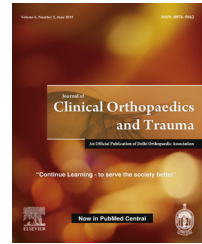


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Original Article

Validation of thoracic injury rule out criteria as a decision instrument for screening of chest radiography in blunt thoracic trauma



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ABSTRACT

Background: Thoracic injury rule out criteria (TIRC) were first introduced as a decision instrument for selective chest radiography in blunt thoracic trauma in 2014. However, the validity of this model has not been assessed in other studies. In this regard, the present survey evaluates the validity of TIRC model in a multi-center setting.

Methods: In this cross-sectional study, clinical presentations and chest radiograms of multiple trauma patients referring to 6 educational hospitals in Iran were evaluated. Data were gathered prospectively during 2015. In each center, data collection and interpretation of radiograms were conducted by two different emergency medicine specialists. Measures were then taken for assessment of discriminatory power and calibration of the model.

Results: Data from 2905 patients were gathered (73.17% were male; the mean age was 33.53 ± 15.42 years). Area under the receiver operating characteristics curve of the TIRC model for detection of thoracic traumatic injuries was 0.93 (95%CI: 0.93–0.94). Sensitivity and specificity of the model were 100 (98.91–100) and 67.65 (65.76–69.45), respectively.

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The intercept of TIRC calibration plot was 0.08 (95%CI: 0.07–0.09), and its slope was 1.19 (95% CI: 1.15–1.24), which are indicative of the model being perfect in detecting presence or absence of lesions in chest radiograms.

Conclusion: The findings are corroborative of external validation, good discrimination, and proper calibration of TIRC model in screening of multiple trauma patients for obtaining chest radiograms.

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1. Background

Thoracic trauma as one of the most important causes of morbidity and mortality in the first four decades of life^{1,2} is the cause for 25% of trauma-related deaths.³ Early diagnosis of these injuries can significantly decrease their burden. Radiology plays an important role in the assessment of trauma patients. In the past, the Advanced Trauma Life Support recommended that radiograms should be obtained from the chest, pelvis, and neck of all multiple trauma patients. However, recently it has limited the neck and pelvis radiograms to hemodynamically unstable patients or subjects with positive findings in their physical examinations.⁴ These changes are made based on the findings that suggest plain radiograms present little information useful for making decisions about the hemodynamically stable patients or subjects with negative cervical and pelvic physical examinations.^{5–9}

Recently similar attempts have been made to decrease the burden of obtaining unnecessary radiograms in thoracic trauma. In this regard two different scoring systems of NEXUS chest and thoracic injury rule out criteria (TIRC) have been proposed by two separate research teams.^{10,11} NEXUS chest, developed based on the data from 2628 patients referring to three trauma centers, is a 7-item scoring system that includes age of more than 60 years old, rapid deceleration mechanism (falling from a height of more than 20 ft or a motor vehicle accident with a speed of more than 40 mph), chest pain, intoxication, altered mental status, distracting painful injury and tenderness to chest wall palpitation as factors predictive of thoracic trauma. The validation study of this scoring system was conducted on 9905 patients.¹¹ However, information about the rapid deceleration criterion is rarely available to the physicians. This is mainly due to inaccurate recording of information about the accidents by emergency medical services, particularly in developing countries, which can limit the application of this scoring system.

In 2014 Forouzanfar et al. develop the TIRC model based on the data gathered from 2608 patients referring to one trauma center. According to this model any of these factors can predict a thoracic lesion: age over 60, hemodynamic instability, Glasgow Coma Scale (GCS) lower than 15, crepitation, decrease in pulmonary sounds, pain and tenderness of the chest wall, thoracic skin abrasion, and dyspnea.¹⁰ As can be seen, this model does not have the limitations of NEXUS chest scoring system. However, the validity of the TIRC model has not been evaluated in another survey. Accordingly, in the present study,

we aimed to assess the validity of TIRC model in a multi-center survey.

2. Methods

2.1. Study setting

In this cross-sectional survey conducted during 2015, clinical presentations and chest radiograms of multiple trauma patients referring to 6 educational hospitals in Iran were evaluated. The study protocol was approved by the ethics committee of Tehran University of Medical Sciences. All the researchers were committed to the principles of Helsinki's Declaration and informed written consent was obtained from all the included patients or their legal guardians.

2.2. Participants

Hemodynamically stable multiple trauma patients aged over 15 years were included through a consecutive sampling method. Exclusion criteria included being the subject of penetrating traumas and not willing to participate. These criteria were based on the study carried out by Forouzanfar et al.¹⁰

2.3. Data collection

Prospectively gathered data included information about demographic characteristics of the patients (age, gender, trauma mechanism) and findings of their physical examinations. Data were collected by the emergency medicine specialists. Subsequently chest radiograms were obtained from the subjects in two views of anteroposterior and lateral.

Physical examination of the patients further focused on presence of painful distracting injuries, altered mental status (GCS < 15), tachypnea, pain or tenderness in thoracic region, dyspnea, abrasion or wound caused by the trauma in chest region, deformity of the thorax, tenderness in upper abdominal region, crepitation in palpation, diminished pulmonary sounds, and subcutaneous emphysema.

Final diagnosis of thoracic injury was made based on chest radiography. Computed tomography scan (CT scan) was performed in 3.2% of patients, which were demanded by other specialists such as surgeons or internal medicine specialists. In these patients, final diagnosis was based on CT scan findings. Chest radiograms were interpreted by another emergency medicine specialist, blinded to the

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