Routine Initial Computed Tomography of the Chest in Blunt Torso Trauma

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Computer tomography (CT) is an effective technique in the initial evaluation of the abdomen and head following blunt trauma. To evaluate the role of CT of the thorax, a prospective study comparing routine early thoracic CT scanning with initial chest roentgenogram (CXR) was carried out on 73 patients with blunt torso trauma undergoing concomitant abdominal CT examination. Initial CXR and CT scans were interpreted independently by radiologists in a blinded fashion. CXR diagnosed more bony injuries than CT, while the CT identified pulmonary contusions and effusions more accurately. Only those contusions diagnosed by CXR proved clinically significant. Patient treatment was changed in one case based on CT findings. In the absence of CXR findings, chest CT scanning frequently identifies abnormalities with limited clinical significance. Although more sensitive, CT of the thorax has a limited role in the initial emergent evaluation of victims of blunt torso trauma.

ISS = Injury Severity Score

Computed tomography (CT) has proved to be an effective diagnostic technique in the evaluation of the abdomen, head, and cervical spine in blunt trauma. It has been suggested that thoracic CT in blunt torso trauma may be of similar value. Its routine use in the initial evaluation of blunt thoracic injury, however, is controversial. Previous reports have been either anecdotal or small retrospective series. Recently, some investigators have recommended emergent chest CT in "all stable patients with blunt torso trauma, cross-body injury pattern and/or even for those patients with injury suggestive of chest trauma." To establish the role and the clinical usefulness of CT of the thorax in the evaluation of victims suffering from blunt chest trauma, a prospective study comparing emergent thoracic CT to admission chest roentgenogram (CXR) was undertaken.

METHODS

All hemodynamically stable victims of blunt torso trauma, at risk for concealed intra-abdominal injury, undergoing emergent abdominal CT during the period September 1, 1987, to January 31, 1988, were included in the study. Those patients undergoing diagnostic peritoneal lavage due to hemodynamic instability were excluded from the study. In addition, we excluded those patients in whom, due to the nature of their injuries, only supine CXR was possible. Initial portable anteroposterior CT was taken in an upright position in the resuscitation area. Prior to the abdominal CT, dynamic axial CT of the chest was performed on a scanner (Somaton II) within 1 h of arrival at our level 1 trauma center. All patients received an initial 70-ml intravenous bolus of 43 percent solution of iothalamate meglumine prior to the scan followed by a continuous infusion of 130 ml over the time during which the thorax was scanned from the apex of the lungs to the diaphragm at 3-cm intervals. For study purposes, interpretation of the CT scan and the CXR was performed independently by different radiologists, blinded to both the clinical findings and the findings of the other radiologic study. Any changes in clinical management based on CT findings were noted. Patient demographics, injury patterns, Injury Severity Score (ISS), and outcome were recorded in a computerized registry. Differences between distribution of the findings on the two groups were statistically analyzed using Fisher's exact test.

RESULTS

Seventy-three patients, mean age 33 years (range, 4 to 79 years), were entered into the study. There were 53 male and 20 female patients. Sixty-five patients (89 percent) were injured in road crashes, three (4 percent) were injured in falls from heights, three (4 percent) were injured in assaults, and two (3 percent) were injured in recreational accidents. The mean ISS was 19.1. Thirteen patients (17.8 percent) had sustained major abdominal injury and 33 (45.2 percent) had sustained severe head injury. Twenty-seven patients had sustained significant chest injury.

Interpretation of the radiologic studies is shown in Table 1. There were five orthopedic injuries (clavicular, humeral, and scapular fractures) identified on CXR but not CT (p<0.004). Both CXR and CT scanning identified single cases of tumor metastasis, diaphragmatic hernia, pleural thickening, and a cavitory lesion. Both procedures were equal in diagnosing segmental atelectasis and chronic obstructive pulmonary disease. In a patient with widened mediastinum, aortic disruption was neither suggested by dynamic CT nor identified on aortography.

CT was significantly more sensitive in the identifi-
Table 1—Radiologic Findings

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>No. of Patients</th>
<th>CXR</th>
<th>CT</th>
<th>Significance*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pneumothorax</td>
<td>6</td>
<td>8</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Pleural fluid</td>
<td>3</td>
<td>15</td>
<td>0.002</td>
<td></td>
</tr>
<tr>
<td>Rib fractures</td>
<td>6</td>
<td>1</td>
<td>0.058</td>
<td></td>
</tr>
<tr>
<td>Pulmonary contusion</td>
<td>6</td>
<td>27</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>Wide mediastinum</td>
<td>1</td>
<td>1</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Pleural abnormality</td>
<td>3</td>
<td>4</td>
<td>NS</td>
<td></td>
</tr>
</tbody>
</table>

*Fishers' exact test (NS = not significant [p>0.05]).

Evaluation of pleural effusion and pulmonary contusion than CXR, and CT was marginally more sensitive to the presence of rib fractures. There was no statistical difference between the two techniques regarding sensitivity for other injuries. One patient had treatment altered by CT findings when a chest tube was placed for treatment of a small pneumothorax identified on CT but not on initial CXR.

DISCUSSION

CT is an accepted technique in the examination of patients who have sustained blunt trauma to the head, abdomen, or spine.1,2 Some have reported success with the use of dynamic thoracic CT in lieu of thoracic aortography in those with suspected aortic disruption.3,4 The upright CXR continues to be the standard in initial assessment of the chest following blunt trauma, and the role of CT in such evaluation has not been well-defined.

Anecdotal reports and retrospective studies of selected populations have suggested that CT may be useful in identifying injuries missed on initial CXR.5,6,8,9 Toombs et al.6 reviewed 20 blunt trauma patients who had CT scans of their chest following identification of injury. Pleural and lung abnormalities (constituting 94 percent of the lesions) were best demonstrated by CT. CXRs demonstrated only 12 (24 percent) of 50 lesions noted on CT; however, the indications for the scan and clinical significance of the lesions identified by CT only were not examined by these investigators.

In a larger series, Wagner and Jamieson9 retrospectively reviewed 92 patients who had undergone thoracic CT for evaluation of pulmonary contusion. Despite no direct comparison of sensitivity of CXR vs CT in this population, the authors concluded that thoracic CT increased diagnostic yield and permitted early diagnosis and treatment of unsuspected pulmonary parenchymal injury. They did comment, however, that additional CT findings relative to CXR were not always significant.

McLean,4 and Woodring and Dillon7 recommended a more limited role for CT in patients with multiple thoracic injuries (as noted on CXR), obesity, question-able CXR findings, or spinal injury. Their vision for the use of CT was to further delineate abnormalities identified on CXR.

In our population, CT proved to be more accurate in demonstrating pleural effusions and small pulmonary parenchymal lesions than CXR, while CXR was more effective for diagnosis of bony injuries. These findings are consistent with the results of Toombs et al.6 Our scanner obtained sections every 3 cm. One can suggest that the CT sensitivity with regard to bony injuries may increase if the section interval, ie, 1 cm or 2 cm, would be used. Some authors10 found that CT and conventional CXR were equally sensitive (77 percent) in detecting rib fractures when a 2-cm interval was used for CT sections.

Despite a higher sensitivity than CXR, our CT findings altered the clinical treatment in only one patient. The clinical significance of these findings was limited, however, as only those pulmonary contusions identified by both CT and CXR proved to be of clinical significance. Three patients required aggressive pulmonary toilet and oxygen therapy, and three required endotracheal intubation and positive pressure ventilation. Those patients with pulmonary contusions identified by CT alone required no specific therapy and resulted in no complications. Those parenchymal injuries identified by CT and not CXR were mainly small contusions or pleural effusions, which caused no physiologic abnormalities.

CT of the chest is an expensive and time-consuming technique. If such a study is to be used on a regular basis in the initial examination of patients sustaining blunt torso trauma, as recommended by McConigal et al.,11 the cost-benefit ratio must be considered. In an era of cost containment, the additional expense is prohibitive, particularly since addition of CT of the thorax to the upright anteroposterior CXR does not appear to be of sufficient clinical value to justify its routine use in this setting.

It can be concluded that chest CT is a sensitive diagnostic technique that can demonstrate pulmonary and pleural abnormality not identified by upright CXR; however, in patients with blunt torso trauma, this does not appear to have clinical relevance. On this basis, although thoracic CT may be useful in delineation of injuries recognized by CXR, it has a limited role in the initial examination of patients with blunt torso trauma.

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REFERENCES

Photodynamic Therapy for Cancer Treatment: A Clinical Update

Thompson Cancer Survival Center, Knoxville, will present this two-day program November 7-8 at the Thompson Center. For information, contact Laser/Hyperthermia Department, Thompson Cancer Survival Center, 1915 White Avenue, Knoxville (615:541-1433).