Original Article

Orthopaedic

External Fixation: Daily versus Weekly Pin Site Care

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ABSTRACT

Objective: To determine whether there were any differences in the frequency and severity of pin site infections by performing pin site care daily or once a week

Study Design: cross sectional descriptive study.

Place and Duration of Study: This study was carried out at Department of Orthopaedics and Traumatology, Khyber Teaching Hospital, Peshawar during the period from Dec 2011 to Jun 2013.

Materials and Methods: This study included 96 patients who were selected by convenient (non probability) sampling technique. Patients were divided into two groups.

Results: The mean infection rate during the study in group 1 was grade I in 16% and grade II in 7%, grade III in1% versus grade I in 12% and grade II in 5%, grade III in 5% in group 2. No grade IV–VI infections were noted.

Antibiotics were prescribed for a mean of 60 days (SD 15) in group 1 and 45 days (SD 30) in group 2. The relative risk (RR) of positive cultures at the proximal pin sites was 1.5 (95% CI 1.2–1.9). No difference was found between the groups.

Conclusion: No differences between daily and weekly pin site care were observed as regards the severity of infections, frequency of infection rate, of positive cultures, except in week 6, and in use of antibiotics or analgesics.

Key Words: Pin sites, pin tract infection, External fixator, care

INTRODUCTION

External fixation involves the surgical application of metal apparatus attached to percutaneous pins or wires that penetrate the bone and are attached to an external metal frame[1] .It is used to treat complex fractures and limb deformity and its use has increased in recent years in line with the notion of damage control orthopaedics as well as a result of guidelines for the management of open fractures[2]. Wires or pins allow fixation of the apparatus to the bone[2,3]. The complications of external fixation include delayed union of fractures, nerve and vessel injury, loosening of half pins, mechanical problems with the fixator and pin site infections[3]. Of these, pin site infection is reported to be the most common[3,4].

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[5]. Each wire or pin penetrates skin and soft tissue[6]. Percutaneous wounds are formed at the interface between the pin or wire and the skin at its site of penetration[7]. 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"[7,8].

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[9]. The intention of wound care cannot be healing until the 'foreign' material can be removed at the end of treatment[10]. It is not possible to employ the principles of chronic wound care either because, again, of the presence of the pin or wire and the associated foreign body reaction[11].

Pin-site care is one important part of the treatment by external fixation and includes the care of the wounds, where the pins and/or wires have been inserted, from the theatre dressing until the wounds are healed[12,13,14]. The purpose of pin-site care is to prevent pin-site infections[13,15]. Pin-site care includes different factors such as theatre dressing, frequency of pin-site care, cleansing agent, removal of scab/crust, and dressing[7,16,17].In the literature, there are several different recommendations when the first postoperative pin-site care has to be carried out, ranging from 24 h to 1 week postoperatively[18,19,20]. However, there is little consensus, if any, upon how often the pin sites should be cleaned to best prevent pin-site infections during the treatment by external fixation[21,22,23].

The aim of this study was to investigate whether there were any differences in the frequency and severity of pin site infections by performing pin site care daily or once a week.This would offer guidance regarding the best methods of wound care aimed at preventing infection in external fixator pin site wounds and assist in developing clinical practice guidelines. The pin-site care developed from these studies would be used in fracture healing and other corrections treated by external fixators.

MATERIALS AND METHODS

This cross sectional descriptive study was carried out at Department of Orthopaedics and Traumatology, Khyber Teaching Hospital, Peshawar during the period from Dec 2011to Jun 2013 including 96 patients who were selected by convenient (non probability) sampling technique.

The inclusion criteria was; patients with age between 18 to 65 years, 25-35 who lived nearby KTH and can come easily to hospital whenever needed, who were independently mobile prior to fracture and having normal cognitive function (a mini mental score of >6). Patients with a pathological fracture, closed fracrtures, type IIIc open tibial fractures, patiensts living in remote areas from the hospital and those who were presenting two weeks after injury were excluded from the study.

All patients were admitted and written informed consent was obtained in all cases. Patients received in emergency were fully resuscitated and all other life threatening injuries were excluded. Complete history was taken to determine the mode of injury and thorough physical examination was done to rule out chest, abdominal or pelvic injuries. After preoperative preparation patients were shifted to Operation Theater. All open wounds were irrigated copiously with normal saline followed by debridement of all the devitalised bone and soft tissue. Antibiotic (Ceftriaxone, 2gram, I.V OD) was given intravenously for all open fractures and additional gentamycin for Grade III open fractures. Fracture was stabilized with A.O. external fixator. Tension free primary closure using interrupted polypropylene 2/0 sutures was attempted wherever appropriate. If safe closure could not be accomplished, the size of the wound was minimized by mobilization of the adjacent tissues over the bone with or without additional split thickness skin grafting. All Grade IIIA fractures were closed successfully with no wound complications. A thorough debridement of all the devitalized bone, soft tissue and the infected material was done with primary approximation of bone and soft tissues. The wounds however were not primarily closed, but allowed to heal by secondary intention.

Immediate postoperative regimen consisted of range of motion exercises of ankle and knee. Partial weight bearing was commenced as soon as possible progressing to full weight bearing within the limits of pain. The patients were assessed clinically and radiologically for signs of pin site infection.

Pin site care

Sterile technique (sterile material and sterile gloves) was used in the hospital and clean tech- nique (sterile material and clean gloves) in the outpatient clinic. All bandages were removed. Each pin site was cleaned with chlorhexidine (5 mg/ml) in alcohol (ethanol 70%) solution No crusts were removed unless signs of infection perceived. A sterile compress, moistened with chlorhexidine (5 mg/ml) in alcohol (ethanol 70%) was placed at each pin site and was fixed by a soft dressing around each pair of pins. When showering, the patient protected the pin sites using a plastic bag. The patients had full access to the outpatient clinic if they had questions or any problems occurred. In the case of pin-site infection or drainage, extra visits were made if needed. Patients were divided intotwo groups. Patients in group 1 were subjected todaily whereas those in Group 2 to weekly pin site care respectively.

We used the Checketts-Otterburns classification to describe the pin sites. Grades I–III were minor infections and grades IV–VI major ones. Bacterial cultures were taken from each pin site after removal of the crusts at 1, 6 and 10 weeks, and from the tips of the pins when they were removed.

Records were kept on the use of antibiotics and analgesics and the occurrence of complications. The pins were assessed as loose or fixed on removal. A loose pin was defined as one, which could be removed by hand without use of a wrench.

Checketts–Otterburn classification

Grade	Characteristics
1	Slight redness and little discharge
2	Redness of the skin, discharge, pain and tenderness in the soft tissue
3	Grade 2 but no improvement with oral antibiotics
4	Severe soft tissue infection involving several pins, sometimes with associated loosening of the pin
5	Grade 4 but radiographic changes
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

Statistics: Data was entered into computer software program SPSS version 10.0. Mean and standard deviation were calculated for age, duration of fixator, duration of PTB and fracture union time. Frequency and percentages were calculated for all categorical data. The Analysis of Variance (ANOVA) test, t-test and chi-square test were employed for the statistical analysis, significance level $p < 0.05$. The number of pins (200) was used in the analysis of the severity of the pin site infections and their frequency, and the number of patients (50) in the analysis of pain and use of analgesics and antibiotics. For a power of 90%, 0.05 and an estimated effect size of 0.5, 84 pins were needed in each group.Data was presented in the form of tables and figures.

RESULTS

The study contains 96 patients, which were divided in two groups equally. There were 28(58.3%) male and 20(41.7%) female in group 1 which in group 2 it was 32(66.7%) male and 16(33.3%) female. Average age was 36.39±9.3SD and 37.16±9.6SD of group 1 and group 2 respectivly. Majority of the patients were of the age range from 26-35 years of age (Table No.1). Age and gender were insignificant in both the groups with p-value=0.399 and 0.966 respectively.

Table No.I: Age wise comparison in both groups

			Group		Total
			Daily Group	Weekly Group	
Age (in year)	<= 25.00	Count	5	5	10
		% within Group	10.4%	10.4%	10.4%
	26.00 - 35.00	Count	24	22	46
		% within Group	50.0%	45.8%	47.9%
	36.00 - 45.00	Count	9	9	18
		% within Group	18.8%	18.8%	18.8%
	46.00+	Count	10	12	22
		% within Group	20.8%	25.0%	22.9%
Total		Count	48	48	96
		% within Group	100.0%	100.0%	100.0%

No differences between daily and weekly pin site infection were observed as in both the group with p-value=0.820 table below.

Table No. 2: Comparison of pin site infection in both the groups

			Group		Total
			Daily Group	Weekly Group	
Pin Site Infection	Yes	Count	14	13	27
		% within Group	29.2%	27.1%	28.1%
	No	Count	34	35	69
		% within Group	70.8%	72.9%	71.9%
Total		Count	48	48	96
		% within Group	100.0%	100.0%	100.0%

Out of infection during the study in group 1 was grade I in 29.17% and grade II in 12.5%, grade III in4.17% versus grade I in 25% and grade II in 16.67%,grade III in 12.5% in group 2. No grade IV–VI infections were noted. Severity of infection were also insignificant with p-value=0.588.

The positive cultures showed 21% staphylococcus aureus, 13% coagulase negative staphylococcus and 6% corynebacterium. 17/96 pins were clinically loose on removal. 5 of the loose pins were infected with staphylococcusaureus. Antibiotics were prescribed for a mean of 60 days (SD 15) in group 1 and 45 days (SD 30) in group 2.

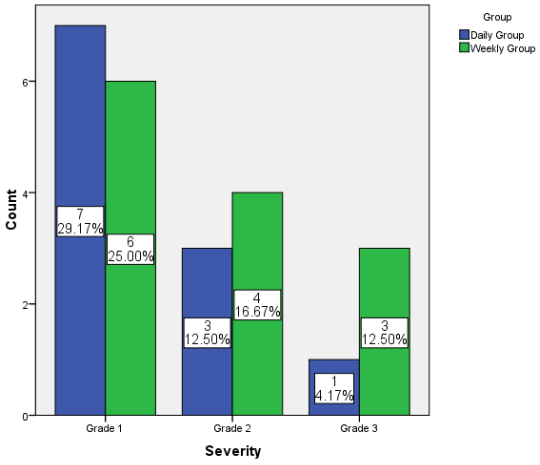

Figure No.1: Comparison of severity of infection between the groups

DISCUSSION

Pin-site infections usually begin as a cellulitis. Most are due to Staphylococcus aureus and respond readily to oral antibiotics. Occasionally, the infection involves deeper tissues and bone and may persist despite the use of appropriate antibiotics. The stability of the fixation is thereby impaired. Deep infections may also persist after removal of the wire or pin if there is a ring sequestrum.

Although superficial infections are more common than deep sepsis they cause pain and interfere with rehabilitation. Protocols for the care of pin-sites are often derived from the preference of the surgeon or nurse, habit, consensus or inappropriate conclusions from the basic principles of wound care. However, where complete healing is not the objective, standard techniques of wound care may be inappropriate.

A review of the literature on pin-site care confirms that opinions differ on the most appropriate management.[2,5,6] There is little scientific evidence to support one technique over another with some even justifying a nihilistic approach.[7,10]

The reported frequency of pin site infections varies widely—i.e., from 4%–51% (Meléndez and Colón 1989, Checketts et al. 1993, Magyar et al. 1998, 1999, Gordon et al. 2000)[11].

In our series, pin site infections occurred in 23%, were usually grade I and none were severe (grade IV–VI). Grade I is probably more an irritation than an infection but may develop into an infection without proper care. 30% of the bacterial cultures were positive. This means

that half of the positive cultures were of no clinical significance and probably skin contaminants.

The frequency of pin site care recommended institutions and by clinicians varies from 4 times daily to weekly (McKenzie 1999) and some authors even encourage patients to take daily showers (Sims and Saleh 1996)[15].

We found no differences between weekly or daily pin site care except for fewer positive cultures ($p = 0.02$) in week 6 in the group with daily pin site care. This single statistically significant difference between the groups could be spurious and a result of mass significance.

Aweakness of our study is low statistical power concerning the use of analgesics, antibiotics and pain because these variables were counted in per- sons and not in number of external pins. Callus dis- traction and pin site infection were associated withpain. The patients' estimation of pain, and their use of analgesics were high, especially during the correction phase. The removal of crusts was also pain- ful and the pain could persist for several days.

In a comparison of all bacterial cultures taken in this study, the risk of a positive culture was 50% higher with a proximal pin site than with a distal one[17]. We found no difference in the clinical risk of a pin site infection, using the Checketts-Otterburns classification.

The location of the fixator and, if correction is performed, affects the risk of a pin infection (Sims and Saleh 2000)[17,18]. The type and placement of the pin, including its coating, affect its stability (Magyar et al. 1997)[18]. The skin movements around the pins also increase the risk of an infection (Paley and Jackson 1985)[19].

17of 200 pins were loose on removal. All loose pins were proximal and had positive cultures. A loose pin increases the risk of an infection (Mahan et al. 1991)[19]. Mahan et al. (1991) found a correlation between loose pins and pin tract infection and reported 23% loose pins and 75% of the cultures from pin tips were positive for bacteria.

CONCLUSION

We conclude that pin site care once a week seems appropriate. The high incidence of pin site infection, the frequent use of antibiotics and fre- quent pain are disadvantages of external fixators.

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