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Identifying preventable trauma death: does autopsy serve a role in the peer review process?

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ABSTRACT

Background: Missing life-threatening injuries is a persistent concern in any trauma program. Autopsy is a tool routinely utilized to determine an otherwise occult cause of death in many fields of medicine. It has been adopted as a required component of the trauma peer review (PR) process by both the American College of Surgeons and the Pennsylvania Trauma Foundation. We hypothesized that autopsy would not identify preventable deaths for augmentation of the PR process.

Materials and methods: A retrospective chart review using our institutional trauma registry of all trauma deaths between January 2012 and December 2015 was performed. Per the protocol of our level 1 center, all trauma deaths are referred to the medical examiner (ME) and reviewed as part of the trauma PR process. All autopsy results are evaluated with relation to injury severity score (ISS), trauma injury severity score (TRISS), nature of death, and injuries added by autopsy. ME reports are reviewed by the trauma medical director and referred back to the trauma PR committee if warranted. Trauma injury severity score methodology determines the probability of survival (Ps) given injuries identified. A patient with Ps of $\geq$0.5 is expected to survive their injuries. Cohorts were created based on when in the hospitalization death occurred: <24 h, or immediate death; 24 to 48 h, or early death; and death >48 h, or late death. A comparison was conducted between the ISS and Ps calculated during trauma workup and on autopsy using chi-square and Fischer's exact tests.

Results: A total of 173 patient deaths were referred to the ME with 123 responses received. Average length of stay was 2.61 d. Twenty-six patients had autopsy declined by the ME, 25 received an external examination only, and 72 received a full autopsy. Autopsy identified one case that was reconsidered in PR ($P = 0.603$) and added diagnoses, but not injuries, to one patient in the early death group ($P = 1$) and two in the late death group ($P = 0.4921$). No preventable cause of death was uncovered, and educational use was minimal. Autopsy did identify injuries in seven cases that were initially not consistent with expected mortality, but postmortem Ps was consistent with expected mortality ($P = 0.254$). Mean ISS was 34.48,

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and mean Ps was 0.275 among all patients. The most commonly identified injuries added by autopsy were rib injuries, lung injuries, and intracranial hemorrhage.

Conclusions: Autopsy does not identify causes of preventable in an otherwise highly functioning trauma program and may be a poor use of institutional resources. In fact, it adds few diagnoses when death occurs after a full trauma assessment has had time to take place. Autopsy may be of use to identify protocol failure in maturing trauma programs, to give answers to grieving families and in select situations where death was unanticipated even after a full evaluation took place.

Autopsy data for trauma patients have been shown to often identify missed injuries. Sometimes, these injuries are major or sole contributors to patients' mortality.[1-14] Despite these life-threatening missed injuries, it is unclear if autopsy results significantly impact trauma performance improvement.[10,15-18] It is also unclear if injuries missed correlate to a missed chance for survival.[19,20] Regardless, both the American College of Surgeons and the Pennsylvania Trauma Foundation require that autopsy results be a component of the trauma PR process. Often, collection of postmortem (PM) data is limited by the accessibility of medical examiner (ME) records and whether or not an autopsy was even performed. The goal of this study was to determine the utility of including autopsy reports and their potential identification of missed injuries as part of the performance improvement process in our trauma center. Our hypothesis was that any missed injuries found on autopsy, while potentially useful in an educational capacity, would not have a significant contribution to morbidity or mortality or change patient management.

Methods

This study is a retrospective review at a single level 1 trauma center. Institutional review board approval was obtained for this study, and a waiver of the consent process was applied for and approved. All trauma mortalities between January 2012 and December 2015 were identified using the institutional trauma registry.

Age, gender, length of stay, mechanism of injury, and referral for PR were identified in the selected patient population. Injury severity score (ISS) and probability of survival (Ps) were calculated for each patient based on injuries identified during admission. Patients were then further stratified based on length of hospital admission prior to death. They were divided into three groups: death <24 h following initial presentation, or immediate death (ID); death between 24 and 48 h after admission, or early death (ED); and death >48 h after admission, or late death (LD).

Per local policy, all trauma deaths are referred to the ME. Patients were excluded if no ME report was available for evaluation. The ME is responsible for making the determination that no autopsy, external examination only, or a full examination are required in each individual case. External examination involves careful inspection of the entire body and may include looking for obvious injuries, gunpowder residue, or collecting hair and nail samples. A full examination includes an external examination as well as an internal examination, where the thoracic, abdominal, and possibly intracranial structures are dissected and reviewed. All autopsy reports include ISS, trauma injury severity score (TRISS), nature of death, and injuries identified PM. Using the Ps calculated after adding diagnoses discovered at autopsy, the death was classified as an expected or an unexpected mortality.

A patient with Ps of ≥0.5 is expected to survive their injuries. Patients with Ps of <0.5 are considered expected fatalities. A comparison was conducted between the ISS and Ps calculated in the trauma bay and on autopsy using a student *t*-test. Referral to PR was analyzed using a chi-squared calculation, and an expected mortality preautopsy and postautopsy was assessed using Fisher's exact test. Significance was defined as $P < 0.05$ for all statistical tests.

The performance improvement and peer review (PR) process at our institution involves the participation and collaboration of the trauma team, the emergency department, orthopedics, radiology, anesthesiology, and neurosurgery. Primary and secondary levels of review are conducted by the Trauma Medical Director, Trauma PI coordinator, and Trauma Program Manager. Cases that cannot be resolved at primary or secondary levels of review are referred for tertiary review to a meeting once a month in which the above participants come together and discuss trauma cases in which there was an adverse outcome as a result of a discernable deviation from protocol. We examine what went wrong and how to prevent it in the future. At the time of this meeting, autopsy reports are not yet available given the delay in their creation. Autopsy reports are reviewed by the trauma director once available, and cases are referred back to PR if potential errors in care or useful teaching points exist.

Results

There were a total of 173 trauma deaths from January 2012 through December 2015 at our level 1 trauma center. All cases were referred to the ME. Requests were placed for autopsy results on all patients. There were 123 responses received. Of the 123 patients with full ME data available, there were 99 men (80%), with an average age of 47 y, and a mean length of stay of 2.61 d. Thirty-two (26%) deaths occurred at least 2 d following admission, and 91 (74%) <2 d after admission. Of the deaths occurring early in the hospitalization, 8 (9%) occurred between 24 and 48 h (ED), but the majority, 83 (91%), occurred within the first initial 24 h of admission (ID). Autopsy was more likely to be