[Original Research]

CHEST

Conservative Management in Traumatic Pneumothoraces

An Observational Study

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BACKGROUND: Traumatic pneumothoraces are a common consequence of major trauma. Despite this, there is a paucity of literature regarding their optimal management, including the role of conservative treatment. The aim of this study was to assess the treatment, complications, and outcomes of traumatic pneumothoraces in patients presenting to a major trauma center.

METHODS: The prospectively collected Trauma Audit and Research Network (TARN) database was used to identify all patients presenting with traumatic pneumothoraces to a UK major trauma center from April 2012 to December 2016. Demographics, mechanism of injury, injury severity score (ISS), management, and outcomes were analyzed.

RESULTS: Six hundred two patients were included during the study period. Mean age was 48 years (SD, 22 years), and 73% were men. Mean ISS was 26 and inpatient mortality was 9%. Of the 602 traumatic pneumothoraces, 277 of 602 (46%) were initially treated conservatively. Two hundred fifty-two of 277 patients in this cohort (90%) did not require subsequent chest tube insertion, including the majority of patients (56 of 62 [90%]) who were receiving positive pressure ventilation (PPV) on admission. The hazard ratio (HR) for failure of conservative management showed no difference between the ventilated and nonventilated patients (HR, 1.1; $P = .84$). Only the presence of a large hemothorax was associated with an increased likelihood of failure of conservative management.

CONCLUSIONS: In the largest observational study of traumatic pneumothoraces published to date, > 90% of patients whose pneumothorax was managed conservatively never required subsequent tube drainage. Importantly, this also applies to patients requiring PPV, with no significant increased risk of failure of expectant management. These data support a role for conservative management in traumatic pneumothoraces. CHEST 2017; ■(■):■-■

KEY WORDS: pneumothorax; trauma; ventilation

ABBREVIATIONS: GCS = Glasgow Coma Scale; HR = hazard ratio; ISS = Injury Severity Score; IQR = interquartile range; MTC = major trauma center; PPV = positive pressure ventilation; TARN = Trauma Audit and Research Network

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Traumatic pneumothoraces are present in one-fifth of patients who have undergone multiple trauma[1] and is the most common potentially life-threatening injury in blunt chest trauma.[2] Thoracic trauma occurs in nearly two-thirds of multiple trauma cases and represents the primary cause of death in 25% of trauma patients.[3] Trauma as a whole is a major public health problem, with > 150,000 deaths and > 3 million nonfatal injuries per year in the United States,[4] representing the leading cause of death for individuals younger than 45 years of age.[5]

Although uncomplicated traumatic pneumothoraces may be well tolerated, the risk of tension and resultant cardiorespiratory compromise makes identification important, particularly since the basic procedure of tube thoracostomy insertion can potentially avert significant morbidity and mortality.[6] Current guidance by the American College of Surgeons Advanced Trauma Life Support[7] advises chest tube placement for any traumatic pneumothorax, although it suggests that asymptomatic pneumothoraces can be managed with observation and aspiration at the treating physician's discretion. It does, however, state that a chest drain is required in patients receiving either general anesthesia or positive pressure ventilation (PPV) to avoid a life-threatening pneumothorax.[7]

This concept has been challenged, principally with the increased use of CT imaging in trauma that has identified small subcentimeter-sized pneumothoraces. This has raised the question of whether these small "occult" pneumothoraces, which can make up to 76% of all traumatic pneumothoraces,[8] can be left untreated, particularly when positive pressure is required. Despite an early study indicating a high rate of tension in conservatively management patients receiving PPV,[9] studies[6,8,10-12] suggest that occult pneumothoraces can be managed expectantly, including in patients receiving PPV.

Whether these results can translate to all traumatic pneumothoraces is unclear and needs clarification. CT scanning is now almost ubiquitous in patients with multiple trauma, and the distinction between occult and overt pneumothoraces may become antiquated. Case studies have also suggested that it is possible to treat larger pneumothoraces with observation.[2,13]

The aim of our study was to use a large trauma patient cohort to create a profile of consecutive patients presenting with traumatic pneumothoraces to examine the outcomes of conservatively managed patients and determine whether there are factors that can help predict whether a chest tube is required.

Methods

From April 2012 to November 2016, patients were identified as part of the Trauma Audit and Research Network (TARN) of patients presenting to the ED at Southmead Hospital, a regional UK adult major trauma center (MTC). It covers a population of 2.3 million, is supported by six other trauma unit hospitals, and admits > 1,000 major trauma patients per year. The TARN registry is a prospective observational registry of hospitalized patients who have undergone major trauma in England and Wales. TARN has given ethical approval (Section 251) for research on the anonymized data submitted by member hospitals. The TARN database includes all trauma patients irrespective of age who have a direct admission or are transferred to a member hospital and whose length of stay is 3 days or more, as well as those admitted to a high-dependency area regardless of length of stay. It also includes deaths of trauma patients occurring in the hospital, including the ED, and those transferred to other hospitals for specialist care or for an ICU/HDU bed. Certain specific injuries were excluded, including isolated neck of femur fractures or intertrochanteric/greater trochanteric fractures in persons > 65 years.

International Classification of Diseases, tenth revision, codes included were S270 (traumatic pneumothorax), S270 (traumatic pneumothorax closed), S2701 (traumatic pneumothorax open), S271 (traumatic hemothorax), S2710 (traumatic hemothorax closed), S2711 (traumatic hemothorax open), S272 (traumatic hemopneumothorax), S2720 (traumatic hemopneumothorax closed), and S2721 (traumatic hemopneumothorax open).

Information was collected on demographics, injury (mechanism of injury, description of injuries, Injury Severity Score [ISS]), management (type, size of drain, length of drain placement), and pneumothorax characteristics (laterality, size, and accompanying hemothorax). Airway support was characterized as either requiring PPV before hospital admission or in the ED (initial PPV) or requiring PPV subsequently due to general anesthesia administration or clinical deterioration (subsequent PPV). The size of the pneumothorax was obtained from chest radiographs at the hilum and apex, and on CT imaging, the largest collection was measured along a line perpendicular from the chest wall to the lungs or mediastinum. Clinical parameters were obtained from initial observations on attendance in the ED. Respiratory distress was determined if respiratory rate was either ≥ 30 or < 8, if supplementary oxygen or mechanical or manual ventilation was used, if the oxygen saturation was ≤ 90%, or if the patient was in respiratory arrest. Hemodynamic instability was determined if the systolic BP was < 90 mm Hg or the heart rate was ≥ 100 bpm. Conscious-level impairment was determined if the Glasgow Coma Scale (GCS) score was < 15 or the patient was ventilated at arrival.

Statistical analysis

Descriptive statistics were used to summarize patient characteristics and clinical data. Means (± SD) were calculated for parametric data, and medians (interquartile range [IQR]) were calculated for nonparametric data. Several checks for normality, including Kolmogorov-Smirnov, Shapiro-Wilk, kurtosis, and skewness calculations, were performed. Continuous parametric variables were analyzed using independent *t* tests, and continuous nonparametric variables were analyzed using the Mann-Whitney test. Categorical data were analyzed using the χ^2 test. $P < .05$ was considered statistically significant.