Twice daily: antibacterial soap and water cleansing, apply stable gauze/sponge;
(vi) Same cleansing; apply Xeroform/Xeroflo;
(vii) No cleansing, apply gauze/sponge (change only if wet or soiled)

The control group (vii) had no cleansing and a dry dressing, which was changed only if it became wet or soiled. There were 92 participants and the pins were predominately localised in the lower limb. The infections rates were (i) 46%; (ii) 9%; (iii) 33%; (iv) 27%; (v) 39%; (vi) 50%; and (vii) 36%, respectively [26].

Two different cleansing protocols were evaluated by Grant et al. in 2005 in patients with acute injury [27]. The first group underwent cleansing with normal saline, flush and application of soft white paraffin ointment, the second group had twice-daily cleansing with normal saline and application of 10% povidone-iodine solution. There were 20 participants. The infection rate in the first group was 34.1% and that in the second group was 18.1% [27].

In another study, three different pin-site care protocols were tested by Egol et al [28]. The first group had daily pin-site care with a solution of 50% saline and 50% hydrogen peroxide. The infection rate in this group was 22.5%. The second group had a weekly application of chlorhexidine-impregnated dressings (Bio patch) by the treating surgeon. The infection rate for this group was 5%. The third group had weekly dry dressing changes without pin-site care. The infection rate was even lower in this group at just 2.5%. A total of 118 patients participated in the study and the pins were localised in the distal radius [28].

Cavusoglu et al. in 2009 randomised patients who were treated using different pin-site care protocols, but all received care with the same frequency (daily) [29]. The first group used showering and brushing of the pin sites with soap and a toothbrush; the second group utilised showering and cleaning of the crusts with sterile gauze impregnated with iodine solution. There were 39 participants, all of whom received the Ilizarov frame (fine wires) and the pins were localised in the tibia. The infection rate in the first group was 44% versus 51% in the second group. Major complications in the region of 4% were reported in both groups [29].

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