Efficacy of Preoperative Skin Traction in Hip Fracture Patients: A Prospective, Randomized Study

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Objective: To compare the analgesic benefit of preoperative skin traction with the placement of a pillow under the injured extremity in patients with hip fractures.

Design: Prospective, randomized clinical study.

Setting: University-affiliated teaching institution.

Patients and Participants: One hundred consecutive patients with hip fractures admitted to the authors’ institution who met inclusion criteria were enrolled. Fifty-five patients had femoral neck fractures, and forty-five patients had intertrochanteric fractures. The average patient age was seventy-eight years.

Intervention: All patients were preoperatively randomized into two intervention groups. One group underwent placement of five pounds of skin traction on the injured extremity, whereas the second underwent placement of a pillow under the injured extremity. Fifty patients were enrolled in each intervention group.

Results: With respect to immediate postintervention pain levels, patients treated with a pillow showed a trend toward better pain relief, as compared with patients treated with skin traction; however, this was not statistically significant. On the morning after admission, patients treated with a pillow had a statistically significant greater reduction in pain (\(p<0.04\)). These patients also requested a statistically significant lower amount of pain medication (\(p<0.01\)).

Conclusions: The authors think that preoperative skin traction in patients with hip fractures does not provide significant pain relief, as compared with pillow placement under the injured extremity, and thus should not be routinely performed in this patient population for analgesia.

Key Words: Hip fracture, Pain relief, Randomized controlled trial, Skin traction.

Controversy exists over the use of preoperative skin (foam boot) traction as a method of reducing pain in patients who sustain a hip fracture. Proponents of skin traction have proposed analgesia to be the main benefit, with secondary possible benefits including protection against further fracture displacement with resultant damage to periarticular vessels and soft tissues, reduction in the force required to perform fracture reduction at surgery, and indication to the nursing staff of injury to the involved extremity (1,9,10). Skin traction is not a benign treatment, however, and has been associated with numerous adverse effects, including pressure sores, nerve compression, blistering secondary to mechanical shearing forces applied to the skin, interference with nursing care, vascular compromise, and increased pain during its application and with patient movement in bed (1,9,10). At the authors’ institution, this practice has recently been replaced by placement of a pillow under the thigh of the injured extremity; however, the use of preoperative skin traction still remains standard practice at many hospitals.

This prospective, randomized study was performed to compare the preoperative analgesic benefit of skin traction with the placement of a pillow under the injured extremity in patients with hip fractures. The potential additional secondary benefits of skin traction as listed above, however, were not addressed in this study and were not the focus of this investigation.

MATERIALS AND METHODS

The study design was a prospective, randomized clinical trial. The study population included all patients with an isolated femoral neck or intertrochanteric hip fracture admitted to the authors’ institution between June 1995 and February 1997. Exclusion criteria included patients younger than fifty years of age, patients with underlying dementia or other concomitant injury, and patients with delayed hospital presentation (e.g., more than twenty-four hours after the initial injury). Any concurrent injury would have served as an additional source of pain and was thought to be a factor that would confound the
RESULTS

One hundred patients, fifty in each intervention group, were enrolled. Seventy-eight patients were women and twenty-two were men; fifty-five patients sustained a femoral neck fracture and forty-five sustained an intertrochanteric fracture. Patient age averaged 77.8 years (range 50 to 97 years); the time from hospital presentation to surgical treatment averaged thirty hours (range 9 to 140 hours). Similar pain assessment levels (mean 6.0) were reported by patients in both intervention groups before placement of the randomized treatment. In addition, differences in baseline patient characteristics between the two randomized intervention groups were assessed using a Mann-Whitney U test. Analysis showed no statistically significant differences in any of these baseline characteristics (Table 1), indicating that the randomization protocol was successful in producing two equivalent patient groups.

Pain Relief Fifteen Minutes After Intervention

Table 2 shows the reduction in pain for each patient group fifteen minutes after the intervention. Patients treated with a pillow experienced slightly greater reduction in pain than did those in the traction group (1.44 versus 1.24), but this difference was not statistically significant.

To assess whether individuals initially expressing high levels of pain received more immediate pain relief as a result of their respective interventions, we compared the reduction in pain fifteen minutes after intervention between those individuals initially expressing high levels of pain with those who expressed relatively low levels of pain. An initial (preintervention) pain level of zero to five was considered low, and a pain rating of six to ten was considered high. Among those who expressed high levels of pain before the intervention, the traction group reported slightly greater relief of pain (Table 3). For those who expressed low levels of pain, the pillow group reported slightly better relief of pain than those in the traction group. None of these differences, however, were statistically significant.

Pain Relief the Morning After Intervention

Of the 100 patients enrolled in the study, four had surgical intervention on the day of admission. Of the remaining ninety-six patients, forty-nine patients were in the pillow group and forty-seven were in the traction group. There were no statistically significant differences

<table>
<thead>
<tr>
<th>TABLE 1. Baseline patient characteristics of those individuals randomized to pillow or traction intervention</th>
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</thead>
<tbody>
<tr>
<td>Characteristic</td>
</tr>
<tr>
<td>No. patients</td>
</tr>
<tr>
<td>Time from admission to surgery (days)</td>
</tr>
<tr>
<td>Age (yr)</td>
</tr>
<tr>
<td>Patient’s reported pain before intervention</td>
</tr>
<tr>
<td>% intertrochanteric fracture</td>
</tr>
</tbody>
</table>

Values are expressed as mean (standard deviation). The p value reflects test of whether the mean value for pillow group is different from that of the traction group. *chi-squared test.
As previously stated, on average, pain decreased by 2.82 points for the pillow group and by 1.76 points for the traction group. Using analysis of variance, this statistically significant difference is more attributable to the intervention provided rather than the amount of pain medication administered \((p = 0.01)\). There was no statistically significant difference in the average pain relief experienced among patients requesting different rates of pain medication. Pain decreased by 1.51 points overall for those patients who did not request pain medication, by 2.35 for those with a low medication quotient, and by 2.22 points for those patients with a high medication quotient. The difference among these means was not statistically significant \((p = 0.54)\). As a result, pain relief reported by patients did not correlate with the amount of pain medication administered. Instead, analysis of variance showed that the type of intervention (i.e., pillow or traction) was a more important factor in the reduction of pain than was the amount of medication administered to the patient.

### Medication Requests Before Surgery

Patients randomized to the traction group requested more pain medication overall than did those in the pillow intervention group. Thirty-nine (78 percent) of fifty patients in the pillow group requested one or more pain medication dosages per twenty-four hours, whereas more than 90 percent of the patients treated with traction requested one or more pain medication dosages \((\text{chi-squared} = 4.61; p = 0.03)\) (Table 4). Furthermore, patients in the traction group were also more likely to request pain medication at a higher rate than were those in the pillow group. Thirty-two (64 percent) of the fifty patients randomized to traction requested medication at a rate of 2.44 dosages or greater per twenty-four hours, consistent with a high medication quotient, whereas only 36 percent of the patients randomized to the pillow group requested medication at a similar rate \((\text{chi-squared} = 7.84; p < 0.01)\) (Table 4).

### Patient’s Self-assessment of Pain Relief Efficacy (Medication Versus Intervention)

Fifty-four percent of patients in the traction group, as compared with only 34 percent in the pillow group, reported that their intervention was a painful experience. The data also showed that most patients in both groups (62 percent of the pillow group and 78 percent of the traction group) reported that their intervention was a painful experience.

### Table 2. Differences in pain relief by intervention group

<table>
<thead>
<tr>
<th>Medication Requests Before Surgery</th>
<th>Pillow 6.12 (2.80)</th>
<th>Traction 5.86 (2.73)</th>
<th>Average reduction</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Immediate before intervention</td>
<td>4.68 (2.89)</td>
<td>4.62 (2.42)</td>
<td>1.44 (2.08)</td>
<td>0.60</td>
</tr>
<tr>
<td>Pain 15 minutes after intervention</td>
<td>1.51 (2.35)</td>
<td>1.76 (1.82)</td>
<td>1.24 (1.67)</td>
<td></td>
</tr>
</tbody>
</table>

Values are expressed as mean (standard deviation). The \(p\) value reflects test of whether the average reduction for pillow group is different from that of the traction group, as assessed using one-way analysis of variance.

### Table 3. Differences in average pain relief fifteen minutes after intervention, stratified by preintervention pain level

<table>
<thead>
<tr>
<th>Preintervention pain level</th>
<th>Average reduction in pain</th>
<th>Traction − Pillow</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Pillow</td>
<td>Traction</td>
<td></td>
</tr>
<tr>
<td>0–5</td>
<td>0.68</td>
<td>−0.60</td>
<td>0.45</td>
</tr>
<tr>
<td>6–10</td>
<td>−1.05</td>
<td>−0.60</td>
<td>0.20</td>
</tr>
</tbody>
</table>

N, newton.

### Table 4. Number of patients requesting pain medication before surgery by intervention group

<table>
<thead>
<tr>
<th>Medication category</th>
<th>Pillow (62)</th>
<th>Traction (78)</th>
<th>Totals (140)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No medication</td>
<td>11</td>
<td>5</td>
<td>16</td>
</tr>
<tr>
<td>Low medication</td>
<td>21</td>
<td>13</td>
<td>34</td>
</tr>
<tr>
<td>High medication</td>
<td>18</td>
<td>32</td>
<td>50</td>
</tr>
<tr>
<td>Column totals</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
</tbody>
</table>

traction group) reported that they had received more pain relief from medication than the respective intervention. Neither of these findings reached statistical significance.

Three patients had complications related to placement of skin traction. One patient experienced transient sensory changes over the dorsum of the foot that resolved with adjustment of the skin traction boot. Two patients experienced superficial skin blisters that were treated with silvadene cream and dressing changes. Both patients went on to heal these areas of involvement without permanent sequelae.

Statistical Power of the Study

With fifty individuals randomized to each group, this study had 80 percent power to detect a difference in average pain reduction of 1.064 between the pillow and traction groups. A replicate study, enrolling similar patients, would require only twenty patients (ten in each group) if the objective was to enroll only enough patients to achieve 80 percent power to detect a difference in average pain reduction of 2.5 between intervention groups. Power analysis further shows that nearly 500 patients in each group would be required to have sufficient statistical power to detect a statistically significant difference in pain reduction of 0.4, and that nearly 1,000 patients would be required in each group to detect a statistically significant difference of 0.2.

DISCUSSION

Controversy exists over the use of preoperative skin traction as a method of reducing pain for patients who have sustained a hip fracture (2,4,7,8). At the authors’ institution, this practice has recently been replaced by placement of a pillow under the thigh of the injured extremity. The use of skin traction, however, is still standard practice at many hospitals around the world. In this study, patients who were treated with a pillow under the injured extremity experienced a trend toward greater pain reduction immediately after pillow placement, as compared with those patients who were placed in skin traction. When comparing pain relief for both groups of patients on the morning after admission, patients treated with a pillow experienced significantly greater reduction (10 percent) in pain. This reduction in pain was not found to correlate with a greater intake of pain medication. In contrast, patients in the traction group experienced less pain reduction, and as a result, these patients required a higher pain medication intake. These findings suggest that pillow placement under the injured extremity is more effective in reducing pain and that traction placement may cause pain and result in higher medication requirements.

In addition, a higher percentage of patients in the traction group felt that their intervention was a painful experience, as compared with the pillow group (54 percent versus 34 percent), although this difference did not reach statistical significance. This suggests that placement of skin traction is more painful than placement of a pillow under the injured extremity. Both involve movement of the extremity, but pillow placement takes place in a matter of seconds, whereas a longer time and greater movement of the injured extremity are required for placement of skin traction. Furthermore, pillow placement was performed under the thigh of the injured lower extremity in the patient’s resting position, which presumably correlated with the position of maximal comfort for the patient; therefore, immobilization in this position should result in less discomfort.

Our findings confirm previous reports in the literature that have questioned the use of skin traction in this patient population. Finsen et al. (4) reported no differences in overall pain control in eighty patients with hip fractures who were randomized to no traction, skin traction, or skeletal traction. In 1993 Anderson et al. (2) described 252 patients with hip fractures who were randomized to skin traction or no immobilization. They found no differences in experienced pain, analgesia required, frequency of pressure sores, or ease of surgery between the two groups. Needoff et al. (7) presented results for sixty-seven patients with hip fractures who were randomized to skin traction or no traction and found no differences in patient pain assessment and analgesic use. All three articles concluded that there was no analgesic benefit of preoperative traction for patients with hip fractures and recommended that its routine practice should be discontinued in this patient population. These articles did not consider, however, the effect of potential confounders (2,4,7).

This is the first article to statistically account for potential confounding factors in the study design. The design of this investigation was a prospective, randomized, controlled clinical trial with sufficient numbers of patients enrolled to answer the proposed research question. Patients were not medicated at the time of initial pain assessment so as not to confound their baseline pain levels. The randomization protocol was successful in producing two groups with similar underlying characteristics for this study comparison (e.g., fracture type, patient age and sex, and baseline preintervention pain levels). The main limitation of this investigation centered around the ability to adequately assess and quantify pain objectively. Pain expression is a complex subjective phenomenon mediated by numerous factors (5). The use of a ten-point analogue scale has been widely reported in the literature and has been previously validated for research purposes. This scale is probably limited in its overall scope and ability to fully reflect all the complex intricacies involved in pain expression (5).

In conclusion, the results of this study show no benefit of skin traction in terms of preoperative pain relief for patients with hip fractures, as compared with simple pillow placement under the injured extremity. Patients who underwent pillow placement showed a trend toward better pain relief and required less pain medication intake than did those treated with skin traction. As a result,
preoperative skin traction for analgesic benefit in patients with hip fractures is no longer routinely performed at the authors’ institution. However, the additional proposed benefits of skin traction (i.e., prevention of fracture displacement and possible facilitation of fracture reduction at time of surgery) were not addressed in this study and should be addressed in subsequent studies. Consequently, the best overall emergent treatment for this group of patients is yet to be determined and should be the topic of future investigation.

REFERENCES