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PREVALENCE OF PIN TRACT INFECTION: THE ROLE OF COMBINED SILVER SULPHADIAZINE AND CHLORHEXIDINE DRESSING

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ABSTRACT

Objective: Infection at the pin tract is a common complication of external fixation. This study was done to compare the rate of pin site infection following combined 1 % silver sulphadiazine and 5 % chlorhexidine dressing with 5% chlorhexidine dressing alone.

Method: This was a prospective controlled study which compared the results of pin site dressing using a combination of chlorhexidine and silver sulphadiazine cream (Study group) with dressing using chlorhexidine alone. Eligible patients had external fixation in the treatment of open fractures or orthopaedic conditions. Pin-tract infection was deemed to be present if erythema, cellulitis or purulent discharge occurred around a pin site. We did not distinguish between deep and superficial infection.

Results: The study group had one hundred and seventy pin sites while the control group had one hundred and sixty-four pin sites. Thirty-eight patients, in whom thirty-seven uniplanar external fixators and one Ilizarov ring fixator were used, made up both groups. Three patients (7.9%) had pin tract infection in the study group while nine patients (23.7%) had pin tract infection in the control group.

Conclusion: There was a significantly lower prevalence of pin-tract infection amongst patients whose external fixation pins were dressed with 1 % silver sulphadiazine and 5 % chlorhexidine than in those dressed with chlorhexidine alone (P=0.03). Therefore, we advocate the use of a combination of silver sulphadiazine and chlorhexidine for pin site dressing.

Key Words: External fixation, Prevalence, Pin-tract Infection, Dressings. *(Accepted 10 June 2009)*

INTRODUCTION

External fixation pins are a source of bacterial invasion of tissues through the pin tract. As a result, infection along the pin tract is common following external fixation. External fixation pin tract infection rate ranges widely from 11.2-45.2% [1-4]. Uncontrolled pin tract infection may lead to deep-seated infection such as osteomyelitis, or precipitate loosening of the pins.

Pin tract infection can be prevented using varying methods including antimicrobial coated pins and silver coated pins [5, 6&7], alcohol antiseptic occlusive pressure dressings [8], AO pinless external fixator [9], avoidance of thermal injury during pin insertion [8]. Pinless external fixators are free of deep infections like osteomyelitis but may be associated with superficial pin site infection.[10] It allows further surgical intervention with intramedullary nails because the intramedullary cavity is not violated. The goal of pin care is reduction of pin-tract infection rate to the barest minimum. No single method has eliminated pin tract infection. Pin-tract infection usually starts from the pin-skin interface and then progresses to the subcutaneous tissue and may advance further to cause osteomyelitis. It is necessary to assess pin-site treatment methods or their modifications in order to determine their effectiveness in reducing the incidence of pin-tract infection. Hydroxyapatite-chlorhexidine coated pins have been used in external fixation with evidence of capacity to minimize pin tract infection.[11] Chlorhexidine is known to be helpful in reducing microbial colonization of devices such as catheters.[12&13] The efficacy of chlorhexidine is enhanced by impregnating hydroxyapatite coated pins with chlorhexidine. Such preparations are long-acting but expensive and not readily available in our setting. The effect of liquid chlorhexidine wanes when the application dries-up. As a result combining it with a creamy preparation of silver sulphadiazine should prolong its presence at the pin site and this is expected to enhance the prevention of pin-tract infection. Silver Sulphadiazine is an established and highly effective topical antimicrobial agent used in the dressing of burns wound with the capacity to reduce bacterial colonization.[14-16] Silver sulphadiazine cream causes a slow and sustained release of silver ions which bind to bacterial

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deoxyribonucleic acid, thus inhibiting growth and multiplication of bacterial cells. It penetrates into exudates and necrotic tissue. It is effective against staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa, and strains of Proteus, Klebsiella, and Candida albicans.[16]

Chlorhexidine solution and silver sulphadiazine cream are well established antimicrobial agents which are readily available, affordable, and easy to apply repeatedly. When they are combined a mixture is formed and their effectiveness in the prevention of pin tract infection could offer a better alternative to chlorhexidine-only dressing. Indeed, it could offer degrees of prevention of infection similar to that arising from use of long-acting chlorhexidine impregnated hydroxyapatite coated pins which are not readily available in our setting and are costlier than the non-coated pins. We thus combined both antimicrobial agents as dressing materials for pin sites in external fixation. The purpose of this study was to assess the prevalence of pin-tract infection as a measure of the level of control of infection at the pin-skin interface by a combination of chlorhexidine and silver sulphadiazine dressing compared with chlorhexidine dressing only. The null hypothesis of this study expects that there will be no difference between chlorhexidine-only dressing and combined silver sulphadiazine and chlorhexidine dressing in terms of prevalence of pin tract infection.

PATIENTS AND METHODS

All patients requiring external fixation who were aged 5years to 75years were candidates for inclusion in the study. They were not admitted if any of the following criteria was present: 1. Acute or Chronic Osteomyelitis; 2. Limb ischaemia lasting more than 12 hours; 3. Sepsis affecting the skin of the affected limb. This study was done, from March 2002 to August 2006, in the orthopaedic and trauma unit of a tertiary health care facility in Midwestern Nigeria. Thirty-eight patients were consecutively recruited into each group. We noted their bio-data. Thirty-seven AO tubular external fixators and one Ilizarov circular fixators were used in each group. The optimum sample size of 38 patients was determined based on the hypothesis that the combined silver sulphadiazine and chlorhexidine dressing will cause a 25% reduction in the prevalence of pin tract infection with a 90% power of achieving a significant result at the 5% level. The controls were patients who received chlorhexidine-only pin care as opposed to the study group who had combined chlorhexidine and silver sulphadiazine dressing. Group A patients (The study group) had pin site dressing with a sterile strip of gauze that was impregnated with a mixture of 1% silver sulphadiazine cream, (Dermazin® produced by Lek Pharmaceutical and Chemical Company, Ljubljana, Slovenia) and 5% chlorhexidine (5% Chlorhexidine gluconate solution BP ,Disinfex®, produced by Rajrab Pharmaceuticals Limited, Ilorin, Kwara State, Nigeria).

Each pin site in group B patients (The controls) was dressed with a sterile strip of gauze that was impregnated with 5% chlorhexidine. The gauze dressing was wound round each pin and pushed down to the skin-pin interface. These immediate post-procedure dressings were removed 72 hours post-insertion of external fixation pins and fresh dressings were applied in a similar manner and replaced every week. All the patients had intravenous ceftriazone 1gm daily and metronidazole 500mg 8-hourly for five days following the procedure. Children were given 20mg per kg per day of ceftriazone and 7.5mg/kg per dose of metronidazole. Each external fixation device was kept in place for a minimum of 35 days. The use of post-operative antibiotics is a routine prophylaxis which is necessary in orthopaedic practice particularly in procedures with high rate of infection and use of implants[17] and it's duration of five days is expected to be incapable of preventing pin-tract infection for up to thirty-five days which was the shortest duration the external fixators remained on the patients. It was also considered unethical to deny any patient undergoing an invasive orthopaedic procedure prophylaxis against infection. Indeed, it is most likely that the prevalence of pin-tract infection to be observed would be attributable to the dressing methods since both controls and study group were exposed to the same broad spectrum antibiotics for the same number of days. Anaesthesia was either regional or general. All the cases were managed entirely as in-patients. Each pin (A 4.5mm schanz screw) was applied through a 5mm stab wound in the skin with a size 10 blade. The holes in the near cortex were pre-drilled with a hand drill and a 2.7mm drill bit through a drill guide during the application of uniplanar external fixation and the pins were inserted until the far cortex was engaged. There was no pre-drilling in the insertion of 1.8mm kirschner wires for the Ilizarov circular external fixator. Active exercises of the digits were encouraged from the first day post-operation. The pin sites were examined during change of dressing for evidence of pin-tract infection. The presence of erythema, cellulitis or purulent discharge was taken as evidence of infection. Swab was taken from any pin site with evidence of infection for microscopy, culture and sensitivity. Antibiotics therapy was recommenced in those patients with pin-tract infection. The results obtained were analyzed with SPSS-10. Statistical significance of the rate of infection was determined using Chi-squared test.

RESULTS

Thirty-eight patients made up of 13 females and 25 males aged between 5 and 75years (mean= 38.53±15.26) were seen and treated in the study group with 170 pin sites. There were also thirty-eight patients in the control group with 164 pin sites. The control group was made up of 16 females and 22 males with a mean age of 41.4±14.2. Details of the demographic and clinical features of the patients are in table 1.

Three patients (7.9%) in the study group and nine patients (23.7%) in the control group had pin-tract infection (p=0.03) which affected 12 (7.1%) and 33 (20.1%) of the pin sites respectively. Swab culture yielded growth of staphylococcus aureus in the twelve patients with pin tract infection. The difference was statistically significant.

Table 1: **Details of the clinical and demographic characteristics of patients in both groups.**

Feature	Study group
No of patients	38
Age* (years)	38.53±15.26 (5-
Male: Female	25:13
Site of external fixation	
Femur	7
Tibia	24
Humerus	7
Radius or Ulna	0
Indication (Diagnosis)	
Gunshot Injury	13
Road traffic accident	21
Non-union	2
Quiescent osteomyelitis	2
Pin tract infection (Patients) **	3 (7.9)
Pin tract infection (pin sites) **	12 (7.1)

*Mean ± standard deviation and (range).
** Number and (percentage)

DISCUSSION

This study shows that combination of chlorhexidine and silver sulphadiazine cream in the care of external fixation pins is associated with a low prevalence of pin-tract infection which arises following microbial colonization of the pin-skin interface. The pin tract infection rate of 7.9% of patients is relatively low when compared with the average rate in the literature.[1-4] This reduced rate of infection may be due to reduction in the extent of bacterial colonization of the pin sites. The low rate of pin-tract infection when compared with the average rate in the literature may also be attributable to the capacity of silver sulphadiazine and chlorhexidine to separately inhibit bacterial proliferation[11-16].

The difference in the rate of pin tract infection between the study group (7.9%) and the control group (23.7%) is statistically significant with p-value = 0.03The consistent growth of staphylococcus aureus from swabs taken at sites of pin tract infection suggests that skin, possibly that of the patient, is the source of contamination.

The results of this study compare favourably with those of previously published reports on the role of chlorhexidine and silver sulphadiazine in the prevention of infection in invasive devices such as epidural catheters[12&13], which are similar to external fixator pins in invasiveness. Chlorhexidine has a broad spectrum antimicrobial activity by causing membrane disruption; it has low toxicity and a very low tendency to cause skin sensitization[12]. Silver sulphadiazine, is not absorbed into the blood stream in patients with intact skin[18] and as such it is safe for use in pin site dressings where the surrounding skin is intact. Silver sulphadiazine cream is indeed safer than the silver sulphadiazine coated pin which has a tendency to cause increased serum levels of silver[7]. Silver sulphadiazine has the capacity to penetrate necrotic tissue and then the bacteria cell wall and bind to its deoxyribonucleic acid and prevent bacterial multiplication.[16] The combination of chlorhexidine and silver sulphadiazine appears from this study to be synergistic in their effect on bacteria and offers hope of enhancing prevention of pin-tract infection particularly in settings where chlorhexidine impregnated hydroxyapatite coated pins are not readily available and often repeated pin site dressing may not be possible because of inadequate manpower. The use of this combination of chlorhexidine and silver sulphadiazine dressings

should also significantly reduce the incidence of pin tract infection in patients treated with pins and plasters where access to pin sites for regular dressings is virtually impossible.

In conclusion, we advocate the use of a combination of 1% silver sulphadiazine cream and 5% chlorhexidine as dressings for external fixator pins based on the reduction in the prevalence of pin-tract infection.

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