Factors Affecting Revenue From the Management of Pelvis and Acetabulum Fractures

Heather A. Vallier, MD, Beth Ann Cureton, MD, and Brendan M. Patterson, MD, MBA

**Objectives:** The purpose was to define charges and reimbursement in the management of pelvis and acetabulum fractures and to identify opportunities for revenue enhancement.

**Design:** Retrospective review.

**Setting:** Level 1 trauma center.

**Patients/Participants:** Four hundred sixty-five patients with 210 pelvic ring injuries and 285 acetabulum fractures.

**Intervention:** All fractures were treated surgically.

**Main Outcome Measurements:** Professional and facility charges and collections were determined for each patient. Costs of care and profitability were calculated for patients with isolated pelvis or acetabulum fractures.

**Results:** Definitive fixation was ≤24 hours of injury in 35% and >72 hours in 24%. Mean hospital length of stay (LOS) was 9.2 days, with mean 3.1 days in the intensive care unit (ICU). Mean facility charges were $51,069 with collections of $22,702 (44%). Mean orthopaedic professional charges were $20,184 with collections of $4629 (23%). Combined pelvis and acetabulum fractures had the highest facility collection rates (49%) with lower professional collections (21%) versus isolated fractures (25%, P = 0.03). The payer mix had significantly more commercial (27%), managed care (27%), and Bureau of Worker’s Compensation (10%) versus the entire hospital.

**Conclusions:** Patients with multiple injuries generated higher facility charges and collection rates. Professional collection rates were lower in patients with more than 1 surgical procedure in the same setting. Trauma patients were more likely to have commercial, managed care, and Bureau of Worker’s Compensation insurance versus the entire hospital. Fractures managed definitively within 24 hours were associated with shorter LOS, shorter ICU stay, and fewer complications, resulting in lower treatment expenses. Fracture care was profitable to the hospital when definitively completed within 72 hours. Prolonged LOS and complications were associated with larger costs of care.

**Key Words:** pelvis ring injury, acetabulum fracture, hospital costs, revenue, insurance coverage

**Level of Evidence:** Economic Level IV. See Instructions for Authors for a complete description of levels of evidence.


**INTRODUCTION**

Subspecialty services at trauma centers are unique and highly functional, enhanced through maturation over time. They provide a superior level of care, often on an expeditious basis. Severely injured patients have less morbidity and mortality when treated at regional trauma centers. Unfortunately, many trauma centers have closed because of financial insolvency. Others remain threatened because of rising expenses, declining reimbursements, and inability to provide emergent specialty care.

Pelvis and acetabulum fractures are among the unique services available at trauma centers. Between 75% and 85% of patients with these fractures will have injury to other systems, underscoring the necessity for a well-experienced team of related trauma providers. Trauma centers have the expectations of continuous reassessment and improvement along with the operational and financial challenges of maintaining highly specialized services with frequently erratic and unconventional workflows—all of which greatly increase their costs.

The purposes of this project were to characterize professional and facility charges and reimbursement for patients treated surgically for pelvis and acetabulum fractures and to assess the profitability of these patients. One hypothesis was that uninsured and underinsured patients would become more frequent over the period of study and would threaten net revenue. A second hypothesis was that both delayed definitive care and the occurrence of complications would significantly increase treatment costs. We propose to identify opportunities to improve revenue related to pelvis and acetabulum fracture care.

**PATIENTS AND METHODS**

A retrospective review of an IRB-approved database identified 648 skeletally mature patients treated between 2000 and...
and 2006 at a level 1 trauma center with surgery for pelvic ring injury and/or acetabulum fracture. Patients with inpatient rehabilitation during the initial episode of care were excluded. Patients with incomplete financial records were excluded. A total of 465 patients with 210 pelvic ring injuries and 285 acetabulum fractures were studied.

Facility charges were defined as inpatient hospital charges and collections related to the trauma admission and subsequent inpatient and outpatient care for 6 months. These were determined with the Trendstar billing system (IDEA Consulting Group, Inc, Palm Harbor, FL). Facility charges included all equipment, supplies, implants, nonphysicians’ services, and technical charges related to the emergency room, operating room, inpatient hospital, and outpatient clinic. Orthopaedic professional fees and collections were abstracted from the EPIC billing system (Epic Systems Corp, Madison, WI). Professional charges included surgical and nonsurgical care during the initial trauma admission and outpatient care for the subsequent 6 months. This included management of other musculoskeletal injuries in patients with multiple fractures. Medical records were reviewed to exclude any facility or professional care not related to the initial trauma admission. All facility and professional charges and collections were adjusted to 2006 levels based on annual rates of inflation.

Length of intensive care unit (ICU) stay and hospital length of stay (LOS) were determined. ICU stays included all regular and step-down ICU days, whereas standard hospital units may or may not have had additional monitoring capabilities such as telemetry or sleep apnea but still were considered part of the non-ICU hospital stay. Complications related to injury and treatment were identified. These included infection, pneumonia, adult respiratory distress syndrome, organ failure, deep venous thrombosis, and pulmonary embolism. Facility costs were calculated. These were adjusted to 2006 levels based on rates of inflation. Direct expenses included fixed and variable components for staffing (nonphysician) salaries, benefits, and other expenses; as well as supplies and implants. Indirect expenses included overhead costs for administration and environmental maintenance.

Statistical analysis was performed. Continuous variables including age, Injury Severity Score (ISS), time to definitive treatment, payment, charge, reimbursement rate, LOS, length of ICU stay, and facility costs were reported as a mean with SD. Student t test was used to analyze continuous variables. Categorical variables, including payer, transfer status, time of treatment, isolated versus multiple injuries, and trauma-related complications, were reported as percentages and analyzed with Fisher’s exact test or analysis of variance. Statistical significance was determined at P < 0.05.

RESULTS

Four hundred sixty-five patients with 210 pelvic ring fractures and 285 acetabulum fractures were included. Thirty patients had both pelvic ring and acetabulum fractures treated surgically. Fractures were classified by the Orthopaedic Trauma Association system.21 Pelvis ring injuries were 61-B (n = 71) and 61-C (n = 139). Acetabulum fractures were 62-A (n = 124), 62-B (n = 123), and 62-C (n = 38). With a mean age of 39.9 years (range, 16–86) and a mean ISS of 24.8 (range, 9–66), 317 men and 148 women were treated. One hundred eight patients had injuries isolated to the pelvis or acetabulum and 357 had multiple injuries, including other fractures and/or other system trauma. Definitive fracture fixation was performed within 24 hours of injury in 165 patients (35%), within 24–48 hours in 130 patients (28%), within 48–72 hours in 57 patients (12%), and more than 72 hours after injury in 113 patients (24%). Mean time to definitive fixation of the pelvis or acetabulum was 2.9 days. Mean hospital LOS was 9.2 days (median 7.0 days, range 2–33 days), which included a mean of 3.14 days (median 1.0 day, range 1–21 days) in the ICU. Forty-five patients (9.7%) were not admitted to the ICU. Patients were admitted to the ICU at the discretion of the admitting general trauma surgeon. Reasons for patients with isolated pelvis and acetabulum trauma to be admitted to the ICU included hemodynamic instability on presentation (n = 17), advanced age (n = 8), intubation before admission due to intoxication (n = 7), open pelvis fracture (n = 1), postoperative monitoring (n = 17), and other trauma surgeon discretion (n = 13).

Table 1 shows the facility and professional charges and collections. Mean facility charges per patient were $51,069, and mean facility collections were $22,702 (44% of charges). Mean orthopaedic professional charges were $20,184, and mean collections were $4629 (23% of charges). The professional component included all patient evaluation and management services and procedural services, operative and nonoperative, for the pelvis and acetabulum and other musculoskeletal extremity injuries. Although the mean professional charges and collections for patients with multiple injuries were almost twice as much as for isolated injuries, the percent collected was not significantly different (23% vs. 25%, P = 0.063). However, facility collections were significantly higher in the multiple trauma patients (45% vs. 40%, P = 0.001). Patients with pelvic ring fractures also had a higher percent of facility collections versus those with acetabulum fractures (41% vs. 35%, P < 0.001), whereas the orthopaedic professional percent collected was 23% for both groups. Patients with pelvic ring fractures were more likely to have multiple injuries, which likely contributed to the larger facility and professional charges and better facility collections (47% vs. 40%, P < 0.0001) compared with fractures of the acetabulum.

The highest mean revenue per patient was generated in patients with combined pelvis and acetabulum fractures. Total mean charges in this group were $110,791 with $45,267 collected (41%), which was driven by a 49% collection rate for the facility. Interestingly, professional collections in the combined pelvis and acetabulum patients were only 21% [P = 0.03 vs. isolated injury (25%)], likely due to multiple procedure discounting of professional charges for procedures performed on the same day, despite a better payer mix in the more severely injured patients.

Mean charges and collections were determined based on the payer (Table 2). Although Bureau of Worker’s Compensation (BWC) patients had the highest collections (68% for facility and 43% for professional), they comprised less than 10% of the patients treated. Of note, commercial and managed care payers generated some of the highest mean total collections, 40% and 37%, respectively. However,
Figure 1 depicts a decreasing trend of commercial and HMO patients during the course of the study, with commercial insurance for 32% of patients in 2000 and 22% of all patients in 2006. Nongovernmental-managed care patients (HMO) comprised 26% of our population in 2000 and 19% in 2006. Concurrent with these trends were increased numbers of uninsured and Medicaid patients by 2006. Nine percent of patients had Medicaid in 2000 versus 25% in 2006.

The lowest mean total collections were noted in uninsured patients (Table 2). In our hospital, collections from self-pay trauma patients arise primarily from automobile insurance payments. These payments are directly credited to the facility accounts and are not credited to physician accounts. If professional collections are obtained from self-pay patients, they are a result of the patients actually making some payment on the charges. When compared with insured patients, those patients with no insurance were more likely to be younger in age (33.3 vs. 40.9 years \( P = 0.0004 \)) and have a lower ISS (19.7 vs. 25.5, \( P = 0.0008 \)) (Table 3). Twenty of the uninsured patients (36%) had an injury isolated to the pelvis ring or

### Table 1. Mean Orthopaedic Professional and Facility Charges and Collections Based on the Initial Hospitalization and 6 Months of Related Outpatient Care

<table>
<thead>
<tr>
<th>Category</th>
<th>Professional Charges</th>
<th>Professional Collections</th>
<th>Professional Percent Collected</th>
<th>Facility Charges</th>
<th>Facility Collections</th>
<th>Facility Percent Collected</th>
<th>Total Charges</th>
<th>Total Collections</th>
<th>Total Percent Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pelvis ring fracture (n = 180)</td>
<td>$22,318</td>
<td>$5179</td>
<td>23</td>
<td>$60,847</td>
<td>$28,810</td>
<td>47</td>
<td>$83,165</td>
<td>$33,989</td>
<td>41</td>
</tr>
<tr>
<td>Acetabulum fracture (n = 255)</td>
<td>$17,146</td>
<td>$3954</td>
<td>23</td>
<td>$41,046</td>
<td>$16,567</td>
<td>40</td>
<td>$58,193</td>
<td>$20,521</td>
<td>35</td>
</tr>
<tr>
<td>Pelvis and acetabulum fracture (n = 30)</td>
<td>$33,192</td>
<td>$7069</td>
<td>21</td>
<td>$77,598</td>
<td>$38,198</td>
<td>49</td>
<td>$110,791</td>
<td>$45,267</td>
<td>41</td>
</tr>
<tr>
<td>Isolated injury (n = 108)</td>
<td>$11,034</td>
<td>$2745</td>
<td>25</td>
<td>$24,790</td>
<td>$9978</td>
<td>40</td>
<td>$35,825</td>
<td>$12,724</td>
<td>36</td>
</tr>
<tr>
<td>Multiple injuries (n = 357)</td>
<td>$22,951</td>
<td>$5199</td>
<td>23</td>
<td>$59,019</td>
<td>$26,550</td>
<td>45</td>
<td>$81,971</td>
<td>$31,750</td>
<td>39</td>
</tr>
<tr>
<td>Total</td>
<td>$20,184</td>
<td>$4629</td>
<td>23</td>
<td>$51,069</td>
<td>$22,702</td>
<td>44</td>
<td>$71,253</td>
<td>$27,331</td>
<td>38</td>
</tr>
</tbody>
</table>

Total charges and collections include professional plus facility. Percents reflect the revenue collected of the amount charged. Groups displayed include pelvis ring fractures, acetabulum fractures, or both; isolated pelvis or acetabulum fracture; and patients with multiple trauma. Values include other orthopaedic and non-orthopaedic injuries treated during the same hospitalization.

### Table 2. Mean Orthopaedic Professional and Facility Charges and Collections Based on the Initial Hospitalization for Each of the Payer Groups

<table>
<thead>
<tr>
<th>Payer</th>
<th>Professional Charges</th>
<th>Professional Collections</th>
<th>Professional Percent Collected</th>
<th>Facility Charges</th>
<th>Facility Collections</th>
<th>Facility Percent Collected</th>
<th>Total Charges</th>
<th>Total Collections</th>
<th>Total Percent Collected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial (n = 124, 27%)</td>
<td>$21,915</td>
<td>$5478</td>
<td>25</td>
<td>$51,852</td>
<td>$23,123</td>
<td>45</td>
<td>$73,396</td>
<td>$29,101</td>
<td>40</td>
</tr>
<tr>
<td>Managed Care (n = 126, 27%)</td>
<td>$20,701</td>
<td>$5393</td>
<td>26</td>
<td>$52,845</td>
<td>$21,865</td>
<td>41</td>
<td>$73,547</td>
<td>$27,257</td>
<td>37</td>
</tr>
<tr>
<td>BWC (n = 45, 9.7%)</td>
<td>$17,778</td>
<td>$7698</td>
<td>43</td>
<td>$45,450</td>
<td>$30,873</td>
<td>68</td>
<td>$63,229</td>
<td>$38,571</td>
<td>61</td>
</tr>
<tr>
<td>Medicare (n = 26, 5.6%)</td>
<td>$25,037</td>
<td>$4378</td>
<td>17</td>
<td>$68,643</td>
<td>$30,520</td>
<td>44</td>
<td>$93,680</td>
<td>$34,898</td>
<td>37</td>
</tr>
<tr>
<td>Medicaid (n = 88, 19%)</td>
<td>$21,667</td>
<td>$2732</td>
<td>13</td>
<td>$56,884</td>
<td>$28,026</td>
<td>49</td>
<td>$78,551</td>
<td>$30,757</td>
<td>39</td>
</tr>
<tr>
<td>Self-pay (n = 56, 12%)</td>
<td>$13,353</td>
<td>$557</td>
<td>4.2</td>
<td>$32,560</td>
<td>$5088</td>
<td>16</td>
<td>$45,912</td>
<td>$5645</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>$20,184</td>
<td>$4629</td>
<td>23</td>
<td>$51,069</td>
<td>$22,702</td>
<td>45</td>
<td>$71,253</td>
<td>$27,331</td>
<td>38</td>
</tr>
</tbody>
</table>

Total charges and collections include professional plus facility. Percents reflect the revenue collected of the amount charged. Values include other orthopaedic and non-orthopaedic injuries treated during the same hospitalization.
acetabulum versus 27% isolated injuries in insured patients \( (P = 0.01) \). In contrast, patients with commercial insurance had a mean ISS of 25.3. Seventy-two percent of them arrived by helicopter (vs. 58% for other payers, \( P = 0.006 \)). Commercial patients were also most likely to be transferred from another hospital than other payer groups (61% vs. 50%, \( P = 0.03 \)).

During the initial episode of care, 58 patients (12%) had 95 complications. Eighty-three percent of these were pulmonary complications, including pneumonia and Acute Respiratory Distress Syndrome. Complications occurred more frequently when definitive fixation of the pelvis or acetabulum was delayed. For those patients with fixation within 24 hours, 14 had complications (8.5%). Patients treated more than 72 hours after injury had a complication rate of 19% \( (P = 0.01) \). Mean LOS in those patients with complications was 17.2 days with a mean ICU stay of 10.6 days. An uncomplicated course of care was associated with a significantly shorter stay in the hospital (8.1 days, \( P = 0.0001 \)) and in the ICU (2.1 days, \( P = 0.0001 \)). With the numbers available, the occurrence of complications, hospital LOS, and ICU LOS were not related to patient age.

It follows that patients treated on an early basis would have a shorter hospital stay both because their fixation was completed earlier and because of fewer complications. Mean LOS and ICU stay were 8.5 and 2.8 days, respectively, in patients treated within 24 hours, versus 11.5 days \( (P = 0.003) \) and 4.2 days \( (P = 0.006) \). Delayed fixation of pelvis and acetabulum fractures occurred more often in patients who were transferred from another hospital (52% vs. 36%, \( P = 0.07 \)). Combined pelvis and acetabulum fractures were more often treated more than 4 days after injury (11% vs. 5%, \( P = 0.042 \)), and patients with isolated pelvic ring or acetabulum fractures were also more likely to be treated more than 4 days after injury, accounting for 29% of all those delayed patients, versus 16% of those treated within 24 hours \( (P = 0.03) \).

Table 4 shows mean charges and collections based on timing of fixation or the presence of complications. Orthopaedic professional charges and collections were unaffected by the timing of fixation, and the ISS scores of these 2 groups were not significantly different \( (P = 0.37) \). Mean facility charges and collections increased slightly when fixation was delayed: $22,483 versus $27,611 \( (P = 0.09) \), consistent with a longer hospital stay in the group with delayed fixation. However, the primary factor resulting in increased hospital charges was the occurrence of a complication. Mean total charges increased from $60,273 to $148,300, with a concomitant increase in the percent collected (37% to 42%, \( P = 0.001 \)). Patients who developed complications were more likely to have a greater level of initial injury as measured by ISS (37.0 vs. 23.0, \( P = 0.0001 \)).

Patients with injuries isolated to the pelvis \( (n = 30) \) or acetabulum \( (n = 78) \) were studied further, to determine the net revenue to the hospital. Direct and indirect costs were determined, with both fixed and variable components for direct costs. Variable costs included supplies, implants, and other materials. The mean cost for patients treated for isolated pelvic ring fractures within 24 hours of injury was $7146, and the mean cost for isolated acetabulum fractures treated within 24 hours of injury was $7777. Based on facility collections of $9978 in this group of patients, these cases were profitable, with mean net revenue of $2376 per patient. However, when patients were treated more than 72 hours of injury, due to longer length of stay, the mean costs for isolated acetabulum fractures was $10,253, and the mean cost for isolated pelvic ring injury was $9322, resulting in a net loss of $16 per case. Prolonged hospital stay was a key determinant of hospital cost. Patients with complications during their course of care had longer ICU and regular hospital stays, accounting for additional $14,829 in mean costs per patient, not inclusive of other variable expenses in this patient group.

### Table 3. Presenting Characteristics of Patients Treated Surgically for Pelvis and Acetabulum Fractures

<table>
<thead>
<tr>
<th>Payer</th>
<th>Mean Age (yrs)</th>
<th>Mean ISS</th>
<th>Transfer ( (n = 245, 53%) )</th>
<th>Air Transport ( (n = 286, 62%) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial</td>
<td>41.6</td>
<td>25.3</td>
<td>76*</td>
<td>89</td>
</tr>
<tr>
<td>Managed Care</td>
<td>39.6</td>
<td>24.9</td>
<td>63</td>
<td>75</td>
</tr>
<tr>
<td>BWC</td>
<td>43.7</td>
<td>22.0</td>
<td>24</td>
<td>27</td>
</tr>
<tr>
<td>Medicare</td>
<td>66.8†</td>
<td>28.0</td>
<td>15</td>
<td>13</td>
</tr>
<tr>
<td>Medicaid</td>
<td>32.5†</td>
<td>27.5</td>
<td>44</td>
<td>54</td>
</tr>
<tr>
<td>Self-pay</td>
<td>33.3†</td>
<td>19.2†</td>
<td>23</td>
<td>28</td>
</tr>
</tbody>
</table>

*Mean age and ISS are shown as well as a history of transfer from another hospital or arrival to the treating facility by helicopter. Patients transported by helicopter may arrive from the scene of the injury or from another hospital.

*Patients with commercial insurance were more likely to be transferred from another facility \( (P = 0.03) \) and were more likely to be transported by helicopter \( (P = 0.006) \).

†Self-pay and Medicaid patients were significantly younger in age, and Medicare patients were older than other patient groups \( (P < 0.001) \).

‡Self-pay patients had significantly lower ISS scores versus other payers \( (P = 0.0006) \).
DISCUSSION

Trauma remains the leading cause of death and disability among persons under the age of 45 and is a major driver of healthcare expenses. Management of pelvis and acetabulum fractures is one of the subspecialty services provided primarily at trauma centers by fellowship-trained personnel, both orthopaedic trauma surgeons and their colleagues in other specialties. The purposes of this study were to characterize professional and facility charges and reimbursement for these patients and to identify opportunities to increase revenue related to pelvis and acetabulum fracture care. The strengths of this study include a large sample size with payer mix, patient demographics, and injury features representative of a large, urban academic level 1 trauma center. Our trauma center has an established history of managing multiple trauma patients, and many aspects of their care are standardized. Potential weaknesses of this study include the applicability of our insurance contracts, our patient sample, and our costing methodology to other hospitals. Our physicians are hospital employees, and the business practices in other practice settings with other business models may not be comparable. Despite these limitations, we believe several issues of importance have been identified.

Previous studies have demonstrated facility reimbursement to be substantially greater than professional reimbursement in the management of multiple trauma patients. In other words, orthopaedic traumatologists collect a fraction of the total hospital collections because the hospital benefits from payments for general inpatient and outpatient services, as well as ancillaries, including radiography, physical and occupational therapies, and laboratory testing, among other items of standard care for these patients. Consistent with this, we identified several dollars of collection by our trauma center for every dollar collected by surgeons. In addition to the collections reported in this study, our hospital also receives federal and state assistance for charity care through Disproportionate Share for Hospital funds. These dollars are not directly shared with professional providers, and they were not accounted for in our study, effectively increasing the revenue generation for the facility, beyond the level we measured.

Patients with multiple injuries had twice as many orthopaedic professional charges and almost 3 times as many facility charges versus patients with isolated fractures of the pelvis or acetabulum. Although the professional collection rate was the same for each of these groups, the facility reimbursement was significantly greater in the multiply injured patients (45% vs. 40%, \( P = 0.001 \)), suggesting financial benefit in managing more complex patients. This is consistent with other studies that have demonstrated higher total charges and profits in the care of the most severely injured trauma patients. The highest mean reimbursements were seen in our patients with combined pelvis and acetabulum injuries. However, the professional collection rate was significantly lower for these complex patients versus those with isolated fractures, possibly due to contractual discounting of multiple procedures performed in the same surgical setting. This represents an opportunity for surgeons and hospitals to negotiate with nongovernmental payers to contract a higher rate of physician compensation for providing some of the most complex orthopaedic trauma services available.

The highest reimbursement rates were noted for patients with Worker’s Compensation claims or with commercial insurance. Over the course of the study, the percentages of commercial and HMO patients decreased, whereas the numbers of Medicaid and self-pay patients increased, consistent with our hypothesis. This follows trends of the United States population and the trends for our hospital system as a whole. Notably, patients treated for pelvis and acetabulum fractures still have a more favorable payer mix than our entire hospital (Table 5). Fifty-seven percent of all pelvis and acetabulum fracture patients transferred to our hospital by helicopter had
In contrast with our uninsured patients, the largest payer groups in our study were commercial and HMO, comprising 54% of our payer mix. These payers represent contracting opportunities for hospitals and physicians to negotiate even better reimbursement rates with payers for providing highly specialized services to their clients, effectively offsetting financial losses due to indigent patients. Other authors have similarly reported the economic benefit of caring for severely injured patients with nongovernmental insurance in counteracting losses incurred with other payers. 30–32 In contrast with our uninsured patients, those with commercial insurance had higher mean ISS scores and were more likely to be transferred from another hospital. These characteristics are associated with more complex care, generating larger total charges and collections, again enhancing the financial benefit of treating this group of patients.

Regional trauma centers manage highly complex patients. The operational costs of developing and maintaining these centers are substantial.16 Establishing an experienced group of subspecialty providers and support staff, and availability of personnel and resources, including equipment, critical care, and operating room space, remains a financial challenge. In an era of declining reimbursement, rising expenses, and reduced availability of subspecialists to participate with call schedules, the sustainability of high-level trauma care is vulnerable. We have demonstrated that provision of pelvis and acetabulum fracture services can be profitable. However, in addition to the aforementioned problem inherent in growing numbers of uninsured and underinsured patients, other issues were noted to significantly affect charges and profitability of this service line.

Isolated pelvis and acetabulum fractures represent an uncomplicated group of patients to assess. Our mean net revenue, collections minus costs, was $2376 per patient when these patients were definitively managed within 24 hours of their injury. Notably, almost 20% of these patients were uninsured. Thus, it would be expected that the profitability of patients with multiple trauma would have a greater potential for a positive margin because of a better payer mix and higher collection rates. This finding also demonstrates the importance of expeditious management of these fractures. When surgical care was delayed more than 72 hours after injury, our hospital began to lose money in treating these patients, as costs exceeded reimbursement. Ideally, trauma centers should have adequate surgeon availability and institutional support, including daily operating room access with appropriate staff, equipment, and instrumentation to support pelvis and acetabulum fracture work on an early basis to optimize both clinical outcomes and service profitability. Both length of stay and complications are minimized with early surgery in adequately resuscitated patients, resulting in a greater profit margin.19,33,34 Furthermore, reducing length of stay will allow for more new patients to access the trauma center as beds and resources become available.

Our findings are consistent with other studies that have shown the effects of prolonged hospital LOS and ICU stays on costs of care.35–39 Hospital costs for orthopaedic trauma care are driven by implant costs and LOS, which become particularly important when reimbursement is fixed for a given diagnosis group or type of procedure.40,41 One recent study on the management of patients with femoral shaft fractures showed that hospital costs could be contained with shorter lengths of stay.42 Recommendations included daily-designated trauma operating room availability and avoidance of delays for plain and high-level radiography required for preoperative assessment. They also recommended improving access to physical therapy and discharge planning services. Altogether these practices should decrease the time from injury to surgery and should minimize hospital LOS.42–44

Patients with pelvis and acetabulum fractures and complications over their course of care had longer ICU and regular hospital stays, accounting for additional $14,829 in mean costs per patient. Other studies have also demonstrated greater treatment costs along with better margins in trauma patients who had complications.15,26,45 Hospitals should recognize the relationships between delayed timing of definitive care, development of complications, and resultant increases in hospital stay and costs. Provision of appropriate physician compensation and resources is imperative in maintaining subspecialty services 24/7/365 to expedite fracture management. This includes experienced operating room staff and appropriate equipment and instrumentation every day, with priority access during daytime hours. Payers should acknowledge the operational costs inherent in achieving and maintaining these services, presenting an opportunity for trauma centers and providers to negotiate payment rates based on historical performance.

In summary, patients with multiple injuries in addition to pelvis and acetabulum fractures generated the highest charges and collection rates for the facility. Professional collection rates were lower in patients undergoing more than 1 surgical procedure in the same setting. The payer mix of patients being treated for pelvis and acetabulum fractures had significantly more commercial, managed care, and BWC insurance versus the entire hospital, despite a gradual increase in the percentage of trauma patients with Medicaid or no insurance during the study. Uninsured patients were significantly younger, had

| TABLE 5. Payer Mix for the Study Group Versus for the Entire Hospital During the Years of Study |
|---------------------------------------------------|------------------|
| Pelvis and Acetabulum Fractures (%) | Hospital (%) |
| Commercial | 27* | 21 |
| Managed Care | 27* | 7.5 |
| BWC | 9.7* | 2.0 |
| Medicare | 5.6 | 24† |
| Medicaid | 19 | 31† |
| Self-pay | 12 | 15† |

*Commercial, HMO, and BWC coverage was more common in the trauma patients (all P < 0.0001).
†Medicare, Medicaid, and self-pay were more common in the hospital system (all P < 0.0001).
lower ISS, and were more likely to have an isolated pelvis or acetabulum fracture. Fractures managed definitively within 24 hours were associated with shorter LOS, shorter ICU stay, and fewer complications, resulting in lower treatment expenses. Fracture care was profitable to the hospital when definitive management was completed within 72 hours. Prolonged LOS and the occurrence of complications were associated with substantially larger costs of care.

ACKNOWLEDGMENTS

The authors thank Greg Brican for assistance with financial data and cost accounting.

REFERENCES


© 2013 Lippincott Williams & Wilkins www.jorthotrauma.com | 273
Invited Commentary

The treatment of the trauma patient involves utilization of a substantial portion of the health care dollar. In many cases, a large portion of these patients are unfunded, and our treatment expenses exceed our ability to pay. To continue the profitability of trauma service lines in the face of rising numbers of uninsured populations, expeditious management and fiscal responsibility is paramount. As a result, we must now critically study both the economic and the clinical impact of our treatment options.

The authors in this study have chosen to examine the financial impact of the operative treatment of pelvis and acetabular fractures. As one of the unique services available at trauma centers, this was an excellent choice for study. These are injuries, which without treatment, would lead to significant morbidity and mortality. This study demonstrates that fractures managed definitively within 24 hours are associated with shorter length of stay, shorter intensive care unit stay, fewer complications, and lower treatment costs. Several recent publications support these findings. These conclusions highlight the fact that cost effective care does not equate to substandard care. In this case, cost-effective care was clinically effective care, namely, the avoidance of complications.

The results of this study demonstrate that complication rates more than doubled after a 24-hour delay in fixation. Even at a major trauma center, the mean time to definitive fixation was 2.9 days. This shows that significant room for clinical and economic improvement exists. Importantly, this clearly demonstrates the value of fellowship-trained traumatologists at any trauma center. A single physician cannot be on call all the time, and communities may need to hire more traumatologists to provide the best clinical and cost-effective care. More surgeons are not the only solution. To decrease the cost of trauma care, hospitals must provide designated OR rooms, adequate stipends, equipment, and support staff. This will decrease time to the OR, lengths of stay, and complication rates for many fracture types, not just those of the pelvis and acetabulum. More studies such as this should be undertaken to determine which fracture types should be treated at regional trauma centers and which need to be cared for expeditiously.

Trauma system development should help avoid these issues, which affect both academic and nonacademic hospitals, employed and private practitioners alike. To provide expeditious and state of the art care to our patients, hospitals and physicians must align to survive. The authors correctly point out that traumatologists collect only a fraction of total hospital collections. Several authors have demonstrated huge discrepancy between hospital and physician compensation, indicating that there is some financial leeway for physician reimbursement for trauma care. Orthopaedic surgeons should be conscious economically and fiscally responsible. However, we also should not be naive that health care is a business. As we strive toward excellence in patient care, let us not forget the economic benefits our subspecialty has to offer.

Peter L. Althausen, MD, MBA
Reno Orthopaedic Clinic
Reno, NV

REFERENCES

274 | www.jorthotrauma.com © 2013 Lippincott Williams & Wilkins
Click here to confirm that you have read the article and receive Trauma Education Credit