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Papers presented

Incidence and management of occult hemothoraces

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Abstract

Background: Little is known about the incidence of and associated management outcomes of occult hemothorax in blunt trauma patients. The increased use of computed thoracic tomography for the evaluation of the multiply injured blunt trauma patient has led to an increase in the identification of these hemothoraces and management dilemmas.

Methods: A retrospective review of blunt trauma patients with occult hemothoraces was performed. Patients were divided into 2 groups: chest tube versus no chest tube. Outcomes and complications for the 2 groups were defined. Data included demographics, Injury Severity Score, length of stay, need for mechanical ventilation and thoracic consult, pneumonia, and empyema. The size of the occult hemothorax was measured on the computed thoracic tomography.

Results: Eighty-eight patients (21.4%) had a total of 107 occult hemothoraces. Patients in the chest tube group were more likely to have a higher Injury Severity Score and an associated occult pneumothorax and to have smaller hemothoraces.

Conclusions: Occult pneumothoraces occur in a significant proportion of the multiply injured blunt trauma population. Small, isolated, occult hemothoraces can be managed safely in the stable patient.

Keywords: Occult hemothorax; Chest tube; Outcomes; Incidence

Thoracic trauma is responsible for a significant percentage of all trauma deaths and may have an associated mortality rate of up to 25% [1]. The standard supine chest radiograph has been the gold standard for the evaluation of the patient with thoracic trauma. However, since the mid- to late 1990s and the advent of helical computed tomography, thoracic computed tomography (TCT) has been used more frequently in the evaluation of the multiply injured patient. Although the most common indication for its use is to evaluate a trauma patient with an abnormal chest radiograph or known blunt thoracic trauma, it has been shown to diagnose abnormalities not identified on chest radiograph. Helical TCT is highly sensitive for the diagnosis of pneumothorax, hemothorax, and pulmonary contusions as compared with supine chest radiograph [2–5].

The increased use of TCT for the evaluation of the blunt trauma patient has led to the identification of hemothoraces not seen on supine chest radiograph in 20% to 30% of patients [2,3,5–8]. The significance of these occult hemothoraces is not clear. Some studies have hinted at the fact that these findings require no specific intervention and do not alter patient care [2,3]. Other studies suggest that the use of TCT may lead to a change in therapy and improved outcomes [5,6]. Only 1 recent study has addressed the specific management of occult hemothoraces [8]. The purpose of this study was to define the occurrence of occult hemothorax in patients with blunt trauma undergoing concurrent chest radiograph and TCT for initial evaluation of their injuries and the associated management issues and outcomes.

Methods

Emergency and radiology department databases were reviewed and cross-referenced with the trauma registry database at a level I trauma center to identify all blunt trauma patients admitted to the trauma service who had concurrent

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Table 1
Demographics for blunt trauma population with concurrent CXR and TCT

Sex	
Male	310 (75.6)
Female	100 (24.4)
Average age, y	42.7 ± 19
Mechanism	
Motor vehicle crash	306 (74.6)
Fall	35 (8.5)
MCC	25 (6.1)
Pedestrian	21 (5.1)
Other	19 (4.6)
Snowmobile	4 (1.0)
Average ISS	19.9 ± 12.6
Average chest AIS	2 ± 1.6
Average length of stay	11.4 ± 12.9
Average intensive care unit length of stay	5.4 ± 6.8
Mortality	26 (6.4)*
Occult pneumothorax	75 (18.3)*
Occult hemothorax	88 (21.5)*

* Number of patients with findings.
CXR = chest x-ray; MCC = motorcycle crash.

chest radiograph and TCT as part of their initial trauma evaluation from 1996 through 2001.

The medical records were reviewed to confirm the registry data and the presence or absence of an occult hemothorax. An occult hemothorax was defined as a hemothorax that was not identified on the initial chest radiograph but was identified on the concurrent TCT as noted on the official radiology department reading of the studies. Only those patients with occult hemothorax and who were admitted to the hospital were included in the study. Those patients not admitted to the hospital, who died in the emergency room or operating room, or had charts unavailable for review were excluded from the study. Demographic data such as age, sex, Injury Severity Score (ISS), length of stay, and mechanism of injury were abstracted from the trauma registry.

Further chart review for each patient with an occult hemothorax was performed to determine whether or not a chest tube was placed as initial management. The patients then were divided into 2 groups: chest tube or no chest tube. Outcomes such as pneumonia, empyema, further chest tube placement, and complications in each group then were identified and compared. The diagnosis of pneumonia was made on the basis of purulent sputum, infiltrate on chest radiograph, and a quantitative mini-nonbronchoscopic bronchial alveolar lavage culture with greater than 10^5 microorganisms. Empyemas were defined as an infected loculated pleural fluid collection or peel.

TCT scans were performed on GE (GE Medical Systems, Milwaukee, WI) single-detector helical and multidetector-row scanners, including 4-channel, 8-channel, 16-channel, and 64-channel scanners. Because this study occurred over a 5-year period, scans performed early in the study were performed on different channel scanners than those performed later in the study.

Scans were performed with the administration of 150 mL of Omnipaque (GE Healthcare, Princeton, NJ) injected at 5 mL/s. Images through the chest were reconstructed at 1.2-, 2.5-, or 5-mm slice thickness. Images were analyzed by a single thoracic radiologist (L.W.) blinded to the clinical data. Images were assessed for presence and maximal thickness of hemothorax. Statistical analysis was performed with the chi-square, Fisher exact test for categoric variables and the *t* test for continuous variables. Statistical significance was assigned to a *P* value of less than .05. The Institutional Review Board at the Medical College of Wisconsin approved this study.

Results

During the study period, 9745 patients were admitted to the hospital with 75.8% having sustained blunt trauma and 24.2%, penetrating trauma. A total of 410 patients were identified as having had concurrent chest radiograph and TCT as part of their initial trauma evaluation. The majority of the patients were male, involved in motor vehicle crashes, had an average age of 42.7 years, and an average ISS of 19.9 (Table 1). A total of 107 occult hemothoraces were identified in 88 patients (21.5%). The 88 patients with occult hemothoraces had an average ISS and average chest Abbreviated Injury Score (AIS) of 27.4 and 3.4, respectively. The majority of the patients required mechanical ventilation and 34 patients had an associated occult pneumothorax. Of note, there were 5 patients in this group who had aortic injuries (Table 2).

Chest tubes were placed for initial management in 41 (48%) of the patients with occult hemothorax and in 62 of the 107 (68%) occult hemothoraces. Those patients with occult hemothorax managed initially by chest tube had a higher average ISS and more pneumonia than those managed initially without chest tubes. There was no statistically significant difference between those patients managed with a chest tube at presentation and those not managed with a chest tube at time of presentation, intensive care unit length of stay, need for mechanical ventilation, and the development of empyema or pneumonia. All 3 of the empyemas occurred in the chest tube group and 1 of these patients developed methicillin-resistant *Staphylococcus aureus* sepsis, multisystem organ failure, and died (Table 3). Only 5 hemothoraces in the no-chest-tube group required later chest tube placement for progression of the hemothorax. Two of the 5 patients who had progression requiring place-

Table 2
Characteristics for patients with occult hemothoraces

Average age, y	45.3 ± 19.7
Average ISS	27.4 ± 12.7
Chest AIS	3.4 ± 1.0
Length of stay	14.3 ± 11.7
Intensive care unit length of stay	7.6 ± 7.7
Empyema	3 (3.4%)
Pneumonia	9 (10%)
Mechanical ventilation*	58 (66%)
Mortality	7 (8%)
Associated thoracic injuries	
Rib fractures	74 (84.1%)
Occult pneumothorax	34 (38.6%)
Aortic injury	5 (5.7%)

* At any time during hospitalization.