CARE OF EXTERNAL FIXATOR PIN SITES

By Debbie Lagerquist, RN, BS, Michelle Dabrowski, RN, BS, Cari Dock, RN, BS, Angela Fox, RN, BS, Michell Daymond, RN, BS, Kristin E. Sandau, RN, PhD, CNE, and Margo Halm, RN, PhD, ACNS

External fixators include pins and wires placed by surgeons to stabilize fractures such as those involving the tibia. In critical care, external fixators are more commonly used to stabilize cervical spine fractures. Because halo fixators secure cervical alignment, these devices allow early mobilization and shortened stays. However, halo-fixator complications include cranial pin loosening, localized infection, and superficial pressure sores.1,2 Loosening of cranial pins for halo fixators with signs of local infection, fever, headaches, or seizures deserves rapid notification of the surgeon and neuroimaging.3 Likewise, any tracking (open area with skin pulled away from pins) or clicking noises necessitate prompt assessment by the surgeon for potential loosening of pins.

Although daily assessment of pin sites to monitor for complications is not debated, the approach to pin-site care to prevent infection is less clear-cut. A common method of site care involves using normal saline to clean around each pin. Clinicians may question if this treatment is aggressive enough to prevent infection. Pin sites located in significant soft-tissue areas have a higher risk of infection.4 A skin infection surrounding pins can produce complications such as increased pain, delayed healing or fracture misalignment, osteomyelitis, or a systemic infection resulting in prolonged stay or readmission, and increased health care costs.5 Since this type of infection occurs in up to 20% of patients with external fixation devices,6 it is imperative that nurses take appropriate preventive measures, prompting the following PICO question: "In patients with external fixators, what solution and cleansing frequency of pin sites is associated with the lowest pin site infection rates?"
### Table 1
Matrix of studies

<table>
<thead>
<tr>
<th>Reference</th>
<th>Population (N)</th>
<th>Design and interventions</th>
<th>Findings*</th>
<th>Antibiotics/analgesics</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>W-Dahl and Toksvig-Larsen 5</td>
<td>External fixation (knee; 196 pins from 49 patients)</td>
<td>Prospective observational Solutions: CHG, sodium chloride</td>
<td>+CHG (fewer positive cultures and <em>Staphylococcus aureus</em> infection)</td>
<td>+CHG (less pain at weeks 6 and 10)</td>
<td>B</td>
</tr>
<tr>
<td>Grant et al 8</td>
<td>Skeletal pin (116 pin sites from 18 patients)</td>
<td>RCT Solutions: povidone-iodine, soft white paraffin ointment</td>
<td>+Povidone-iodine (fewer signs of infection)</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Chan et al 9</td>
<td>External fixation (tibia; 60 patients)</td>
<td>RCT Solutions: diluted povidone-iodine, normal saline</td>
<td>0</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>W-Dahl et al 10</td>
<td>External fixation (tibia; 50 patients)</td>
<td>RCT Solution and frequency: daily pin-site care, weekly pin-site care with 0.9% sodium chloride solution</td>
<td>0</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Camilo and Bongiovanni 11</td>
<td>External fixation-Illizarov apparatus (30 patients)</td>
<td>RCT Solution and dressings: normal saline with 10% polyvinylpyrrolidone-iodine solution, normal saline dressing</td>
<td>0</td>
<td></td>
<td>B (but small sample)</td>
</tr>
<tr>
<td>Ogbemudia et al 12</td>
<td>External fixation (fractures/orthopedic conditions; 170 pin sites from 38 patients)</td>
<td>Prospective, observational Solutions and dressings: 1% silver sulphadiazine/5% CHG dressing, 5% CHG dressing</td>
<td>+CHG-silver dressing</td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Patterson 13</td>
<td>External fixation, skeletal traction or halo pin (527 pins from 92 patients)</td>
<td>Multisite RCT Solutions and dressings: ½-strength *H₂O₂/gauze, ½-strength *H₂O₂/Xeroform gauze dressing, saline/gauze, saline/Xeroform gauze dressing, antibacterial soap/water and gauze, antibacterial soap/water and Xeroform gauze dressing, stable gauze/no pin cleansing</td>
<td>+H₂O₂/Xeroform gauze dressing</td>
<td></td>
<td>B</td>
</tr>
</tbody>
</table>

*Continued*
In an earlier prospective study, Gordon et al. followed up 27 children after teaching families a simple pin-care system with no cleansing of tibial pins other than daily showers. Reporting only 4% pin-site infections, these investigators recommended simple showering with no additional pin-site hygiene. In a more recent study, researchers found no difference in infection rates between showering and gentle cleansing of tibial pins with soft toothbrushes compared with 5% chlorhexidine dressings, as well as H₂O₂/Xerofoam gauze dressings (Cardinal Health, Dublin, Ohio). No significant difference in infection rates was documented between plain versus silver sulfadiazine dressings in another study.

**Frequency of Pin-Site Management**

Daily versus weekly cleansing of healthy pin sites or dressing change protocols appeared to make no difference for maintenance care.

### Table 1 (Continued)

<table>
<thead>
<tr>
<th>Reference</th>
<th>Population (N)</th>
<th>Design/ intervention</th>
<th>Pin-site infection</th>
<th>Pain</th>
<th>Antibiotics/ analgesics</th>
<th>Level of evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Egol et al</td>
<td>External fixation (distal radial fracture; 118 patients)</td>
<td>RCT Solutions, dressings, and frequency: weekly dry dressings/no pin-site care, daily pin-site care with ½ normal saline/½ H₂O₂, weekly Biopatch (CHG) dressings</td>
<td>0</td>
<td>0</td>
<td>0 antibiotics</td>
<td>B</td>
</tr>
<tr>
<td>Lethaby et al</td>
<td>External fixation or skeletal traction (6 studies)</td>
<td>Systematic review Solutions, dressings, and frequency: cleansing vs no cleansing (3 studies), cleansing solutions (2 studies), daily vs weekly pin-site care (1 study), dressing comparison (4 studies)</td>
<td>0</td>
<td></td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Cavusoglu et al</td>
<td>External fixation-Ilizarov apparatus (tibia; 610 pin sites in 38 patients)</td>
<td>RCT Solutions, showering, and techniques: pin-site cleansing with sterile gauze impregnated with 10% polyvinylpyrrolidone iodine (Polyod) every 3 days for first 15 days followed by daily showering and brushing pin sites with soap/soft toothbrush (group 1) and daily showering and cleaning crusts using sterile gauze impregnated with 10% polyvinylpyrrolidone iodine (group 2)</td>
<td>0</td>
<td></td>
<td></td>
<td>B</td>
</tr>
<tr>
<td>Yuenyongviwat and Tangtrakulwanich</td>
<td>External fixation (tibia; 30 patients)</td>
<td>RCT Dressings: silver sulfadiazine dressing, dry dressing</td>
<td>0</td>
<td></td>
<td></td>
<td>B</td>
</tr>
</tbody>
</table>

Abbreviations: CHG, chlorhexidine; H₂O₂, hydrogen peroxide; RCT, randomized controlled trial.

in 2 studies, other complications (pin loosening, need for removal before fracture healing) were assessed, but findings were not significant.

**Showering**

In an earlier prospective study, Gordon et al. followed up 27 children after teaching families a simple pin-care system with no cleansing of tibial pins other than daily showers. Reporting only 4% pin-site infections, these investigators recommended simple showering with no additional pin-site hygiene. In a more recent study, researchers found no difference in infection rates between showering and gentle cleansing of tibial pins with soft toothbrushes.
versus showering and cleansing crusts with sterile gauze impregnated with 10% polyvinyl-pyrrolidone iodine.

**Recommendations for Practice**

Collective studies on solutions, dressings, frequency of pin care, and showering demonstrated level B evidence (Table 2). In the 1 systematic review15 of 6 randomized controlled trials comparing different pin-site protocols in adults and children, researchers concluded that evidence was insufficient to recommend a specific technique to minimize infection and prevent complications. Therefore, the main recommendation was to minimize the risk of cross-infection at pin sites.

However, evidence from a clinical practice guideline on skeletal pin-site care from the National Association of Orthopaedic Nurses (level D) and manufacturers’ recommendations (level M) provide additional considerations for practice in the absence of stronger conclusive evidence. According to the clinical practice guideline, pin-site care should be done daily or weekly after the first 48 to 72 hours. Weekly pin-site care, which results in less cost and potentially better adherence by patients after discharge, is supported for (uninfected) pin sites.31,14 For pin-site management, chlorhexidine 2 mg/mL may be the most effective solution to promote comfort and reduce infection and the need for medication. Promising dressings in reducing pin-site infections include combined 5% chlorhexidine/1% silver sulphadiazine or Xeroform dressings.31,11 Until further studies support cost/benefit analysis for supplementing half-strength H2O2 with Xeroform dressings, clinicians are advised to wait before adding this extra cost to care.

Clearly, patients and their families should be taught pin-site care, including signs and symptoms of infection.5 Manufacturers’ recommendations (level M) provide additional considerations to guide practice in the absence of stronger conclusive evidence. One major manufacturer’s online guidelines for external limb fixators recommends that patients cleanse the pin site, from the first day that fixators are applied until the day they are removed, with sterile gauze impregnated with sterile water (or other solution) ordered by the surgeon.20 Patients are instructed to wash their hands, and using a fresh swab for each pin, remove any crust and then dry with a fresh swab. Additionally, patients are instructed to cleanse the length of each pin and wrap with loose gauze for about 5 days until pin sites are dry. No showering is advised until after 10 days.

In regard to guidelines for halo traction pins, many agencies recommend half-strength H2O2 and normal saline as the preferred cost-effective solution for (uninfected) pin sites. More recently, an orthotics company’s halo guidelines include recommendations for using isopropyl rubbing alcohol (or half-strength rubbing alcohol with normal saline) a minimum of once a day.21 Because little evidence exists on the efficacy of rubbing alcohol, more research is needed to best inform practice about the use of this solution. One cleansing agent, iodine, can be ruled out for use in modern practice because research has shown that it interferes with tissue healing.22 Clearly, guidelines for pin-site management must be interpreted contextually; for example, a patient who lives in a country without access to clean shower water may need different cleansing recommendations. Second, type and frequency of cleaning will vary depending on whether the patient has an open wound or has undergone reconstruction by a plastic surgeon.

Finally, an orthopedic pin-care protocol from Hennepin County Medical Center23 in Minneapolis, Minnesota, is provided for staff to incorporate into their practice and patient education. This protocol classifies pin-site appearance and indicates the appropriate care. For example, for pin sites with “no redness or drainage,” weekly cleansing with normal saline is recommended. However, for pin sites that are “slightly red,” cleansing with normal saline is recommended. Finally, for pin sites that are “red and tender with a colorless watery or clear yellow drainage,” cleansing with half-strength H2O2 is recommended. For any “worsening redness, draining, or swelling,” patients are instructed to call the orthopedic clinic to start treatment with antibiotics. Because care of external fixator pin sites has been studied in a heterogenous fashion, further research including multisite studies is recommended to compare outcomes of products currently used in practice.

**FINANCIAL DISCLOSURES**

None reported.

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**Table 2**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Meta-analysis of multiple controlled studies or metasynthesis of qualitative studies with results that consistently support a specific action, intervention, or treatment</td>
</tr>
<tr>
<td>B</td>
<td>Well-designed controlled studies, both randomized and non-randomized, with results that consistently support a specific action, intervention, or treatment</td>
</tr>
<tr>
<td>C</td>
<td>Qualitative studies, descriptive or correlational studies, integrative reviews, systematic reviews, or randomized controlled trials with inconsistent results</td>
</tr>
<tr>
<td>D</td>
<td>Peer-reviewed professional organizational standards, with clinical studies to support recommendations</td>
</tr>
<tr>
<td>E</td>
<td>Theory-based evidence from expert opinion or multiple case reports</td>
</tr>
<tr>
<td>M</td>
<td>Manufacturer’s recommendation only</td>
</tr>
</tbody>
</table>

*From Armola et al,19 with permission.*
REFERENCES
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