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The utility of chest X-ray as a screening tool for blunt thoracic aortic injury☆

Adam Gutierrez, Kenji Inaba*, Stefano Siboni, Zachary Effron, Tobias Haltmeier, Paul Jaffray, Sravanthi Reddy, Alexander Lofthus, Elizabeth Benjamin, Joseph Dubose, Demetrios Demetriades

Division of Trauma and Surgical Critical Care, Department of Surgery, LAC+USC Medical Center, University of Southern California, Los Angeles, CA 90033, USA

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ABSTRACT

Background: The early and accurate identification of patients with blunt thoracic aortic injury (BTAI) remains a challenge. Traditionally, a portable AP chest X-ray (CXR) is utilized as the initial screening modality for BTAI, however, there is controversy surrounding its sensitivity. The purpose of this study was to assess the sensitivity of CXR as a screening modality for BTAI.

Methods: After IRB approval, all adult (≥18 yo) blunt trauma patients admitted to LAC+USC (01/2011–12/2013) who underwent CXR and chest CT were retrospectively reviewed. Final radiology attending CXR readings were reviewed for mediastinal abnormalities (widened mediastinum, mediastinal to chest width ratio greater than 0.25, irregular aortic arch, blurred aortic contour, opacification of the aortopulmonary window, and apical pleural haematoma) suggestive of aortic injury. Chest CT final attending radiologist readings were utilized as the gold standard for diagnosis of BTAI. The primary outcome analyzed was CXR sensitivity.

Results: A total of 3728 patients were included in the study. The majority of patients were male (72.6%); mean age was 43 (SD 20). Median ISS was 9 (IQR 4–17) and median GCS was 15 (IQR 14–15). The most common mechanism of injury was MVC (48.0%), followed by fall (20.6%), and AVP (16.9%). The total number of CXRs demonstrating a mediastinal abnormality was 200 (5.4%). Widened mediastinum was present on 191 (5.1%) of CXRs, blurred aortic contour on 10 (0.3%), and irregular aortic arch on 4 (0.1%). An acute aortic injury confirmed by chest CT was present in 17 (0.5%) patients. Only 7 of these with CT-confirmed BTAI had a mediastinal abnormality identified on CXR, for a sensitivity of 41% (95% CI: 19–67%).

Conclusion: The results from this study suggest that CXR alone is not a reliable screening modality for BTAI. A combination of screening CXR and careful consideration of other factors, such as mechanism of injury, will be required to effectively discriminate between those who should and should not undergo chest CT.

Introduction

Despite recent advances in the diagnosis and management of blunt thoracic aortic injury (BTAI), it remains a highly lethal injury. BTAI often results from a rapid-deceleration mechanism with the most common being a motor vehicle collision [1–4]. The most common location for a BTAI is at the aortic isthmus just distal to the takeoff of the left subclavian artery [4]. Aortic injuries are present in 1/3 of blunt trauma deaths and 80% of patients who die from BTAI do so at the scene or are dead upon arrival at the hospital [5]. Among the patients dying after arrival at the hospital, 84% die within the first 4 h of reaching the hospital [1]. Rapid diagnosis is therefore critical for the prompt initiation of appropriate therapy.

A portable AP chest X-ray (CXR) is near universally available as part of the initial workup for blunt chest trauma and is critical for the diagnosis of immediately life-threatening conditions. There is however controversy surrounding its sensitivity as a screening modality for detecting BTAI. Mediastinal abnormalities, such as a

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* Corresponding author at: Division of Trauma and Surgical Critical Care, Department of Surgery, LAC+USC Medical Center, University of Southern California, 1200 N. State Street, Inpatient Tower (C) – Rm C5L100, Los Angeles, CA 90033, USA. Tel.: +1 323 409 7761; fax: +1 323 441 9909.
E-mail address: kenji.inaba@med.usc.edu (K. Inaba).

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widened mediastinum, opacified aortopulmonary window, irregular aortic arch, and blurred aortic contour have been associated with a diagnosis of BTAI [3,6,7]. Non-mediastinal abnormalities are less sensitive and specific indicators of BTAI and include a right-shifted trachea, pulmonary contusion, and left apical cap [8]. Previous studies have demonstrated overall sensitivities of CXR for BTAI ranging from 56% to 93% [9–11]. These studies included either non-mediastinal findings or only a single mediastinal finding as part of their sensitivity calculations. Further study is needed to elucidate the overall sensitivity of mediastinal findings specific for BTAI.

Due to this controversy surrounding the sensitivity of CXR for BTAI, there remains uncertainty regarding the utility of CXR as a screening tool for BTAI, especially in the face of increased utilization of chest computed tomography (CT), which is the gold standard for making the diagnosis [12,13]. Despite the radiation burden, some authors have argued that all blunt trauma patients should undergo chest CT, rendering CXR obsolete as a screening tool in these patients [2,14–16], while others suggest that CXR should continue to be used and that chest CT only be obtained with an abnormal CXR or high-risk mechanism of injury [9,10,17,18].

The purpose of this study was therefore to determine the sensitivity of mediastinal abnormalities on CXR as a screening modality for BTAI.

Methods

After Institutional Review Board approval, the trauma registry of the Los Angeles County+University of Southern California Medical Center was retrospectively reviewed to identify all adult (≥18 years old) trauma patients over a 3-year period from January 2011–December 2013. All patients with a blunt mechanism of injury who underwent a portable AP CXR in the resuscitation area upon arrival and a chest CT scan within 12 h of admission were included in the analysis. Patients with pre-existing chronic aortic injuries were excluded from the analysis.

Data abstracted from the Trauma Registry included age, gender, initial systolic blood pressure (SBP), initial heart rate (HR), initial Glasgow Coma Scale (GCS), mechanism of injury, and Injury Severity Score (ISS). All confirmed cases of BTAI were further reviewed to collect data on patient characteristics, injury location, treatment, and outcome.

Attending radiologist final CXR readings were individually reviewed for abnormalities including rib fracture, pneumothorax, haemothorax, subcutaneous emphysema, and mediastinal emphysema. Specific abnormalities utilized to screen for aortic injury were also abstracted including widened mediastinum, mediastinal to chest width ratio greater than 0.25, irregular aortic arch, blurred aortic contour, opacification of the aortopulmonary window, and

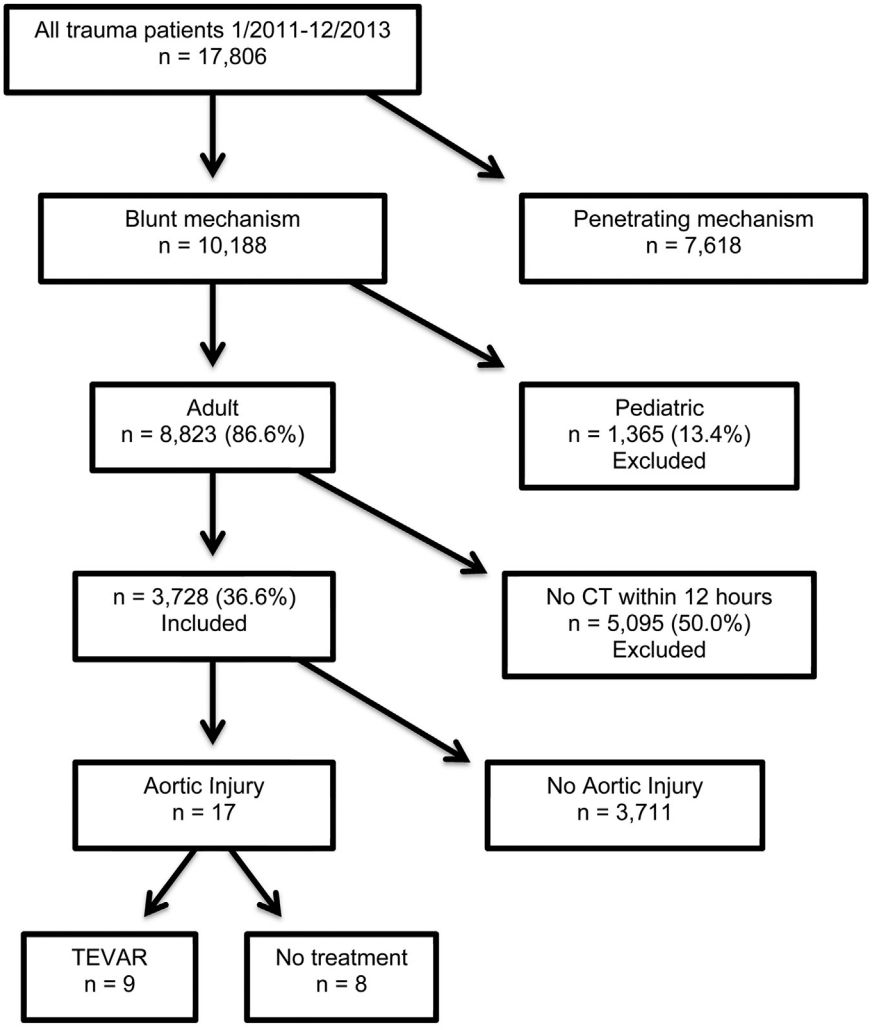

Fig. 1. Study design.