ABSTRACT

Background: There are an estimated 150,000 hip fractures per year in the United States, with estimated costs of care between $10.3 billion and $15.2 billion. With such high costs and an increasing burden of care, there has been interest in newer methods to increase efficiency of care. One such method is expedited fracture care, with earlier operative intervention. The purpose of this study was to determine if intervention within six hours of admission decreased costs with no change in the rate of major complications.

Methods: A retrospective review of all patients age >65 undergoing operative intervention for a proximal femur fracture over a two year period were identified. Patients were divided into two groups: those undergoing operative intervention < six hours after admission (early) and those undergoing operative intervention > six hours after admission. Patient age, average length of stay, and complication rates were determined for the two groups.

Results: Our study identified 657 patients, 111 of which underwent early intervention with the remaining 546 undergoing late intervention. The average length of stay for the early intervention group was 4.11 days, compared to 5.68 days for the late intervention group (p=0.0005). There was a significant difference in average cost between the two groups. The average cost of the early intervention was $49,900, with the average cost of late intervention being $65,300 (p = 0.0086). There was no significant difference in incidence of major complications between the two groups.

Conclusion: Programs emphasizing early intervention for hip fractures have the potential for large healthcare savings, with an average savings of $15,400.

Level of Evidence: Level IV, therapeutic case series.

INTRODUCTION

The population of Americans older than age 65 is increasing and with this increase the incidence of hip fractures is also expected to rise. Hip fractures occur at an estimated rate of 150,000 per year in the United States and account for 7% of all osteoporosis related fractures. With such a high prevalence, hip fracture care has been thought to reach costs estimated to be $10.3 billion to $15.2 billion dollars annually. As hip fracture care places such a large burden on the healthcare system, methods to increase efficiency of care and safely decrease the costs associated with the care of these patients have become particularly attractive.

Multiple investigations have evaluated the timing of hip fracture surgery. Despite ongoing controversy, there is a trend toward expedited surgical intervention as outcomes have been shown to improve with surgical intervention within 48 hours of admission. Some centers have even proposed intervention within six hours of admission, as there is some data to indicate that this may be safe for properly selected patients. In addition to being associated with improved outcomes, expedited surgical intervention for fractures has also shown some promise for decreasing the costs associated with fracture care. With these ongoing controversies there is a paucity of data in the literature regarding the financial implications of expedited hip fracture care.

We present a series of two cohorts of geriatric hip fracture patients. One cohort undergoing surgical intervention within six hours (early) of admission and a second cohort in which surgical treatment was delayed greater than six hours (late) from the time of admission. Our hypothesis was that early surgical intervention would significantly decrease the costs associated with inpatient treatment. Our null hypothesis was that there would be no change in the rate of major complications between the early and late intervention groups.
METHODS

Institutional review board (IRB) approval was obtained prior to initiation of the study. All patients age > 65, undergoing operative intervention for a proximal femur fracture at a community based level II trauma center over a two year period (2011-2013), were identified using current procedural terminology codes. Patient age, average length of stay, direct variable and direct fixed expenses as well as major complication rates were determined for two groups of patients, those undergoing early surgical intervention and those undergoing late surgical intervention.

Direct variable and direct fixed expenses were defined in a similar fashion as previously done by Kleweno et al\(^1\) in which direct variable expenses consisted of those costs pertaining to patient care that vary with patient volumes, i.e. length of stay, supplies, pharmacy, operating room time, laboratory, radiology and therapy. Direct fixed expenses were defined as those pertaining to patient care, but not varying with patient volume i.e. managerial salaries, overhead.

<p>| Table 1. Average length of stay (LOS) in days for the early and late treatment groups. ((F=12.26, p=0.0005)) |
|-------------------------------------------------|---------------------------------|-----------------|</p>
<table>
<thead>
<tr>
<th>n</th>
<th>Ave LOS (days)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early(0-6hrs.)</td>
<td>111</td>
<td>4.11</td>
</tr>
<tr>
<td>Late(&gt;6hrs.)</td>
<td>546</td>
<td>5.68</td>
</tr>
</tbody>
</table>

| Table 2. Sum of direct variable and direct fixed expenses for inpatient surgical treatment of hip fractures between the early and late groups (\(F=6.95, p=0.0086\)). |
|-------------------------------------------------|-----------------|-----------------|
| Average Cost (CI=95%) | p-value |
| Early(0-6hrs.) | $49,900 ($41,400-$60,300) | P=.0086 |
| Late(>6hrs.) | $65,300 ($61,100-$69,600) | |

| Table 3. Rates of major complication between the early and late intervention groups. |
|-------------------------------------------------|-----------------|---------------|
| Complication | n | % | n | % | p-value |
| CVA | 1 | 0.9 | 9 | 1.6 | 0.3191 |
| Hemorrhage | 0 | 0 | 3 | 0.5 | 0.5719 |
| PE | 0 | 0 | 4 | 0.7 | 0.4744 |
| Prosthetic | 0 | 0 | 1 | 0.2 | 0.8303 |
| Sepsis | 1 | 0.9 | 6 | 1.1 | 0.3910 |
| Total | 2 | 1.8 | 23 | 4.1 | 0.1312 |

STATISTICAL ANALYSIS

Cost and length of stay were compared independently for the early and late intervention groups using \(\chi^2\) methods. Costs and length of stay were further examined using analysis of variance for comparison. Values were log-transformed in order to stabilize variances. 95% confidence interval values were computed for each group.

RESULTS

A total of 657 patients were included, of those 111 underwent surgical intervention within six hours of admission, with the remaining 546 undergoing intervention at a time greater than six hours from the time of admission. Average age for the early intervention group was 79 years. Average age for the late intervention group was 81 years.

No Transient Ischemic Attack (TIA) or Deep Vein Thrombus (DVT) occurred in either group.

DISCUSSION

Review of the current data shows a significant difference in cost for two groups of patients, those undergoing early and late operative fixation of hip fractures. An average cost savings of $15,400 was present for each patient treated within 6 hours of admission when compared to those treated in a more delayed fashion. This translates to an overall cost savings of over $1.7 million dollars between the two cohorts when controlling for the greater number of patients in the late intervention group.

Average length of stay for the two groups was also significantly different which may explain a portion of the discrepancy between the two groups. It has been shown that approximately 29% of direct variable expense can be attributed to length of stay\(^1\). Our results are in agreement to studies that have identified cost savings for treatment of femoral shaft fractures and pelvic ring injuries as the length of hospital stay decreases\(^11,12\). Specifically, Vallier et al\(^12\) showed increased profitability for treatment of pelvic ring disruptions, when operative intervention was undertaken within 72 hours after admission. Similarly, Dy et al\(^14\) evaluated two systems based strategies designed to increase the likelihood of operative intervention occurring within 48 hours of admission. They found that when between 88 and 93% of patients underwent intervention within the given time frame fracture care remained cost effective. Our data differs from previous reports as our average direct costs for both cohorts was found to be higher than those previously described\(^13,15-17\). Despite these differences in cost, the overall cost effectiveness with early intervention is maintained and similar to those previously presented.

Timing of hip fracture surgery continues to be controversial despite reports of improved patient outcomes.
with expedited surgical intervention\textsuperscript{5,8,9}. Some centers have advocated intervention within six hours as a mode to improve mortality after hip fracture surgery\textsuperscript{9}. Review of our data shows no increase in major complications for those patients treated within six hours of admission, lending support to argument that expedited surgical intervention for hip fractures is likely safe.

Limitations of our study include the fact that selection bias may exist between the two groups, as the early intervention group may have had fewer co-morbidities and undergone fewer diagnostic interventions prior to undergoing surgical fixation. These differences would have potentiated the higher costs for the late intervention group. Healthier patients would also be expected to have an average length of stay that is shorter than those with a higher number of comorbidities as this has been shown to be a determinant of length of stay\textsuperscript{18}. This increased length of stay, also may have perpetuated the cost difference between the two groups.

CONCLUSION

Programs emphasizing expedited hip fracture surgery have the potential to produce large healthcare savings. Patients undergoing hip fracture surgery within 6 hours have decreased cost of treatment with no difference in major complications.

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