Prevalence of Pin-Site Infection: The Comparison between Silver Sulfadiazine and Dry Dressing among Open Tibial Fracture Patients

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Objective: Pin-site infection is one of the most troublesome complications of external fixation. The present study aimed to compare the rate of pin-site infection following silver sulfadiazine with dry dressing.

Material and Method: This was a prospective randomized controlled study among 30 clients that compared the outcome of pin dressing using silver sulfadiazine (study group = 15) with dry dressing (control = 15). All eligible subjects of open tibial fracture had an emergency debridement with external fixation. Pin tract infection was considered to be present if superficial inflammation (erythema, cellulitis), serous or purulent discharge occurred around a pin site and deep infection of osteolysis around the pin, and sequestrum.

Results: Seven subjects (46.7%) had pin-site infection in the present study group while six subjects (40.0%) had it in the control group, with comparable severity.

Conclusion: There was no significant difference in prevalence of pin-site infection between both groups (p = 0.97). Therefore, either silver sulfadiazine or dry dressing could be advocated.

Keywords: Pin-site infection, Silver sulfadiazine, Open tibial fracture

External fixation is a standard choice of fixation for open fracture. The main advantages include low risk of implant-associated infection and ease for wound care, but the main disadvantages of this type of fixation is the risk of pin-site infection. The prevalence of pin-site infection reports ranged from 10-42% depending on the study site, study subject and follow-up period[1-3]. The most common causative organism of pin-site infection is gram-positive bacteria such as Staphylococcus aureus and Staphylococcus epidermidis[4-5]. The consequence of pin-site infection is pain, pin loosening and increased risk of implant-associated infection. Currently, there has been no standard guideline for pin-site care. A number of methods for pin-site care have been studied such as dry dressing, chlorhexidine, hydrogen peroxide, normal saline with conflicting results[5-9]. However, no previous study evaluates the efficacy of silver sulfadiazine, which is an effective local antibiotic for burn wound and can eradicate most common causative organisms for pin-site infection[10-13]. The objective of the present study was to compare the efficacy of silver sulfadiazine with dry dressing for pin-site infection prevention.

Material and Method

Permission to conduct the present study was granted by the Ethic Committee, Faculty of Medicine, Prince of Songkla University. The present study was done between September 2007 and June 2008. The patients who had open tibial fracture with requiring external fixation were candidates for inclusion in the present study. They were excluded if there was any immunocompromized condition (diabetes, and HIV) and malignancy. After emergency debridement and irrigation, the AO external fixator was used in each group. At day-3 post-operation, the subjects were randomized into two groups. The study group had daily pin-site dressing with normal saline and applied 0.5 ml
of 1% silver sulfadiazine. The control group had daily dry dressing and optionally removed dry scale by the patients. At home, the pin-site care was carried on by self-administered dressing.

The pin sites were monthly examined as outpatients for evidence of pin-site infection by an independent observer. Grade I-III according to the Checketts-Otterburns classification was classified as minor infection and Grade IV-V as major infections (Table 1). All of the subjects had monthly radiographic evaluation for the evidence of union.

Statistical analysis

The sample size required to detect the difference of prevalence equal to 30% of pin-site infection based on alpha and beta equal to 0.05 and 0.2, respectively was 40 pins in each group. The authors estimated the dropout rate was about 20%, so the total sample size was at least 15 patients per group. The authors analyzed the database on intention-to-treat analysis. Comparison between mean was analyzed using student t-test, while Chi-square was used to compare categorical data.

Results

Thirty open tibial fracture patients were included in this study. Fifteen cases were included in the present study group (silver sulfadiazine) while the other 15 were in the control group (dry dressing). The patient characteristics were male in 12 and 13 cases, and mean age of 29.1 and 30.1 years, respectively. The majority cause of injury was motorcycle in 11 and 12 cases, and was a comminuted fracture pattern in 13 and 10 cases. The location of fracture was distributed into proximal in five and one cases, midshaft in five and eight cases and distal in six and six cases. At least 80% were Grade III Gustilo’s classification(14) of open fracture in 13 and 12 cases. Four pins or less were mostly used in external fixation in 12 and 12 cases and about two-thirds required two surgical intervention of less. All variables had no statistically significant difference. The length of stay was 39.9 and 42.1 days, the mean duration of follow-up was 106.3 and 108.6 days, and the mean duration of parenteral antibiotic was 9.9 and 12 days, respectively.

In the present study and control group, the prevalence of pin-site infection was seven (43.7%) and six (40.0%), the minor infection (Grade I-III) was six of 15 (40.0%) and five of six (83.3%), the major infection (Grade IV or more) each had only one subject, and the number of two episodes or less was seven of seven subjects (100%) and five of six subjects (83.3%). These variables showed no statistical significance. One of seven subjects and one of six subjects needed to have premature external fixation performed.

Discussion

The present study showed that the silver sulfadiazine was not associated with a low prevalence of pin-site infection, which compared to the dry dressing. Nevertheless, the pin-site infection rate was 46.7 in the study group and 40% in the control group, which was relatively high when compared with the average rate in previous studies(15-19).

Pin-site infection usually starts from the pin-skin interface and then progresses to 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 of pin-site infection. The present study demonstrates that local decontamination using silver sulfadiazine cannot minimize the risk of pin-site infection. Other strategies to prevent pin-site infection such as silver-coated pins(20) should be further evaluated with sound methodological study in the future.

Despite using a randomized controlled study, the authors noted some limitations in the present study.

<table>
<thead>
<tr>
<th>Grading</th>
<th>Skin around the pin</th>
<th>Drainage from pin site</th>
<th>Radiographic findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Normal</td>
<td>None</td>
<td>Normal</td>
</tr>
<tr>
<td>I</td>
<td>Minimally inflamed</td>
<td>None</td>
<td>Normal</td>
</tr>
<tr>
<td>II</td>
<td>Inflammation</td>
<td>Serous</td>
<td>Normal</td>
</tr>
<tr>
<td>III</td>
<td>Inflammation</td>
<td>Pus</td>
<td>Normal</td>
</tr>
<tr>
<td>IV</td>
<td>Inflammation</td>
<td>Pus</td>
<td>Osteolysis around the pin</td>
</tr>
<tr>
<td>V</td>
<td>Inflammation</td>
<td>Flank pus</td>
<td>Sequestrum</td>
</tr>
</tbody>
</table>

Table 1. Checketts-Otterburns classification
Firstly, the authors did not blind the assessor, since the authors believe the present outcome might not be bias from treatment. Secondly, the one-month follow-up period might too long to early detect pin-site infection. Nevertheless, the authors informed the sign and symptom of infection to the patients to come back before the appointment in case of suspected infection.

The authors recommend only dry dressing for pin site care without local application of any antiseptic and antibiotic. In addition, the recent trend of minimizing the duration period of external fixation can minimize the risk of pin site infection.

In conclusion, local application of silver sulfadiazine does not minimize the prevalence of pin-site infection in open tibial fracture compared to dry dressings.

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Potential conflicts of interest

None.

References

อุบัติการณ์ของการติดเชื้อตำแหน่งหมุดตรึงกระดูก: การเปรียบเทียบระหว่างยาซิลเวอร์ซัลฟาไดอะไซด์กับการเปลี่ยนแผลแบบแห้งในผู้ป่วยกระดูกทิเบียหักแบบเปิด

วราห์ ยืนยงวิวัฒน์, บุญสิน ตั้งตระกูลวนิช

วัตถุประสงค์: การติดเชื้อตำแหน่งหมุดตรึงกระดูก (pin-site infection) เป็นหนึ่งในภาวะแทรกซ้อนที่เป็นปัญหาของการตรึงกระดูกภายนอก (external fixator) การศึกษานี้มุ่งหมายศึกษาประสิทธิผลของการใช้ยาซิลเวอร์ซัลฟาไดอะไซด์เปรียบเทียบกับการเปลี่ยนแผลแบบแห้ง (dry dressing) ในการป้องกันการติดเชื้อตำแหน่งหมุดตรึงกระดูก

วัสดุและวิธีการ: เป็นการศึกษาแบบสุ่มมีกลุ่มควบคุม (randomized control study) ให้ผู้ป่วยกระดูกทิเบียหักแบบเปิดจำนวน 30 ราย แบ่งเป็นกลุ่มละ 15 คน โดยกลุ่มที่ 1 ทำแผลด้วยยาซิลเวอร์ซัลฟาไดอะไซด์ และกลุ่มที่ 2 ทำแผลด้วยผ้าก๊อซแห้ง ทำการวินิจฉัยมีการติดเชื้อรอบหมุดตรึงกระดูกเมื่อมีอาบแผล, หนอง, การแทรกซ้อน (osteolysis) ของกระดูกที่ตรึง

ผลการศึกษา: ผู้ป่วยที่ 7 ราย (46.7%) มีการติดเชื้อรอบหมุดตรึง 1 กลุ่มที่ทำแผลด้วยยาซิลเวอร์ซัลฟาไดอะไซด์ และ 6 ราย (40.0%) ในกลุ่มที่ใช้ผ้าก๊อซแห้ง โดยทั้งสองกลุ่มมีความรุนแรงของการติดเชื้อมีความแตกต่างกัน

สรุป: อุบัติการณ์ของการติดเชื้อตำแหน่งหมุดตรึงกระดูกของทั้งสองกลุ่มนี้ไม่มีความแตกต่างอย่างมีนัยสำคัญ (p = 0.97) แต่ทั้งนี้ สมมุติฐานให้ใช้ยาซิลเวอร์ซัลฟาไดอะไซด์และการเปลี่ยนแผลแบบแห้ง