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Academic Time at a Level 1 Trauma Center: No Resident, No Problem?

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BACKGROUND: Globally, the compliance of resident work-hour restrictions has no impact on trauma outcome. However, the effect of protected education time (PET), during which residents are unavailable to respond to trauma patients, has not been studied. We hypothesized that PET has no impact on the outcome of trauma patients.

METHODS: We conducted a retrospective review of relevant patients at an academic level I trauma center. During PET, a trauma attending and advanced practice providers (APPs) responded to trauma activations. PGY1, 3, and 4 residents were also available at all other times. The outcome of new trauma patient activations during Thursday morning 3-hours resident PET was compared with same time period on other weekdays (non-PET) using a univariate and multivariate analysis.

RESULTS: From January 2005 to April 2010, a total of 5968 trauma patients were entered in the registry. Of these, 178 patients (2.98%) were included for study (37 PET and 141 non-PET). The mean injury severity score (ISS) was 16.2. Although no significant difference were identified in mortality, complications, or length of stay (LOS), we do see that length of emergency department stay (ED-LOS) tends to be longer during PET, although not significantly (314 vs 381 minutes, p = 0.74). On the multiple logistic regression model, PET was not a significant factor of complications, LOS, or ED-LOS.

CONCLUSIONS: Few trauma activations occur during PET. New trauma activations can be staffed safely by trauma activations and APPs. However, there could be some delays in transferring patients to appropriate disposition. Additional study is required to determine the effect of PET on existing trauma inpatients. (J Surg 69:138-142. © 2012 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

KEY WORDS: protected educational time, surgical residency, trauma, work-hour restriction, advanced practice providers, ACGME

COMPETENCIES: Patient Care, Practice Based Learning and Improvement, Systems Based Practice

INTRODUCTION

Since July 2003, surgical residency programs are required to implement the work-hour restriction, the so-called “80 hours rule” for the patient safety purpose by the Accreditation Council for Graduate Medical Education (ACGME). To date, most of the literature has demonstrated that the limitation of work hours did not affect the outcome of patients negatively; even better outcomes were reported in a large retrospective study. By contrast, contradictory results have been demonstrated in the literatures of surgical subspecialty, including trauma.

To complement the workload uncovered by residents under the work-hour restriction, a large number of surgical program currently hire the advanced practice providers (APPs), physician assistant (PA) and nurse practitioner (NP). A recent survey conducted by Pezzi et al. showed that 79% of general surgery program use APPs, and significant increase of the number of APPs after implementation of work-hour restriction. It is considered that 1 reason why the significant decrease of resident availability in trauma service did not have negative impact on the patient outcome is the effective use of APPs.

As a part of ACGME competency requirements, each general surgery residency program have been obligated to establish educational curriculum. The implementation of a weekly structured conference program or protected block curriculum have been shown to positively affect the residents’ perception of their ability in required competencies.
tional time (PET) is generally scheduled for several hours in the morning of weekdays. Of note, they are excused from all clinical duties in patient care during PET. Although this relatively short period can be covered without affecting the patient outcome, situation could be different in trauma or emergency general surgery practice. All clinical duties, including elective and emergency operation, inpatient care and new patient through emergency room need to be covered by attending surgeon and APPs. The absence of appropriate workforce might potentially result in worse outcome of patient.

The purpose of this study was to compare the outcome of trauma patients admitted to a level 1 trauma center during PET with patients admitted prior to PET. We hypothesized that PET would not have a negative impact on the outcome of the trauma patient.

PATIENTS AND METHODS

A retrospective review of the institutional trauma registry data from January 2005 to May 2010 was performed. This database is a part of the Pennsylvania Trauma Outcome Study (PTOS) maintained by the Pennsylvania Trauma System Foundation. This study was approved by the Institutional Review Board of the Milton S. Hershey Medical Center at the Pennsylvania State University. The PTOS data include all trauma patients who are admitted for longer than 48 hours, intensive care unit admission, transfer cases, and mortality cases. The patients with solitary hip fracture, asphyxiation, drowning, hypothermia, or hyperthermia are excluded from PTOS data. Also burn patients were excluded from this study.

Trauma service

In an ACGME-accredited general surgery residency program at the Penn State Milton S. Hershey Medical Center, residents rotate trauma service as intern (PGY1), junior resident (PGY2 and 3) and senior resident (PGY4) for 2-3 months, respectively. Trauma service is run by 1 trauma attending surgeon of the week. During daytime of weekdays, 1 senior resident, 1 junior resident, 2-3 interns (general surgery, surgical subspecialty, emergency medicine, and anesthesia) and 1-2 APPs covers trauma inpatients, operating room cases, clinic, and new trauma patients admitted though the emergency room (ER). During this study period, all APPs in our trauma service were PAs.

Trauma activation and consultation

Level I and II trauma activation are responded and run by the trauma service. The emergency medicine attending, residents, anesthesia/operating room team, respiratory therapist, radiology resident, and X-ray technician are all to be present at the patient’s arrival. Level III trauma activation is run by emergency medicine attendings and residents. Either a senior resident or trauma surgery attending also respond and participate in the initial resuscitation. A senior or junior resident usually cover trauma consultation from the ER. Each case is discussed with the trauma surgery attending.

PET

All surgical residents are required to attend a weekly structured conference, including a didactic lecture, grand round, skill training session, journal club, medical ethic conference, or in-training examination review held every Thursday at 7 AM. Until June 2008, 2 hours of sessions had been held, and this was extended to 3 hours afterward. The in-hospital pager is to be turned off during this time. The trauma surgery service pager is carried by APPs for residents. During PET, the trauma attending and APPs are in charge of all clinical duty, and the role of surgical resident in trauma resuscitation is replaced by APPs.

Statistical analysis

The patients admitted to trauma surgery service during PET (Thursday 7-9 AM from January 2005 to June 2008, 7-10 AM from July 2008 to May 2010) were included in the PET group. The patients admitted to the trauma surgery service during same time frame on Monday, Tuesday, Wednesday, and Friday were included in the non-PET group. Patient baseline characteristics and clinical outcome were collected. The in-hospital outcome was our primary outcome. We also compared the length of hospital stay (LOS), the length of ER stay, and in-hospital complication rate as secondary outcomes. In-hospital complication is defined as an unexpected event directly affecting patient care by PTOS and classified by systems. Wilcoxon tests were used for continuous variables and $\chi^2$-tests were used for categoric variables in a univariable analysis. Multiple logistic regression models were also instituted for the multivariable analysis. Clinically significant factors were included as independent variables.
TABLE 1. Patient Characteristics

<table>
<thead>
<tr>
<th></th>
<th>PET</th>
<th>Non-PET</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (SD)</td>
<td>47.2 (20.2)</td>
<td>48.9 (20.5)</td>
<td>0.64</td>
</tr>
<tr>
<td>Male sex</td>
<td>67.5%</td>
<td>65.9%</td>
<td>0.85</td>
</tr>
<tr>
<td>Blunt mechanism</td>
<td>91.8%</td>
<td>95.7%</td>
<td>0.34</td>
</tr>
<tr>
<td>Level I activation</td>
<td>18.9%</td>
<td>17.7%</td>
<td>0.86</td>
</tr>
<tr>
<td>Mean ISS (SD)</td>
<td>17.6 (14.4)</td>
<td>15.9 (12.2)</td>
<td>0.55</td>
</tr>
<tr>
<td>SBP &lt; 110</td>
<td>5.6%</td>
<td>7.9%</td>
<td>0.63</td>
</tr>
</tbody>
</table>

ISS, injury severity score; SBP, systolic blood pressure; SD, standard deviation.

RESULTS

Patient selection and characteristics

A total of 5968 patients who met inclusion criteria were extracted from our institutional trauma registry during the 5 years of the study period (Fig. 1). Of those, only 37 patients were qualified as PET group, as well as 141 patients in non-PET group. Table 1 demonstrates patient baseline characteristics in each group. Overall, no significant differences were found in a comparison of these 2 groups. Although more penetrating injury cases tends to present during PET, less than 10% is similar rate as the overall patient demographics in our institution (8.11% vs 4.26%, p = 0.34). Of note, although 18.9% and 17.7% of patients presented as level I activation, none of patient sustained hypotension (systolic blood pressure less than 90 mm Hg), and only 2.1% presented hypertension in the control group. Systolic blood pressure at presentation was less than 110 mm Hg in 5.6% and 7.9% of patients in PET and non-PET groups, respectively (p = 0.63).

Patient outcome

Of 178 patient observations, 6 deaths were identified (3.4%). No emergent laparotomy or other procedures was performed by trauma service during PET. The patients in PET group were managed by trauma attending and APPs for an average of 76.5 minutes, and 31 patients (83.8%) were still in the ER to be transferred when the resident took over the care. The univariable analysis failed to demonstrate significant differences in primary and secondary outcomes (Table 2). In-hospital complications developed more frequently in non-PET group; however, the results are not statistically significant (8.1% vs 14.8%, p = 0.28). In contrast, there was a tendency for patients in PET group to stay in the ER longer than the non-PET group. In all, 80.5% of patients in PET group stayed in the ER longer than 2 hours compared with 76.6% in non-PET group (p = 0.28).

Because of the few mortality cases in this study, a subsequent multivariable analysis was not performed. After adjusting for a potential confounding variable, the relationship between PET and each outcome were explored using multiple logistic regression models (Tables 3-5). Level 1 activation was significantly associated with a higher in-hospital complication rate. Although the injury severity score (ISS) was not significantly associated with complication, it was a significant risk of hospital stay longer than 1 week and an ER stay longer than 2 hours. PET was not associated with any outcomes of interest.

DISCUSSION

Our study demonstrated that the unavailability of resident physicians in the trauma service because of the PET did not impact the outcome of trauma patients negatively at our academic level 1 trauma center. To the best of our knowledge, this timely and interesting topic has never been investigated before. We believe that these data are encouraging for the general surgery residency program in the United States to maintain the quality of care as well as the quality of residency training.

Improving both resident education and patient safety under the work-hour restrictions is a major task for the program directors in each general surgery program since 2003. Afessa et al.19 showed that the patients admitted during the educational rounds in the morning had significantly higher severe illness and poorer clinical outcome in the intensive care unit. An adjusted odds ratio of rounding time admission for hospital mortality was 1.42 (p = 0.016) in the surgical intensive care unit.

TABLE 2. Univariable Analysis of Patient Outcome

<table>
<thead>
<tr>
<th></th>
<th>PET</th>
<th>Non-PET</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mortality</td>
<td>5.4%</td>
<td>2.8%</td>
<td>0.44</td>
</tr>
<tr>
<td>Mean LOS (SD)</td>
<td>6.2 (5.1)</td>
<td>7.1 (7.3)</td>
<td>0.92</td>
</tr>
<tr>
<td>Intensive care unit admission</td>
<td>32.4%</td>
<td>38.3%</td>
<td>0.51</td>
</tr>
<tr>
<td>Mean vent days (SD)</td>
<td>0.6 (2.0)</td>
<td>1.6 (4.5)</td>
<td>0.52</td>
</tr>
<tr>
<td>Time in ER ≥2 hours</td>
<td>80.5%</td>
<td>76.6%</td>
<td>0.61</td>
</tr>
<tr>
<td>Complication rate</td>
<td>8.1%</td>
<td>14.8%</td>
<td>0.28</td>
</tr>
</tbody>
</table>

LOS, length of stay; ER, emergency room; SD, standard deviation.

TABLE 3. Logistic Regression Model for In–Hospital Complication

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 activation</td>
<td>4.79</td>
<td>1.70–13.53</td>
<td>0.003</td>
</tr>
<tr>
<td>ISS</td>
<td>1.34</td>
<td>0.96–1.87</td>
<td>0.08</td>
</tr>
<tr>
<td>PET</td>
<td>0.38</td>
<td>0.09–1.56</td>
<td>0.18</td>
</tr>
</tbody>
</table>

ISS, injury severity score; CI, confidence interval.

TABLE 4. Logistic Regression model for Length of Hospital Stay ≥1 Week

<table>
<thead>
<tr>
<th>Variable</th>
<th>Odds Ratio</th>
<th>95% CI</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>1.16</td>
<td>0.98–1.37</td>
<td>0.07</td>
</tr>
<tr>
<td>Gender</td>
<td>1.57</td>
<td>0.76–3.24</td>
<td>0.22</td>
</tr>
<tr>
<td>Level 1 activation</td>
<td>1.31</td>
<td>0.50–3.41</td>
<td>0.57</td>
</tr>
<tr>
<td>ISS</td>
<td>1.63</td>
<td>1.18–2.25</td>
<td>0.002</td>
</tr>
<tr>
<td>SBP &lt; 110</td>
<td>1.04</td>
<td>0.30–3.63</td>
<td>0.94</td>
</tr>
<tr>
<td>HR &gt; 100</td>
<td>1.42</td>
<td>0.65–3.08</td>
<td>0.37</td>
</tr>
<tr>
<td>PET</td>
<td>0.64</td>
<td>0.27–1.52</td>
<td>0.32</td>
</tr>
</tbody>
</table>

ISS, injury severity score; CI, confidence interval; HR, heart rate; SBP, systolic blood pressure.
Although a poorer outcome may not have resulted solely from inadequate level of patient care because of resident education, the results have made them to change the staffing and implement rapid response team. Most surgical residency programs, including our program, schedule PET as block time during weekday mornings. Not surprisingly, a cohort study conducted in Canada demonstrated that the trauma patient admission rate was the lowest at 7-10 AM and on Thursday of the week. Given the small number of trauma admissions and no emergency operation by trauma surgery service required during PET in our study, it seems to be the least effective for patient safety to schedule PET during this time frame.

Our results may also imply the importance of APPs in the era of work-hour restriction, which enforces frequent patients handoffs or shift changes. Undoubtedly, the incorporation of APPs has taken the major role of maintaining the quality of patient care in the last decade despite the unavailability of the surgical residents. Nationwide, APPs are increasingly used in the care of trauma patients. In our institution, APPs receive the sign out from surgical residents and are responsible for patient care as well as new trauma activation. Later on, any change or new patient information is updated promptly to residents after PET. Christmas et al. demonstrated the efficacy of physician extenders in the era of resident work-hour restrictions. The integration of 2 nurse practitioners on the trauma service led to the reduction of surgical resident work hours from 86 hours per week to 79 hours. Furthermore, the duration of intensive care unit and total hospital stay has significantly improved as well. As was speculated in the Discussion, although APPs rotate the service between trauma and emergency general surgery service every month in our institution, they are specialized in the care of acute care surgery patients as opposed to residents who rotate on a monthly basis. APPs can do more than just take care of inpatients; they are intensely trained and feel more comfortable taking care of the severely injured patients in the trauma bay. Therefore, simultaneous trauma activation can be usually covered by several APPs and 1 trauma attending without any problem.

Our study has several limitations. First, in the period of PET, only 0.6% of trauma admissions were identified. Therefore, the number of our cohort was relatively small. However, as mentioned previously, this fact might imply that scheduling weekly PET in this time block has the smallest negative effect on the outcome of trauma patients. The data at an urban level 1 trauma center revealed that the highest volume of trauma admissions was identified on Sunday and Saturday followed by Friday and Monday. As the distribution of the volume, type of injury, and severity of injuries were reported to be significantly variable between weekdays and the weekend, as well as between daytime and night time, we used cohorts matched for admission time frame in the control group. Second, no case requiring emergency surgical procedures by the trauma service was identified in our study. In addition to the patient characteristic of our institution, a relatively small number of penetrating injury patients, the evolution of nonoperative management of blunt solid organ injury in the last decades could have resulted in the lack of emergency laparotomy or thoracotomy. In case an emergency laparotomy is required, the trauma attending performs the case in operative room with 1 of the APPs. In the mean time, a backup trauma attending is also available who is on either the emergency general surgery service or surgical intensive care unit. Third, we did not explore the outcome of inpatients who have been hospitalized already. More frequent patient handoffs might be more affective to inpatients rather than newly admitted patients. Finally, this is a single institution retrospective study. A multi-institutional prospective study participated by various types of trauma centers should answer more accurately this newly emerged question.

In conclusion, our novel data examining the outcome of trauma patients who were admitted to trauma service during PET did not show any significant negative impact of unavailability of residents. These data need to be verified in a larger prospective study participated by multiple type of trauma centers.

### REFERENCES

1. Accreditation Council on Graduate Medical Education. Common program requirements. Available at: http://www.acgme.org/acWebsite/dutyHours/dh_ComPrgrRequirmentsDutyHours0707.pdf.


6. Hutter MM, Kellogg KC, Ferguson CM, Abbott WM, Warshaw AL. The impact of the 80-hour resident work-


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