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Do autopsies still matter? The influence of autopsy data on final injury severity score calculations

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ABSTRACT

Background: Despite a proven record of identifying injuries missed during clinical evaluation, the effect of autopsy on injury severity score (ISS) calculation is unknown. We hypothesized that autopsy data would alter final ISS and improve the accuracy of outcome data analyses.

Materials and methods: All trauma deaths from January 2010 through June 2014 were reviewed. Trauma registrars calculated Abbreviated Injury Scale and ISS from clinical documentation alone. The most detailed available autopsy report then was reviewed, and AIS/ISS recalculated. Predictors of ISS change were identified using multivariate logistic regression.

Results: Seven hundred thirty-nine deaths occurred, of which 682 (92.3%) underwent autopsy (31% view-only, 3% with preliminary report, and 66% with full report). Patients undergoing full autopsy had a lower median age (39 versus 74 years, $P < 0.01$), a higher rate of penetrating injury (41.7% versus 0%, $P < 0.01$), and a higher emergency department mortality rate (30.8% versus 0%, $P < 0.01$) than those receiving view-only autopsy. Incorporating autopsy findings increased mean ISS (21.3 to 29.6, $P < 0.001$) and the percentage of patients with $ISS \geq 25$ (49.9% to 69.2%, $P < 0.001$). Multivariate analysis identified length of stay, death in the emergency department, full rather than view-only autopsy, and presenting heart rate as variables associated with ISS increase.

Conclusions: Autopsy data significantly increased ISS values for trauma deaths. This effect was greatest in patients who died early in their course. Targeting this group, rather than all trauma patients, for full autopsy may improve risk-adjustment accuracy while minimizing costs.

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Introduction

The autopsy examination, once the gold standard for definitive diagnosis, has seen its rate of use decline by almost 60% since the early 1970s.¹ Although the literature supports the notion that autopsies still identify missed injuries despite marked technological improvements in diagnostic capabilities, debate continues about the clinical relevance of such findings.^{2–4} Multiple groups have reported failing to identify actionable errors after introducing autopsy data into their trauma performance improvement processes.^{5,6} In light of such findings and costs exceeding \$1250 per autopsy, some have suggested autopsy simply is not cost-effective in trauma process improvement.⁷ However, large studies of autopsy data are rare, and the role for autopsy data in improving risk adjustment remains unclear.

The injury severity score (ISS) is a validated tool used by the trauma community to quantify, in an objective and comparable way, the overall severity of each patient's traumatic injuries. To calculate ISS, each traumatic injury is assigned an Abbreviated Injury Scale (AIS) score for the corresponding regions of the body (head, face, chest, abdomen, extremities—including pelvis—and external); the sum of the squares of the three highest AIS scores is the ISS.⁸ Accurate calculation of AIS scores and the ISS relies on the identification of the entirety of a patient's injuries. Typically, this occurs through a retrospective review of the medical record by trained registry staff. This heavy reliance on the medical record, however, exposes ISS calculation to the risk of undocumented injury that might have been missed during trauma evaluations before death.⁹ As AIS and ISS become important components of risk-adjusted benchmarking, erroneous scoring could negatively impact institutional remuneration, should the widespread implementation of value-based payments occur.¹⁰

Our study aimed to investigate the role that an autopsy examination may play in determining or altering ISS calculations. We hypothesized that the addition of autopsy data would significantly increase ISS and AIS scores. We further postulated that clinically relevant predictors of ISS change following the inclusion of autopsy data exist, and that these predictors could assist providers in identifying those cases that would most benefit from the addition of autopsy data.

Materials and methods

Study population

Patient data were collected retrospectively for all patients evaluated by the trauma service at the University of Cincinnati Medical Center, a verified level I trauma center, from January 1, 2010, through June 30, 2014, and who died during their index admission. The primary outcome of this study was change in AIS/ISS following autopsy. The secondary objective of this study was to identify variables that served as predictors of ISS change. This study was approved by the University of Cincinnati's Institutional Review Board and performed with the assistance of the Hamilton County Coroner's office.

Patient characteristics

Patient characteristics and demographic information collected from our institutional trauma registry included age, race, mechanism of injury, motive of injury, date and time of arrival, initial emergency department (ED) vital signs to include systolic blood pressure, pulse, respiratory rate, and Glasgow Coma Scale, diagnoses as documented in the medical record, and, where applicable, time of death and autopsy status. Race was divided into black, Hispanic, white, or other. Mechanism of injury was characterized as penetrating trauma, asphyxiation, or thermal burn. Motive of injury was separated into accidental, self-inflicted, assault, or unknown, with assault patients in this study being identified as homicide victims.

Autopsy categorization

Autopsies were described as view-only, preliminary, and full. View-only examinations were performed at the discretion of the country coroner medical staff. These entail an external viewing of the body with injuries and causes of death identified with guidance from the hospital record. Preliminary reports included an abbreviated listing of injuries found at the time of internal and external examination performed by the coroner medical staff. Full reports included a detailed listing of the internal and external examination findings, nonassociated trauma findings, organ descriptions and weights, as well as toxicology results.

Outcomes

A senior institutional registrar calculated each study patient's preautopsy and postautopsy AIS/ISS. To determine preautopsy scores, the registrar reviewed the totality of the clinical documentation from the patient's admission while blinded to autopsy data. Postautopsy calculation differed only in its inclusion of the most detailed autopsy report available. Injuries identified during autopsy, which were not diagnosed in the clinical record, were added to the deceased patient's injury list, while diagnoses that specifically excluded autopsy were removed. New postautopsy scores were calculated from this modified listing of injuries.

To ensure accurate chart abstraction, each registrar completes an audit of all other registrars monthly. For each peer, an auditing registrar selects a previously coded chart and reviews it, blind to the prior coding, using a 30-point validation tool. The trauma information coordinator reviews the subsequent report for discrepancies in coding; if any are identified, the trauma information coordinator, along with senior performance improvement and registry staff, determines the appropriate coding and educates registrars on the correct protocol going forward. Each registrar's errors are recorded and reported as an accuracy rate. Approximately 50 charts are audited each month by this method—roughly 11% of the new additions to the registry.

Data analysis

Preautopsy and postautopsy AIS/ISS were compared to each other; where appropriate, t-test and chi-squared test were

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