The validity of abdominal examination in blunt trauma patients with distracting injuries

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BACKGROUND: Many trauma care providers often disregard the abdominal clinical examination in the presence of extra-abdominal distracting injuries and mandate abdominal computed tomographic scan in these patients. Ignoring the clinical examination may incur undue expense and radiation exposure. The purpose of this study was to assess the efficacy of abdominal clinical examination in patients with distracting injuries.

METHODS: During a 1-year period, all awake and alert blunt trauma patients with Glasgow Coma Scale (GCS) score of 14 or 15 were entered into a prospective study. Abdominal clinical examination was performed and documented prospectively on all patients. Abdominal clinical examination included four-quadrant anterior abdominal palpation, flank palpation, lower thoracic palpation, pelvis examination, and palpation of the thoracolumbar spine. Following examination documentation, all patients underwent computed tomographic scan of the abdomen and pelvis with intravenous contrast.

RESULTS: A total of 803 patients were enrolled: 451 patients had distracting injuries, and 352 patients did not. Of the 352 patients without distracting injuries, 19 (5.4%) had intra-abdominal injuries, of whom 2 (10.5%) had negative clinical examination result. Of the 451 patients with distracting injuries, 48 (10.6%) were diagnosed with intra-abdominal injury, of whom 5 (10.4%) had negative clinical examination result. All five missed injuries in patients with distracting injuries were solid organ injuries, none of which required surgical intervention or blood transfusion. The sensitivity and negative predictive value of abdominal examination for patients with distracting injuries were 90.0% and 97.0%, respectively. The sensitivity and negative predictive value of abdominal examination for surgically significant and transfusion-requiring injuries were both 100%.

CONCLUSION: Distracting injuries do not seem to diminish the efficacy of clinical abdominal examination for the diagnosis of clinically significant abdominal injury. These data suggest that clinical examination of the abdomen is valid in awake and alert blunt trauma patients, regardless of the presence of other injuries. (J Trauma Acute Care Surg. 2015;78:1095–1101. Copyright © 2015 Wolters Kluwer Health, Inc. All rights reserved.)

LEVEL OF EVIDENCE: Diagnostic study, level III.

KEY WORDS: Distracting injuries; abdomen; trauma; clinical examination.

Following blunt trauma, a thorough examination of the abdomen is an important component of the initial patient assessment. Findings of the abdominal examination can often dictate prioritization of patient care. Successful care of the blunt trauma patient is based on timely and accurate diagnosis as inaccurate and delayed diagnosis may lead to unnecessary morbidity and mortality. The abdomen has long been recognized as a site for occult bleeding, especially in patients who present with hemodynamic stability. Unrecognized injuries can challenge the most experienced care providers. Avoiding these situations is best accomplished by applying a systematic approach using clinical examination in concert with diagnostic technology to identify life-threatening injury. The question remains what is the ideal systematic approach to diagnose abdominal trauma that has superior sensitivity for identification of life-threatening injury yet is cost-effective and limits patient exposure to radiologic testing.

There are two main approaches or strategies used by trauma care providers for the diagnosis of abdominal trauma. The first approach is the use of abdominal clinical examination complemented by a selective use of abdominal computed tomography (CT) scanning. The second approach is abdominal clinical examination complemented by routine abdominal CT scan. It has yet to be determined which methodology is optimal for the diagnosis of intra-abdominal injury.

With continuous technical improvements, greater speed, and ease of availability, routine use of CT scanning is more commonplace in trauma centers. These factors may foster overuse of CT scanning and often cause providers to negate the significance of the abdominal clinical examination for blunt trauma. Several authors suggest that pan-scanning of trauma patients is an effective method for identifying injuries that have potential to impact morbidity and mortality.1–4 CT scan is an excellent diagnostic tool for assessing abdominal trauma; however, it is costly, exposes the patient to radiation, and often requires transporting the patient to the relatively unsafe environment of the CT scan suite.

Clinical examination of the abdomen has previously been shown to be highly sensitive for the diagnosis of blunt abdominal injury.5,6 In a recent prospective study, Smith et al.6 concluded that clinical examination was sensitive in ruling out
serious injuries in high-acuity patients. In a prospective observational study, Schauer et al.\textsuperscript{8} concluded that abdominal CT scanning has a low yield in trauma patients who undergo abdominal evaluation for urgent abdominal surgery.

Protocols that selectively use abdominal CT scan for screening blunt trauma patients cite distracting injuries as a contraindication to using the abdominal clinical examination as the screening method to rule out abdominal injury.\textsuperscript{10-13} The question as to whether distracting injuries negate the abdominal clinical examination in blunt trauma patients has yet to be studied using CT scan as the comparator for abdominal clinical examination sensitivity.

The purpose of this study was to prospectively assess the efficacy and sensitivity of abdominal clinical examination in awake and alert blunt trauma patients with distracting injuries.

**PATIENTS AND METHODS**

During the 12-month period from December 1, 2012, to December 1, 2013, data were prospectively collected from all hemodynamically stable blunt trauma patients who were admitted as trauma activations at the University of South Alabama Trauma Center. All patients older than 13 years with a Glasgow Coma Scale (GCS) score of 14 or greater who sustained blunt trauma were entered into the study protocol. Patients were entered into the study regardless of ethanol level or presence of distracting injuries.

The University of South Alabama Investigational Review Board approved this study and approved waiver of consent for entry into this study. Data with regard to demographics and abdominal clinical examination were prospectively collected and documented in a data study form before performance of indicated CT evaluation.

For patients with GCS score of 14 or greater, clinical assessment for neurologic injury was performed by questioning the patient for the presence of pain and movement of all extremities. Physical examination was performed to assess for spinal cord neurologic deficits. If neurologic deficits were not identified, clinical examination of the abdomen was performed. Abdominal clinical examination consisted of questioning the patient for the presence of abdominal pain or back pain and physical examination of the abdomen. Physical examination included four-quadrant anterior abdominal palpation, flank palpation, lower thoracic palpation (anterior and posterior), pelvis examination (posterior and inward compression of iliac wings, compression of symphysis pubis, rectal examination) and palpation of the thoracolumbar spine. Following documentation of the clinical examination, all patients underwent CT scan of the abdomen/pelvis with intravenous contrast. Patients who had thoracic spine tenderness also underwent CT scan of the chest to assess the thoracic spine. All CT scan imaging was reformatted to allow for the examination of the thoracolumbar spine in three dimensions.

The CT scanner used was a Somatom Plus 4 (Siemens, Erlangen, Germany) 64-slice helical CT at 5-mm thickness with 2.5-mm reconstructions. Patients who were deemed to have a negative clinical examination result were cleared based on a GCS score of 14 or greater and assessed to have clinical examination findings inconsistent with abdominal injury. Significance and number of distracting injuries were not a factor in the determination of clinical examination sensitivity, and clinical examination was considered valid without regard to the extent or presence of distracting injuries. No patient was removed from the study because of the extent or severity of extra-abdominal distracting injuries, and no patient was prevented from entering into the study because of the extent or severity of distracting injuries. GCS score of 14 or greater dictated entry into the study.

Blood ethanol levels and urine drug screens were not routinely performed on patients entered into this study, and any results from these laboratory tests if performed had no bearing on the management of abdominal findings or patient entry into the study.

Clinical examinations were performed by general surgery house staff consisting of first-year to fifth-year general surgery residents. Board-certified attending radiologists performed final radiologic study interpretation of CT scans, and these interpretations were the only interpretations used for CT scan interpretation and data collection.

All injuries sustained by patients were recorded on the data study form. Distracting injuries as previously defined by Rose et al.\textsuperscript{14} were divided into three categories as follows: head, torso, and extremity injuries (Table 1).

**RESULTS**

Eight hundred three patients were enrolled during the study period; 448 (68%) enrolled patients were male, and 255 (32%) were female. The average age of the entire study population was 36.7 years. The average age of those without distracting injuries was 33.8 years, and those with distracting injuries, 39.0 years. Of the 352 patients without distracting injuries entered into the study, 301 (86%) had a GCS score of

<table>
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<tr>
<th>TABLE 1. Classification of Distracting Injuries</th>
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<tbody>
<tr>
<td><strong>Head Injuries</strong></td>
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<tr>
<td>Skull fracture</td>
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<tr>
<td>&gt;2 facial bone fractures</td>
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<tr>
<td>Mandible fracture</td>
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<tr>
<td>Intracranial injury (SDH, EOH, SAH, IVH, parenchymal hemorrhage; identified on CT scan)</td>
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<tr>
<td><strong>Torso Injuries</strong></td>
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<tr>
<td>&gt;2 rib fractures</td>
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<tr>
<td>Clavicle fracture</td>
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<tr>
<td>Scapula fracture</td>
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<tr>
<td>Sternal fracture</td>
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<tr>
<td>Pelvic fracture</td>
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<tr>
<td>Thoracolumbar spine fracture</td>
</tr>
<tr>
<td><strong>Long Bone Fractures</strong></td>
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<tr>
<td>Femur fracture</td>
</tr>
<tr>
<td>Tibia/fibula fracture</td>
</tr>
<tr>
<td>Humerus fracture</td>
</tr>
<tr>
<td>Radius/ulna fractures</td>
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<tr>
<td>Hip/shoulder dislocation</td>
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EOH, epidural hematoma; IVH, intraventricular hemorrhage; SAH, subarachnoid hemorrhage; SDH, subdural hematoma.
15 and 51 (14%) had a GCS score of 14. Of the 451 patients with distracting injuries, 387 (86%) had a GCS score of 15 and 64 (14%) had a GCS score of 14. The most common mechanism of injury was motor vehicle crash, 419 (52%), followed by falls (105, 13%), motorcycle crashes (79, 10%), pedestrians versus motor vehicle (66, 8%), all-terrain vehicle crash (52, 7%), and assaults (34, 4%).

A total of 700 injuries were diagnosed in the 451 patients who had distracting injuries (Table 2). Of the 352 patients without distracting injuries, 169 patients (48%) had a positive clinical examination finding (Fig. 1). Nineteen patients (5.4%) without distracting injuries were found to have intra-abdominal injuries (Fig. 1, Table 3). Two (10.5%) of the patients without distracting injuries and diagnosed with abdominal injuries had negative clinical examination results (Fig. 1, Table 3).

Of the 451 patients with distracting injuries, 232 (51%) had a positive clinical examination result (Fig. 1, Table 3). Forty-eight patients (10.6%) with a distracting injury had an intra-abdominal injury diagnosed by CT scan (Table 3). Five patients (10.4%) who had negative clinical examination result with distracting injuries were diagnosed with an intra-abdominal injury (Table 3). A total of 95 distracting injuries were diagnosed in the 48 patients who had abdominal injuries and distracting injuries (Table 2).

The unidentified injuries by clinical examination in the two patients without distracting injuries were both solid organ injuries (Table 3). Neither of these injuries required blood transfusion or operative intervention. The sensitivity of abdominal clinical examination for patients without distracting injuries was 89.5%. The sensitivity and negative predictive value of abdominal examination in patients without distracting injuries for surgically significant and transfusion-requiring injuries were both 100%.

All of the intra-abdominal injuries unidentified by clinical examination in the five patients with distracting injuries were solid organ injuries (Table 4). Distracting injuries associated with the five clinically missed abdominal injuries are described in Table 4. None of injuries missed by clinical examination in those five patients required surgical intervention or blood transfusion. The sensitivity and negative predictive value of abdominal clinical examination for patients with distracting injuries were 89.6% and 97.0%, respectively. The sensitivity and negative predictive value of

![Figure 1. Distribution of patients by distracting injury and clinical examination.](image-url)
abdominal examination in patients with distracting injuries for surgically significant and transfusion-requiring injuries were both 100%.

**DISCUSSION**

Because of the wide availability and easy access of CT scans, routine use of this diagnostic tool has become more prevalent in many trauma centers. CT scan for abdominal trauma is an excellent diagnostic method; however, cost and unnecessary patient radiation exposure should mandate judicious use of this technology. Health care providers are continually coaxed into a more cost-effective use of health care resources, which has created the need for more sensible protocols and diagnostic methodologies that optimally treat patients with less resource use. In addition, protocols that mandatorily use CT scan as a screening modality subject patients to amounts of radiation that are unnecessary and may have detrimental effects on the future health of trauma patients.

In the past, distracting injuries have been used as rationale for repudiating the validity of abdominal clinical examination in blunt trauma patients.10–13 This rationale combined with the ease with which a CT scan can be obtained has caused many trauma care providers to downplay the utility of clinical abdominal examination in this patient population. Most patients who present to busy trauma centers have distracting injuries, and these patients are often relegated to receive abdominal CT scans with little emphasis placed on findings of the clinical abdominal examination.

Our data have shown that the abdominal clinical examination for patients with distracting injuries has 90% sensitivity for abdominal injuries but more importantly 100% sensitivity for injuries that are surgically significant or require blood transfusion. These data are similar to the data we garnered for patients without distracting injuries. Sensitivity for the diagnosis of intra-abdominal injuries for patients without distracting injuries was identical to those with distracting injuries. This leads us to conclude that distracting injuries do not have an adverse effect on the sensitivity of the abdominal clinical examination. None of the “missed” abdominal injuries in either patient group were clinically significant. Blood transfusion or surgical intervention was not required in any of the patients whose abdominal injuries were not identified on clinical examination. In addition, the vast majority of patients who have distracting injuries described in this article require hospital admission to address their extra-abdominal injuries. This would allow for further observation of these patients. Pundits of this approach may question what would happen to patients with distracting injuries who have undiagnosed abdominal injuries? Similar outcomes would be seen in those patients without distracting injuries that had abdominal injuries undiagnosed. Minor solid organ injuries that do not require transfusion or surgical intervention rarely go on to require surgical intervention. Long-term follow-up on these injuries is unnecessary because the vast surgical experience with such injuries tells us that further intervention is rarely necessary.15–19 In a retrospective series by McCray et al.,15 53 Grade 1 splenic injuries were successfully treated with nonoperative management, and of 260 Grade 1 and 2 splenic injuries, 2 (0.8%) failed nonoperative management. In a retrospective review of 140 patients with low-grade splenic injuries that were successfully treated with simple observation, Haan et al.19 concluded follow-up abdominal CT scan confers no benefit.

During the past two decades, CT scan has become the diagnostic tool of choice for the diagnosis of abdominal injury. Before this, diagnostic peritoneal lavage (DPL) was the criterion standard for abdominal injury screening. Given that DPL is invasive and a minor surgical procedure, it was used much more judiciously relative to the manner in which CT scan is used today. Clinical examination was a significant factor in determining the need to perform DPL.20–22 Minor injuries were most likely missed as is the case in the data presented herein; however, these unidentified injuries have minimal clinical impact. In a recent retrospective series of 542 patients, Millo et al.23 concluded that the clinical yield of performing abdominal CT scan in blunt trauma patients with normal clinical examination result was minimal. Poletti et al.24 found that clinical examination in concert with other clinical criteria can obviate the need for CT scan in 22% of the patients.

**TABLE 3. Abdominal Injuries and Clinical Examination Findings**

<table>
<thead>
<tr>
<th>Intra-abdominal Injury</th>
<th>No Distracting Injuries With Positive Clinical Examination Result (Patients, n = 17)</th>
<th>No Distracting Injuries With Negative Clinical Examination Result (Patients, n = 2)</th>
<th>Distracting Injuries With Positive Clinical Examination Result (Patients, n = 43)</th>
<th>Distracting Injuries With Negative Clinical Examination Result (Patients, n = 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>8</td>
<td>1</td>
<td>17</td>
<td>4</td>
</tr>
<tr>
<td>Spleen</td>
<td>7</td>
<td>1</td>
<td>16</td>
<td>4</td>
</tr>
<tr>
<td>Kidney</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Bladder</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Small bowel</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Mesentery</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 4. Missed Abdominal Injuries and Distracting Injuries**

<table>
<thead>
<tr>
<th>Intra-abdominal Injury (5 patients)</th>
<th>Distracting Injuries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 3 spleen injury</td>
<td>Femur fracture</td>
</tr>
<tr>
<td>Grade 2 spleen injury</td>
<td>Rib, radius/ulna fractures</td>
</tr>
<tr>
<td>Grade 1 kidney injury</td>
<td>Radius/ulna, tibia/fibula, humerus fractures</td>
</tr>
<tr>
<td>Grade 1 spleen injury</td>
<td>Rib, pelvis, tibia/fibula, T-spine fractures</td>
</tr>
<tr>
<td>Grade 1 spleen injury</td>
<td>Skull, mandible, facial, femur, radius/ulna fractures</td>
</tr>
</tbody>
</table>

Intracranial hemorrhage (subdural hematoma)
concluded minor injuries may be missed but were clinically insignificant. In a prospective observational study, Holmes et al.\textsuperscript{12} derived clinical predictors that identify patients at low risk for intra-abdominal injury and unlikely to benefit from abdomino-CT scan. In a previous retrospective series at our institution, we found that 155 blunt trauma patients with negative abdominal examination results who required emergent extra-abdominal surgery had 99% negative abdomino-scan screening study results (CT scan or DPL) before their emergent surgery.\textsuperscript{25} In the present study, we have shown that a thorough clinical examination in awake and alert blunt trauma patients with distracting injuries can obviate the need for abdomino CT scan. We believe that the key to identification of intra-abdominal injuries is a careful abdomino-examination that involves all four abdominal quadrants, costal margins both anteriorly and posteriorly, flank, pelvis (posterior and inward compression of iliac wings, compression of symphysis pubis, rectal examination), and thoracolumbar spine. Careful examination and palpation of these areas will identify the vast majority of intra-abdominal injuries. The benefit of thorough abdomino-examination of the areas mentioned is supported by the fact that the most common distracting injuries associated with intra-abdominal injuries were rib fractures, thoracolumbar spine fractures, and pelvic fractures (Table 2). As a rule, these injuries evoke a positive clinical examination, allowing for the identification of associated intra-abdominal injuries.

The use of CT scanning has increased dramatically in the United States during the past two decades. In the United States, between 1995 and 2007, the number of CT scans performed during emergency department visits increased from 2.7 million to 16.2 million.\textsuperscript{26} That was a sixfold increase during that 12-year span. CT scanning must be used judiciously to avoid unnecessary patient radiation exposure because increased radiation exposure carries an increased lifetime risk of cancer.\textsuperscript{27,28} Approximately 75% of radiologic induced patient radiation exposure is the result of CT scanning with an estimated cancer-induced mortality risk of 12.5 deaths per 10,000 CT scans.\textsuperscript{2,29} Considering the exponential increase in the number of CT scans performed in the United States and the associated cancer risk, a more prudent approach to the use of this technology is warranted.

The data presented in this study demonstrate that the number of abdominal/pelvic CT scans performed on all awake and alert blunt trauma patients with distracting injuries would have decreased by 49% (219 of 451) during the 12-month period. Based on a $1,451 hospital charge for an abdominal/pelvic spine CT scan and $226 radiologist service fee at the University of South Alabama, this would have decreased total patient charges by $367,263 during the 12-month period.

A limitation of this study is that it is underpowered and cannot prove or disprove equivalence of abdominal clinical examination in patients with and without distracting injuries. Although our study size is not large enough to prove equivalence, of the 800 patients studied, none of the missed injuries in those with or without distracting injuries required surgical or radiologic intervention, and either group did not require blood transfusion. For this study to be powered at 80% (1 − β) with a probability (α) of 0.05, the population size of the study would have to be approximately 7,000 patients. Clearly, a larger multi-institutional study will be required to prove equivalence of clinical examination in these two patient populations.

**CONCLUSION**

To our knowledge, this is the first study that prospectively compares the efficacy of CT scan to abdominal clinical examination in patients with distracting injuries. Distracting injuries do not seem to diminish the efficacy of clinical abdominal examination for the diagnosis of clinically significant abdominal injury. These data suggest that clinical examination of the abdomen is valid in awake and alert blunt trauma patients, regardless of the presence of other injuries. A large multi-institutional trial will be required to prove that distracting injuries do not impact the sensitivity of abdominal clinical examination in awake and alert blunt trauma patients.

**REFERENCES**


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DISCUSSION

Dr. Andrew Kirkpatrick (Calgary, Alberta, Canada): This is a very thought-provoking article from the Department of Surgery in Mobile which, philosophically, is a call to arms to get out of bed and properly examine our patients rather than just wait for the call from the radiologist or, more likely, radiology resident with a list of reported injuries.

Thus, the authors report that by performing diligent physical examinations of awake and alert patients that these negative physical assessments, even in the presence of distracting injuries, are 90% sensitive and carried a 97% negative predictive value. More practically, though, there was a 100% sensitivity and a 100% negative predictive value for injuries requiring us to do something.

While I am certainly no statistician, I have had enough rejection letters to know that likelihood ratios are the most important descriptors of the true value of diagnostic tests which, in this manuscript, the physical exam is appropriately considered to be.

So while not formally reported as such in the manuscript, plugging the raw data into standard formulas reveals that the likelihood ratio of a negative test in this population was 0.20 for ruling out any abdominal injury which is actually not an ideal test with a ratio of 0.1 being considered such. However, the likelihood ratio of a negative test in ruling out any significant injury requiring therapy was 0.0 which we consider “perfect” for this indication.

Thus, reverting back to a good, old-fashioned, meticulous examination apparently seems to be simply good practice and obvious from this, for us to accept. But I recognize this is a very controversial area with strong opinions that are all over the map.

There are various previous reports that concluded that significant abdominal injuries may be completely asymptomatic, or that distracting injuries associate with intra-abdominal injury, or that such distracting injuries mask abdominal injuries, noting that the most-referenced source of this sentiment based this on only 10 patients. To put a name to it, this phenomenon is known as counterirritation or extinction of pain sensitivity, somewhat akin to the process where rubbing the skin of your arm makes the broken bone feel better.

Before any diagnostic tests can be adopted by any other groups, all considering adopting need to consider the issue of generalizability. Could the good results of physical examination in Mobile be expected to occur in Calgary, Philadelphia, or Helsinki?

Thus, I believe, one critical piece of information that the authors can hopefully provide us is to understand the Injury Severity Scores for the population so we can judge how applicable these patients are to our own experiences back home.

I appreciate that the authors provided aggregate details of the other associated injuries, but I would still like to know how severely injured each patient was, as this pre-test probability greatly affects the usefulness of any tests, including the physical examination.

A couple of other more hypothetical questions may reveal my own personal biases. In Mobile the physical examination is obviously performed to the highest standard. In my mind, using ultrasound is an additional physical sense to that of palpation described by the authors. Do you use point-of-care ultrasound? Do you consider part of a good exam a diagnostic test? Both or neither?

In very severely-injured patients do you think there can be enough other injuries that you might consider these other injuries not just as potential distractors but as overall markers of injury severity which would then raise the overall likelihood of visceral injuries so high that, then, further abdominal imaging is warranted, regardless of the abdominal exam?

And, again, you reported that the vast majority of these patients required admission. Previous RCTs from Dr. Livingston have reported that not only did 19% of that cohort have positive CT scans and no tenderness but, more importantly economically, that those with negative CT scans could be discharged earlier.

You mentioned that the numbers aren’t that big but can you drill down in any way to understand how many, if any, of your patients were admitted just for observation of the abdomen?
Overall, great work and thank you very much for the privilege of this discussion.

**Dr. Nathaniel McQuay** (Baltimore, Maryland): Did I see that correctly that you had seatbelt as a part of your positive exam? Can you tell me how did you come to that conclusion?

Who was actually doing the exam because we know it is somewhat subjective? Was it the PGY1-level or the attendings? And were the exams protocolized, meaning that every exam was done the exact same way? Thank you.

**Dr. Richard Mullins** (Portland, Oregon): Very nice paper. I've done a few thousand physical exams through the years. I agree with your conclusions but I have to take one exception: I find 10–20% of patients I exam have, what I conclude, is unreliable, even though their GCS is 13. They're intoxicated, or they're depressed or embarrassed, or they don't like the look of me, or maybe they speak a language that I can't share with them.

I think that assuming a physical examination in all trauma patients have the same reliability and validity ignores the fact that there are some patient exams that the doctor should conclude; “I can't really reliably communicate with this individual.” Do you agree there is some patient-related variation in the reliability of physical exam in your trauma center?

**Dr. Benton Cason** (Mobile, Alabama): Thank you, Dr. Kirkpatrick, and others for your comments and questions regarding this.

In regard to the Injury Severity Score, I don't have those numbers in front of me, but they are very easily obtainable from our trauma database. However, one would predict that the Injury Severity Score would be fairly high in these patients with distracting injuries due to the fact that most of these patients had multiple injuries in addition to any intra-abdominal injury found.

With regard to the use of ultrasound in the trauma bay, we do utilize a FAST exam as indicated in the evaluation of unstable patients with blunt trauma to the abdomen which, in some cases, does impact the decision to scan these patients but it is versus the decision to take them straight to the OR. The patients that would have had positive findings on an FAST exam after being unstable were not enrolled as they did not receive a CT to verify findings on the physical exam.

With regard to specific distracting injuries, again, we believe that further numbers are necessary before we can make any recommendations based on that.

Regarding admission for observation, how many of these patients were admitted? Although I don't have the numbers in front of me, most of these patients had severe enough distracting injuries that they would have warranted treatment for that injury itself and not for the abdominal exam or not for the abdominal injury.

The reason we select seatbelt sign is that it is a positive sign that there is definitive trauma to the abdomen which indicates that they do need further evaluation. And we considered that a positive finding.

I have no numbers to be able to speak to any communication issues that arose within patients but that could be something we could look at in the future.

Thank you.