

Is thorax CT necessary in emergency thoracic traumas?

Acil toraks travmalarında toraks BT gerekli mi?

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ABSTRACT

Introduction: Recently, computed thorax tomography (Thorax CT) has replaced chest radiography as a routine imaging method in patients presenting to the emergency department after thoracic trauma. It has been shown that unnecessary use of thorax CT increases exposure to high-dose radiation, increases hospital costs, and prolongs the length of stay in the wards. Our study investigated the clinical necessity of thorax CT scans for patients who applied to our emergency department with thoracic trauma.

Material Method: The data of 515 patients diagnosed with thoracic trauma in the emergency department between January 2017 and January 2021 were retrospectively reviewed. According to thorax CT findings, sternum fracture, diffuse parenchymal contusion, scapula fracture, presence of hemothorax, penetrating chest trauma, 3 or more costal fractures, vertebral fracture, diaphragm rupture, and mediastinal organ injury were evaluated as criteria showing that thorax CT was performed with a correct indication.

Results: When we look at the thorax CT requirement criteria that we have determined, we saw that 391 (75.9%) patients had thorax CT performed with the correct indication, and 124 (24.1%) patients did not give us any additional pathological findings.

Conclusion: As a result, we think that a good physical examination, evaluation of clinical findings, and performing thorax CT according to chest radiography findings will reduce unnecessary radiation exposure and hospital expenditure costs.

Keywords: trauma, lung, thorax CT

Öz

Giriş: Toraks travması sonrası acil servise başvuran hastalarda, son zamanlarda bilgisayarlı toraks tomografisi (Toraks BT) rutin görüntüleme yöntemi olarak akciğer grafisinin yerini almaktadır. Gereksiz kullanılan toraks BT'nin yüksek doz radyasyona maruz kalma, hastane maliyetlerini artırması ve servislerde kalış süresini uzattığı gösterilmiştir. Yaptığımız çalışmada acil servisimize toraks travması ile başvuran hastalara çekilen toraks BT'lerin klinik gerekliliğini araştırdık.

Materyal Metot: Ocak 2017 ile ocak 2021 tarihleri arasında acil serviste toraks travması tanısı konulmuş 515 hastanın verileri retrospektif olarak tarandı. Toraks BT bulgularına göre sternum fraktürü, yaygın parankimal kontüzyon, skapula fraktürü, hemotoraks varlığı, penetran göğüs travması, 3 ve daha fazla kosta fraktürü, vertebra fraktürü görülmesi, diyafram rüptürü, mediasten organ yaralanması, toraks BT çekilmesinin doğru bir endikasyon ile yapılmış olduğunu gösteren kriterler olarak değerlendirildi.

Bulgular: Belirlemiş olduğumuz toraks BT gereklilik kriterlerine göre baktığımızda, 391 (%75.9) hastaya çekilen toraks BT'nin doğru endikasyonla çekildiği, 124 (%24.1) hastaya çekilen toraks BT'nin bize ek patolojik bulgu vermediğini gördük.

Sonuç: Sonuç olarak iyi bir fizik muayene, klinik bulgu değerlendirmesi ve akciğer grafisi bulgularına göre toraks BT istenmesinin, gereksiz radyasyon maruziyetini ve hastane harcama maliyetlerini azaltacağını düşünmekteyiz.

Anahtar kelimeler: travma, akciğer, toraks BT

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INTRODUCTION

Thoracic traumas are additional trauma in isolated or multi-trauma patients and can cause life-threatening problems. Sudden deaths in thoracic traumas generally develop due to aortic rupture in the myocardium. Tension pneumothorax, cardiac tamponade, airway obstruction, and hemodynamic instability are the leading causes of death that can be prevented with an effective emergency approach (1).

Approximately 75% of patients with thoracic trauma can be treated with simple tube thoracostomy and respiratory resuscitation. In a few patients, surgical intervention and, rarely, resuscitative thoracotomy in the emergency department may be required (2).

Computed thorax tomography (Thorax CT) has recently replaced chest radiography as a routine imaging method in patients admitted to the emergency department after thoracic trauma. Post-traumatic lung contusion, hemopneumothorax, trachea perforation, costovertebral fractures, hemopneumopericardium, cardiac tamponade, and oesophagus perforation are the conditions that require thorax CT imaging (3). Although thorax CT is more effective in making faster and more accurate diagnoses of lesions that cannot be detected in clinical examination, some studies have shown that unnecessary thorax CT causes exposure to high-dose radiation, increases hospital costs, and lengthens the stay in the wards (4, 5).

A single chest CT scan exposes the patient to a similar amount of radiation as 117 chest X-rays. It is suggested that the practice of requesting a thorax CT after a normal chest X-ray may result in one new case of cancer for every 108 chest injuries diagnosed in women and every 231 chest injuries diagnosed in men (4, 5). From this point of view, it is very important to use thorax CT scans wisely in the emergency department.

Our study investigated the clinical necessity of thorax CT scans for patients who applied to our emergency department with thoracic trauma.

MATERIAL AND METHOD

We started our study with the approval of the Bolu Abant İzzet Baysal University clinical research ethics committee dated 25.05.2021 and numbered 2021/124. The data of 515 patients diagnosed with thoracic trauma in the emergency department between January 2017 and January 2021 were retrospectively reviewed.

The patients were evaluated regarding age, gender, type of trauma, trauma-related thoracic pathologies, presence of extrathoracic pathology, and computed tomography findings.

According to thorax CT findings, pneumothorax, hemothorax, parenchyma contusion and costa fractures were evaluated. According to thorax CT findings, it was classified as no pneumothorax: 0, 20% ↓: 1, 20-40%: 2, 40% ↑: 3. No hemothorax was classified as 0, minimal: 1, moderate: 2, and massive: 3. No contusion was classified as 0, segmentary: 1, lobar: 2, and diffused: 3. In addition, the presence of costal fractures and the number, if any, were recorded.

According to thorax CT findings, sternum fracture, diffuse parenchymal contusion, scapula fracture, presence of hemothorax, penetrating chest trauma, 3 or more costal fractures, observed vertebral fracture, diaphragm rupture, and mediastinal organ injury were evaluated as criteria showing that thorax CT was performed with a correct indication (Table1).

RESULTS

Of the patients included in the study, 373 (72.5%) were male, and 142 (27.5%) were female. The mean age was calculated as 51.2 ± 18.8 (13-93). Considering the forms of trauma, 240

Table 1. Thorax CT requirement criteria and additional pathologies.

Pathologies that require thorax CT	Sternum fracture Diffuse parenchymal contusion Scapula fracture Hemothorax Penetrating chest trauma 3 or more costa fractures Vertebral fracture Diaphragm rupture Mediastinalorgan injury
Extrathoracic pathologies (most common)	Vertebral fracture Spleen laceration Fractures of the femur, tibia and sacrum Fracture of scapula, clavicle and sternum Epidural and subdural hematoma Liver laceration Humerus, ulna and masillofacial fractures

(46.6%) patients were brought to the emergency department due to S.

When the thorax tomography of the patients was evaluated, it was observed that there was no pneumothorax in 330 (64%) patients, less than 20% in 132 (25.6%) patients, 20-40% in 38 (7.3%) patients, and more than 40% in 15 (2.9%) patients. It was observed that 308 (59.8%) patients did not have hemothorax, 171 (33.2%) patients had minimal hemothorax, 45 (8.7%) patients had moderate hemothorax, and 11 (2.1%) patients had massive hemothorax. In terms of contusion, 225 (43.6%) patients had no contusion, 185 (35.9%) patients had segmental contusion, 83 (16.1%) patients had lobar contusion, and 22 (4.2%) patients had extensive contusion. 420 (81.5%) patients had one or more (mean:2.63±2.51) costal fractures. Costal fractures were not observed in 95 (18.5%) patients (Table 2).

It was observed that 260 (50.5%) patients had additional extrathoracic pathologies, especially various bone fractures and intra-abdominal bleeding foci. Thoracic surgery department performed conservative treatment in 402 (78%) patients, tube thoracostomy in 98 (19%) patients, and emergency surgical intervention in 14 (2%) patients. After the emergency service, 338 (65.6%) patients were hospitalized in different services,

94 (18.2%) were admitted to the intensive care unit, 76 (14.7%) were discharged, and 7 (1.35%) patients died in the emergency service (Table 3).

When we look at the thorax CT requirement criteria that we have determined, we see that 391 (75.9%) patients had thorax CT with the correct indication. For 124 (24.1%) patients, thorax CT did not give us any additional pathological findings.

Table 2. Thoracic pathologies and demographic data.

Gender	Male	373 (%72.5)
	Female	142 (%27.5)
Trauma mechanism	IVTA	240 (%46.6)
	Falling from height	159 (%30.8)
	NVTA	52 (%10.1)
	Assault	27 (%5.1)
	SW	15 (%2.9)
Pneumothorax	GW	5 (%0.9)
	None	330 (%64)
	%20 ↓	132 (%25.6)
	%20-40	38 (%7.3)
Hemothorax	%40 ↑	15 (%2.9)
	None	308 (%59.8)
	Minimal	171 (%33.2)
	Moderate	45 (%8.7)
Contusion	Massive	11 (%2.1)
	None	225 (%43.6)
	Segment	185 (%35.9)
	Lobar	83 (%16.1)
	Diffused	22 (%4.2)

In-vehicle traffic accident (IVTA) , Non-vehicle traffic accident (NVTA), Stab wounds (SW), Gunshot wounds (GW).

Table 3. Thoracic surgery approach and emergency room clinical outcome.

Treatments implemented for the thorax	Conservative treatment	402 (78%)
	Tube thoracostomy	98 (19%)
	Surgical intervention	14 (2.7%)
Post emergency service	Clinical hospitalization	338 (%65.6)
	Intensive care hospitalization	94 (%18.2)
	Discharge	76(%14.7)
	Died	7 (% 1.3)

DISCUSSION

The diagnostic accuracy of thorax CT in thoracic traumas is significantly higher than chest radiography in evaluating sternum fractures, rib fractures, pulmonary contusions, pneumothorax, and hemothorax. In particular, chest radiographs are insufficient to detect the extent of pulmonary contusions, the location and number of costal fractures, the presence of sternum fractures, and thoracic vertebral fractures (6).

In a study investigating the necessity of thorax CT in patients brought to the emergency room due to SW 153 patients were evaluated. Thoracoabdominal CT was performed in 98 of 153 patients. New thoracic findings were obtained in 19 (28%) thorax CT scans after chest X-ray, which resulted in a specific treatment change in only three cases. Since all of the cases with additional findings were patients with injuries in the thoracoabdominal region, it was reported that CT was required, especially in injuries in this region (7).

In a recent study investigating the necessity of CT in blunt chest trauma, thorax CT was requested based on physical examination and chest X-ray findings. Chest wall tenderness, sternum tenderness, scapula tenderness, thoracic spine tenderness, disturbing injury to the chest wall, and abnormality in chest X-ray were determined as the cause of thorax CT. It has been reported that with such an approach, thorax CT scans can be reduced by 25-37% (8).

In another study conducted with the same logic, according to the algorithm created after blunt chest trauma, thorax CT was performed in patients

with more than 2 costal fractures, mediastinal pathology finding or suspicion, emphysema, respiratory distress, and incomprehensible clinical findings on chest X-ray. As a result, with the application of the algorithm created according to the control group, a 20% reduction in thorax CT scan use was achieved without increasing morbidity and mortality (9).

When we look at the thorax CT criteria that we determined in our study, we see that in 24.1% of the patients brought to the emergency room with thoracic trauma, thorax CT scan did not give us any additional pathological findings. Since there are few studies in the literature for the post-traumatic imaging algorithm, this study is more valuable.

For example, Mirka et al. created a chest imaging algorithm for trauma patients in their clinic and recommended a whole-body CT scan to all high-energy trauma patients (fall >3m and >50km/h velocity) (10). Incomplete vascular evaluation and inability to evaluate mediastinal lesions on chest X-rays were stated as the reason for CT removal. They stated that their findings were consistent with the recommendations of the American College of Surgeons supporting the use of tomography in all high-energy traumas. Algorithms help with resource management and lead to improved quality of patient care.

A prospective observational study of 160 patients found that low-dose thorax CT can produce acceptable image quality than standard thorax CT and is more reliable diagnostically than lung X-rays in minor chest traumas. It has been stated that low-dose thorax CT can reduce the radiation exposure of standard CT in patients with minor

blunt trauma and can be an alternative to standard CT (11).

As a result, we think that a good physical examination, evaluation of clinical findings and thorax CT according to chest X-ray findings will reduce unnecessary radiation exposure and hospital expenditure costs. In case of clinical suspicion, we think that low-dose thoracic CT instead of standard CT will save the patient from unnecessary radiation exposure.

Study Limitation

The fact that the study was retrospective and could not be based on clinical observation constitutes the most important shortcomings of our study.

Ethics Committee Approval: The study protocol was approved by the Bolu Abant İzzet Baysal University Clinical Researches Ethics Committee on May 25, 2021 (Ethics committee registration number: 2021/124).

Conflict of Interest: The authors have declared that they have no conflict of interest.

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