

# The importance of empiric abdominal computed tomography after urgent laparotomy for trauma: Do they reveal unexpected injuries?

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**Background.** Many institutions now use empiric full-body computed tomography (CT) as a standard step in the initial workup of stable trauma patients. Recent data suggest that these scans may reveal unexpected injuries and improve survival in patients with polytrauma. However, patients who are unstable on presentation are often taken to the operating room (OR) without CT. Many of these patients undergo empiric full-body CTs after being stabilized in the OR, yet few data exist regarding how often early postoperative CT reveals unexpected injuries within compartments that have been explored surgically. Thus, the objective of this study was to determine if empiric abdominal/pelvic (ABD) CT after emergent trauma laparotomies are likely to reveal missed injuries requiring urgent management and improve patient management compared with clinical judgment alone.

**Methods.** We review retrospectively 496 trauma patients who required urgent exploratory laparotomy at UPMC Presbyterian Hospital from 2007 to 2011. Patients were included if they went to the OR for exploratory laparotomy directly from the emergency department within 2 hours of arrival. Patients were excluded if they received any preoperative ABD CT imaging. Patients who expired in the OR were similarly excluded. Patients were stratified into 2 groups based on whether or not they received an empiric ABD CT in the 24 hours immediately after laparotomy. Medical records were reviewed to look for differences in missed injuries, urgent reexplorations, nontherapeutic interventions, and time to urgent reexploration.

**Results.** There were 278 patients who met inclusion at exclusion criteria and constituted the study cohort. Of these patients, 124 underwent early empiric postoperative ABD CT imaging (45%). The remaining 154 patients did not undergo early ABD imaging (no CT group). The overall cohort had a 45% incidence of damage control procedures and a 9% rate of negative laparotomy. The 2 groups were statistically similar in age, presenting vitals, and abdominal Abbreviated Injury Scores. When the ABD CT group was compared with the no CT group, there was no difference in the overall rate of urgent reexplorations (7.3 vs 7.1%;  $P = .956$ ), nontherapeutic urgent reexplorations (22 vs 18%;  $P = .822$ ), or time to urgent reexploration ( $14 \pm 10$  vs  $12 \pm 10$  hours;  $P = .686$ ). Out of the 124 ABD CT patients, only 5 (4.0%) were diagnosed with injuries that were not identified at the time of the initial operation or caused by operative technique. When controlling for demographics, mechanism of injury, and injury severity, a logistic regression analysis revealed that early postoperative ABD CT was not associated with any differential risk of the need for further intervention (odds ratio, 0.85; 95% CI, 0.37–1.9;  $P = .691$ ).

**Conclusion.** The use of ABD CT soon after trauma laparotomy did not provide meaningful improvements in patient care in the cohort studied. Further higher level research is needed to clarify what role empiric ABD CT should play in the early postoperative period. (Surgery 2014;156:979-87.)

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COMPUTED TOMOGRAPHY (CT) allows detailed visualization of body cavities and are excellent tools for diagnosis of osseous, vascular, and solid organ injuries. As CT imaging technology has evolved, the CT has become a valuable tool in the initial workup of stable trauma patients owing to its ease of use and diagnostic precision.<sup>1,2</sup> Full-body CTs performed during a stable blunt trauma patient's workup commonly reveal unexpected injuries that lead to changes in management and disposition, even for patients whose physical examinations show no obvious signs of injury.<sup>3-5</sup> There is also evidence that liberal use of empiric full-body CTs may increase probability of survival in patients with polytrauma.<sup>6</sup> In response to these data, many institutions now use empiric full-body CTs as a standard step in the initial workup of stable blunt trauma patients.

However, the most severely injured patients, who present with hemodynamic instability, are taken directly to the operating room (OR) for exploratory laparotomy without any CT imaging. Some of these patients do undergo selective or full-body CT imaging soon after stabilization in the OR irrespective of their mechanism of injury, yet the diagnostic value of these early postoperative scans remains less than adequately characterized, and it is reasonable to question whether radiographic imaging commonly reveals unexpected injuries within compartments that have been surgically explored. We undertook the current study to determine if empiric abdominal/pelvic (ABD) CTs after emergent trauma laparotomies are likely to reveal missed injuries requiring a change in clinical management. We hypothesized that empiric ABD CT in the early postoperative period would reveal important vascular and solid organ injuries that were not apparent at exploratory laparotomy.

## METHODS

We performed a retrospective study focusing on the efficacy of empiric postoperative abdominal CT after urgent exploratory laparotomy. We selected all blunt or penetrating injured patients who required urgent exploratory laparotomy at a busy level I trauma center, over a 5-year period (2007–2011). All patients in the final study cohort went to the OR directly from the emergency department within 2 hours of arrival without the benefit of preoperative ABD CT imaging. Patients were excluded from analysis if they received any preoperative ABD CT imaging during the initial trauma resuscitation, underwent pre-trauma center imaging at a referral hospital or went to the OR for procedures other

than an exploratory laparotomy. Those patients who expired in the OR or had supportive care withdrawn owing to severe extraabdominal injuries (primarily head injury) soon after exploratory laparotomy were similarly excluded.

Data were obtained via query of the trauma registry and formal chart or electronic medical record review. All records and charts were reviewed by a senior medical student, a general surgery resident, and an attending trauma surgeon. Each investigator reviewed intraabdominal injuries identified in the attending radiologist's final ABD CT report and compared these with injuries noted in the attending surgeon's operative report. Any injuries that were noted in ABD CT report but not in the operative report were classified as missed injuries. The investigators then individually reviewed each patient's chart to determine if any major changes in management occurred as a direct result of CT findings. Major changes in management included abdominal or pelvic angiograms to control ongoing bleeding, or unplanned returns to the OR for operative management of missed injuries. The investigators also reviewed findings on emergency department pelvic x-rays and compared them with findings on pelvic CT noting any pelvic fractures that were missed on x-ray but subsequently diagnosed on CT.

We first characterized the demographics and injury characteristics of the overall study cohort. We then compared those patients who underwent early empiric postoperative ABD CT imaging with those patients who underwent an urgent exploratory laparotomy without early postoperative ABD imaging (no CT). Unplanned reoperations and the requirement for angiography were characterized across the 2 comparison groups. Logistic regression was utilized to determine whether early postoperative ABD CT imaging was independently associated with a higher rate of unplanned take backs to the OR, further diagnostic or therapeutic procedures, or a change in management plans.

Importantly, our analysis defines "empiric postoperative ABD CT" as any CT of the abdomen that was obtained to evaluate for undiagnosed injuries. This does include many patients who underwent thoracic and lumbar spine CT evaluation for spine clearance when required. At our institutions, the CT window for spine evaluation incorporates the abdomen and pelvis, which provided standard ABD CT images in those patients who did not necessarily have a specific order for ABD CT imaging postoperatively. However, not all patients in the cohort underwent ABD CT as an adjunct to thoracic or lumbar spine imaging, and in fact

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