Does Ethanol Affect the Reliability of Pelvic Bone Examination in Blunt Trauma?

Study objective: We sought to determine whether the reliability of clinical evaluation for pelvic bone fracture after trauma is compromised by a serum ethanol level of 100 mg/dL or greater.

Methods: This is a retrospective case control study of trauma registry patients presenting from October 1, 1995, to March 31, 1997, to an urban level I trauma center. Inclusion criteria were as follows: blunt trauma, age 13 years or older, and Glasgow Coma Scale score of 13 or greater. Exclusion criteria were as follows: isolated penetrating injury and suspected spinal injury. Patients were separated into 2 groups: those with an ethanol level of 100 mg/dL or greater, and those with an ethanol level of less than 100 mg/dL. Physician performance in clinical identification of pelvic bone fracture by using a complaint of pain, pelvic tenderness, with or without deformity, was compared between the 2 groups.

Results: Seven hundred sixty-three patients met inclusion criteria. Fifty-five (7.2%) patients had a pelvic fracture, 75% of which were isolated acetabulum or pubic ramus fractures. Two hundred six control patients without pelvic fractures were randomly selected. The sensitivity and specificity of the complaint of pain and tenderness, deformity, or both for identification of a pelvic fracture was not significantly different between the ethanol groups. Five (9%) of 55 patients with pelvic fractures had neither a complaint of pain nor bony tenderness or deformity on examination. This was not statistically associated with an ethanol level of 100 mg/dL or greater ($P=1.000$).

Conclusion: In our study, clinical evaluation for pelvic fracture in trauma patients with a Glasgow Coma Scale score of 13 or greater was not compromised by an ethanol level of 100 mg/dL or greater. The most common reason for clinically missed pelvic fractures was the presence of additional painful distracting injuries.
ETHANOL AFFECTING THE PELVIC BONE EXAMINATION IN TRAUMA
Tien & Dufel

INTRODUCTION

The belief that ethanol alters a patient’s ability to sense and communicate pain has extended to include patients who are cognitively intact and cooperative. Our practice has been to discount the absence of a complaint of pain if the patient has a serum ethanol level of 100 mg/dL or greater. There has been little published work specifically addressing this issue. Our goal is to determine whether trauma patients with a Glasgow Coma Scale (GCS) score of 13 or greater and an ethanol level of 100 mg/dL or greater have more clinically missed pelvic fractures than those with an ethanol level of less than 100 mg/dL.

MATERIALS AND METHODS

This is a retrospective case-control study of patients presenting to an urban level I trauma center between October 1, 1995, and March 31, 1997. Inclusion criteria were triage to the trauma room, a mechanism of blunt trauma, age 13 years or older, and a GCS score of 13 or greater. Exclusion criteria were isolated penetrating injury or suspected spinal injury. Charts documenting a pelvic fracture were identified by using a hospital-based computerized trauma registry. These registry data are collected and compiled by the trauma coordinator on a case-by-case basis. Control subjects meeting inclusion criteria were identified by using block randomization by age groups in 10-year intervals up to age 65 years. Control subjects and patients were chosen in a 4:1 ratio.

Data were abstracted in an unblinded fashion by the principal investigator and a research assistant from standardized emergency department trauma charts. A data form was pilot tested by the principal investigator and revised before initiation of data abstraction. The assistant’s forms were randomly reviewed by the principal investigator for accuracy. Records were reviewed for demographics; mechanism; discharge diagnoses; complaint of pelvic pain, pelvic tenderness, and/or deformity on examination; GCS score; injury severity score; and serum ethanol level. Drug screening was not reviewed.

Two-by-two tables were constructed by using SPSS software (version 8.0; SPSS Inc, Chicago, IL) to determine the sensitivity and specificity of a complaint of pelvic pain, pelvic tenderness, and/or deformity for identifying a pelvic fracture. Patients were separated into two groups: those with an ethanol level of 100 mg/dL or greater and those with an ethanol level of less than 100 mg/dL. Exact 2-sided 95% confidence intervals (CIs) for probabilities were calculated for differences in sensitivity and specificity between the patient and control groups for each clinical element. Fisher exact and t tests were performed where appropriate.

Patients with missing documentation of patient complaint were not used in calculations evaluating the reliability of a complaint of pelvic pain for identifying pelvic fractures. Patients with unclear documentation were included if the missing data were available in another area of the chart. Those with missing serum ethanol levels were excluded entirely.

This study was approved by our institutional review board.

RESULTS

Seven hundred sixty-three of 1,871 patients met inclusion criteria. Fourteen (6.4%) of 220 control patients were excluded because of missing ethanol levels. Eighty-two (11%) of those with a pelvic fracture, 10 had an ethanol level between 200 and 299 mg/dL, and none had an ethanol level $\geq$ 300 mg/dL. Of those without a pelvic fracture, 28 had an ethanol level between 200 and 299 mg/dL, and 6 had an ethanol level of 300 mg/dL. There was no statistically significant difference determined by using the Fisher exact 2-tailed test between the 2 groups for any of the variables, except for injury severity score ($P<.0001, \alpha=.05$).
patients had pelvic fractures, and 27 (33%) of these were excluded because of missing ethanol levels. There was no significant difference in injury severity scores between included and excluded patients with pelvic fractures (difference 7.6; 95% CI –0.6 to 15.2; Table 1). Forty-one (75%) of the remaining 55 patients and 18 (67%) of the 27 excluded patients had isolated acetabulum or pubic ramus fractures.

Five (9%) of 55 patients with a pelvic fracture were not identified on history or physical examination. One of these 5 patients had a missed open-book pelvic fracture. Patients in the study and control groups were well matched (Table 1).

Two hundred fifty-six of 261 patients were analyzed for the complaint of pelvic pain. Five patients were excluded for missing patient complaint documentation. The sensitivity of pain for identifying a pelvic fracture was 79%. There was no significant difference between those subjects with an ethanol level of 100 mg/dL or greater (76.9%) and those with an ethanol level of less than 100 mg/dL (80%; difference –3.1%; 95% CI –19.1% to 12.9%). The overall specificity of pain for identifying a pelvic fracture was 91.5%. There was no difference noted in those with an ethanol level of 100 mg/dL or greater (92%) and those with an ethanol level of less than 100 mg/dL (91.3%; difference 0.7%; 95% CI –1.5% to 17.3%).

Two hundred sixty-one patients were analyzed. The sensitivity of clinical evaluation for pelvic fracture was 97.5%. No difference was noted between those with an ethanol level of 100 mg/dL or greater (98.4%) and those with an ethanol level of less than 100 mg/dL (97.1%; difference 1.3%; 95% CI –10.1% to 12.7%).

The results of clinical evaluation were considered positive for a pelvic fracture if there was a complaint of pelvic pain, a suspicious pelvis examination, or both. Patients with no documented complaints were presumed to have no complaint of pelvic pain (Table 2).

Two hundred sixty-one patients were analyzed. The sensitivity of clinical evaluation for pelvic fracture was 84.9%. There was no difference between those subjects with an ethanol level of 100 mg/dL or greater (81%) and those with an ethanol level of less than 100 mg/dL (73.9%; difference 7.1%; 95% CI –5.5% to 19.7%). The specificity of the physician evaluation for pelvic fracture was 97.9%. There was no difference between those with an ethanol level of 100 mg/dL or greater (98.3%) and those with an ethanol level of less than 100 mg/dL (97.8%; difference 0.5%; 95% CI –11.2% to 12.2%).

Twenty (36%) of 55 patients with pelvic fractures had no pelvic pain; 5 had ethanol levels of 100 mg/dL or greater, and 15 had ethanol levels of less than 100 mg/dL. Four (20%) of these 20 patients had negative results on clinical evaluation for a pelvic fracture. There was no significant statistical association between an ethanol level of 100 mg/dL or greater and a clinically missed pelvic fracture (Table 2). All of these patients had painful distracting injuries elsewhere and minor pelvic fractures (isolated acetabulum or pubic ramus). Distracting injuries included pneumothorax or multiple rib fractures, femur fractures, or severe facial injuries.

When patients were stratified at the 200 mg/dL ethanol level (44 had an ethanol level of ≥200 mg/dL, and 217 had an ethanol level of <200 mg/dL), there was a statistically significant improvement in the sensitivity of clinical evaluation for identifying a pelvic fracture in the ethanol 200 mg/dL group (ethanol level ≥200 mg/dL, 100%; ethanol level <200 mg/dL, 91%; difference 9%; 95% CI 5.2% to 12.8%). However, no difference in specificity of clinical evaluation was noted (ethyl alcohol level ≥200 mg/dL, 97%; ethanol level <200 mg/dL, 89%; difference 8%; 95% CI –9.3% to 25.3%).

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**Table 2.**

*Clinical evaluation of the pelvis and serum ethanol level.*

<table>
<thead>
<tr>
<th>Ethanol Level</th>
<th>No Pelvic Fracture</th>
<th>Pelvic Fracture</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;100 mg/dL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative clinical evaluation</td>
<td>131</td>
<td>3</td>
<td>134</td>
</tr>
<tr>
<td>Positive clinical evaluation</td>
<td>12</td>
<td>34</td>
<td>46</td>
</tr>
<tr>
<td>Total</td>
<td>143</td>
<td>37</td>
<td>180</td>
</tr>
<tr>
<td>≥100 mg/dL</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative clinical evaluation</td>
<td>59</td>
<td>1</td>
<td>60</td>
</tr>
<tr>
<td>Positive clinical evaluation</td>
<td>4</td>
<td>17</td>
<td>21</td>
</tr>
<tr>
<td>Total</td>
<td>63</td>
<td>18</td>
<td>81</td>
</tr>
</tbody>
</table>

The calculated sensitivity and specificity of clinical evaluation for clinical identification of pelvic fracture (positive=presence of pelvic pain, presence of tenderness, and/or deformity of the pelvis) were not statistically significantly different between those with an ethanol level of ≥100 mg/dL and those with an ethanol level <100 mg/dL (sensitivity: difference 7.1%; 95% CI –5.5% to 19.7%; specificity: difference 0.7%; 95% CI –11.2% to 12.2%). There was no statistically significant association between an ethanol level of ≥200 mg/dL and clinically missed pelvic fractures, as determined by using the Fisher exact 2-tailed test (P=1.000; α=0.05).
DISCUSSION

Patients who are perceived as intoxicated or who have a serum ethanol level of 100 mg/dL or greater undergo more invasive procedures than their nonintoxicated counterparts. This may be because they appear more ill as a result of their diminished mental status or because the examination is considered unreliable.

Is ethanol, however, associated with an unreliable clinical evaluation? There are few data to support an affirmative answer. Understudy in this area is largely the result of the complex effects ethanol has on cognition, psychomotor performance, and the perception of pain. Serum ethanol level is not itself a reliable indicator of how compromised a patient is but continues to be used for lack of any better objective measures of ethanol intoxication.

One recent study by Perez et al evaluated the effect of an ethanol level of 100 mg/dL or greater on missed intra-abdominal injuries in trauma patients. They concluded that in hemodynamically stable and cognitively intact patients (GCS score =15), there were no clinically missed intra-abdominal injuries. Another study by Born et al studied delayed fracture diagnosis in blunt trauma patients and concluded that there was no association between ethanol level and missed injury.

Studies exploring the effect of ethanol on pain threshold have had varied results. It is generally agreed that alcoholics have an exaggerated increase in pain threshold after ethanol ingestion. Whether this is a normalization of pain sensitivity or a supernormalization of the pain threshold is unclear. Data are confusing regarding the effect of ethanol on pain thresholds in nonalcoholic subjects.

The effects of ethanol on other areas of cognition are also of potential importance in clinical evaluation. Studies have revealed a decline in attention, performance of complex tasks, and psychomotor ability, as well as an increase in aggressiveness, with ethanol levels approaching 100 mg/dL. Although the completion of complex tasks may not be clinically significant during a trauma evaluation, the ability to attend to and cooperate with the examiner may become important.

Trauma patients were selected as our study population because of their high incidence of ethanol use and standardized method of evaluation. The 1998 Advanced Trauma Life Support (ATLS, American College of Surgeons, Committee on Trauma) guidelines specify the importance of cervical spine, chest, and pelvis radiographs, as well as provide a clear description of primary and secondary survey evaluation. Injury of the pelvis was chosen not only because of its standardized method of evaluation but also because some studies have shown that pelvic fractures can reliably be detected on clinical examination of the patient.

Of the 55 patients with pelvic fractures, 5 had neither a complaint of pelvic pain nor a significant pelvic examination despite the presence of a fracture. All had painful distracting injuries elsewhere that were associated with relatively minor pelvic fractures and did not have a significant association with an ethanol level of 100 mg/dL or greater. In 2 cases, it is possible that the examining physician may not have been as diligent in clinically evaluating the pelvis carefully because no complaints were documented. He or she may have chosen instead to address more obvious serious injuries while planning to obtain a pelvic radiograph. In any case, injuries distracting to both the patient and examiner appeared to play a role in clinically missed pelvic fractures. This suggests that patients with distracting injuries may not have a reliable examination of the pelvis and require routine radiographs.

One limitation to this study is its retrospective design. Misclassification may have occurred because it is not possible to retrospectively ensure a uniform method of examination. Although the examination of the pelvis is a routine part of the trauma evaluation, physicians may not palpate the pelvic bones as carefully when a pelvic radiograph is expected.

This study also had a small sample size. Pelvic bone fractures are uncommon, and separating patient groups into those with an ethanol level of 100 mg/dL or greater and those with an ethanol level of less than 100 mg/dL further limited the number of patients available for statistical evaluation. Small sample size is also the likely explanation for the noted improved sensitivity of the pelvic evaluation in those with an ethanol level of 100 mg/dL or greater. A power calculation for our clinical evaluation sensitivity of 81% in subjects with an ethanol level of 200 mg/dL or greater determined that 620 subjects in each group would be required to detect the above 7.1% difference (α = .05 and β = .80).

An expanded prospective study controlling for a consistent method of pelvic bone examination and including a larger number of patients is required to further validate our conclusions. More research is also required to develop objective reliable markers of ethanol intoxication. Despite the limitations, the data presented here provide no evidence that an ethanol level of 100 mg/dL or greater ad-
versely affects the clinical diagnosis of pelvic fracture in trauma patients with a GCS score of 13 or greater.

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REFERENCES