Göğüs Bilgisayarlı Tomografisinin Künt Toraks Travmalı Stabil Hastalarda Kullanımı: Klinik ve Adli Perspektif

Use of Chest Computed Tomography in Stable Patients with Blunt Thoracic Trauma: Clinical and Forensic Perspective

Stabil Toraks Travmasında Bilgisayarlı Tomografi / Computed Tomography in Stable Thorax Trauma

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Özet

Amaç

Bu çalışmanın amacı künt travmalı stabil hastalarda bilgisayarlı toraks tomografisinin klinik ve adli önemini araştırmaktı.

Gereç ve Yöntemler

Travma sonrası 24 saat içinde akciğer grafisi ve bilgisayarlı toraks tomografisi çekilen künt toraks travmalı 50 hasta retrospektif olarak incelendi. Hastaların dağılımı, torasik lezyonlar, tedavi yöntemleri ve adli sorunları incelendi.

Bulgular

Çalışmamızda, en sık tespit edilen lezyon kot fraktürü idi. Bilgisayarlı göğüs tomografisi torasik lezyonların tespitinde düz akciğer grafisine göre üstün bulundu. Altmışsekiz (%33) okült lezyon saptandı. Bu lezyonların 46 (%18)'sı düz akciğer grafileri ile saptanamayan hayatı tehdit edici lezyonlardı. Yandaş yaralanma 33 (66%) hastada vardı. Pelvis ve ekstremite kırıkları en sık olanlardı. Göğüs bilgisayarlı tomografisi pnömotoraks, hemotoraks ve akciğer kontüzyonunun tespitinde akciğer grafisine üstün bulundu. Seksenbir hayatı tehdit edici lezyon saptandı ve bu lezyonların 50'si (%61: pnömotoraks 13, hemotoraks 24, akciğer kontüzyonu 9 ve pnömomediastinum 4) düz akciğer grafileri ile tespit edilememişti. Klinik tedavi uygulaması 15 (%30) hastada ve adli yaklaşım 14 (%28) hastada değişti.

Sonuç

Göğüs bilgisayarlı tomografilerinin torasik travmalarda tedavi ve adli konularda titiz bir inceleme imkanı sağladığını düşünmekteyiz.

Anahtar Kelimeler

Travma, Yaralanma, Göğüs, Bilgisayarlı Tomografi, Göğüs Radyolojisi, Adli.

Abstract

Aim

The aim of this study was to investigate the medical and forensic importance of thorax computed tomography in stable patients with blunt chest trauma.

Material and Methods

Fifty patients with blunt chest injury were retrospectively evaluated with chest radiography and thorax computed tomography in the first 24 hours after trauma. Patient demographics, thoracic lesions, management options, and forensic assessment were rewieved.

Results

The most common lesion of the study was rib fracture. Thorax computed tomography was significantly superior to chest radiography in detecting thoracic lesions. Sixty eight (33%) occult lesions were detected. Forty six (18%) of these were life threatening that not detected with plain chest radiography. Associated injuries were present in 33 (66%) patients. Pelvic and extremity fractures were the most common injury. Thorax computed tomography was significantly superior to chest radiography in detecting pneumothorax , hemothorax and lung contusion. Eightyone life threatening lesions were detected and 50 (61%; pneumothorax 13, hemothorax 24, lung contusion 9, and pneumomediastinum 4) of these lesions could not be detected with plain chest radiography. The clinical management [in 15 patients (30%)], and the forensic assesment was changed [in 14 (28%)] patients were changed.

Conclusion

We concluded that using Computed Tomography of the thorax in thoracic travmas prive meticulous assesment in management of patients and forensic issues.

Keywords

Trauma, Injury, Chest, Computed Tomography, Chest Radiography, Forensic.

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Introduction

Chest traumas comprise 10–15% of all traumas and is responsible for a significant percentage of all trauma deaths with an associated mortality rate of up to 25%.[1] Seventy percent of the chest traumas are blunt and the remainders are penetrating injuries. Blunt injuries of the chest result mainly from traffic accidents, while penetrating injuries result from gunshots or stab wounds.[2] Despite major developments in the management of trauma, it remains the leading cause of mortality in children and adolescents.[2]

Chest radiography (CR) is the most frequently used tool for thoracic evaluation in the emergency departments.[3] However, there has been a marked increase in computed thorax tomography (CT) use for the initial evaluation of blunt chest injury. Thorax CT has clearly proven to be valuable in detecting thoracic lesions not seen on CR. However, routine use of thorax CT in chest trauma has been controversial, because it is expensive, needs more time, needs transportation of patients, and causes more radiation exposure.[3,4]

Detecting occult lesions may result in changes management of the trauma patients. Trupka et al. reported that they changed their management after thorax CT scans in up to 70% of cases.[3] In contrast, some authors reported that routine thorax CT scans do not effect the management of blunt chest trauma.[4,5]

Other important issue is that trauma patients are predominantly forensic. Detecting of occult thoracic lesions may cause crucial changes in making decision of forensic evaluation.

In this retrospective study, we investigated that, whether thorax CT provides additional informations as compared with plain CR, whether thorax CT changes the management of patients, and whether thorax CT changes making desicion in forensic evaluation, in patients with blunt chest trauma.

Material and Methods

From October 2003 to March 2004, charts of blunt chest trauma patients admitting to "Ankara Numune Education and Research Hospital" were reviewed. Data of patients included etiology of the trauma, thoracic lesions, associated injuries, management and initial forensic reports were collected. Thoracic lesions were classified as rib fracture, scapula fracture, clavicula fracture, hemothorax, pneumothorax, pneumomediastinum, lung contusion, subcutaneous emphysema and atelectasia.

After the initial physical examination and stabilization of vital signs, CR were obtained in all emergent patients. Most of CR were taken in the supine posteroanterior position.

Indications for thorax CT in hemodynamically stable patients were; 1(unreliable physical examination finding of chest wall and lungs, 2) abnormal findings of chest trauma on CR, 3] presentation of dyspnea or chest pain. CT scans were obtained in first 24 hours, immediately evaluated and reviewed by the attending radiologist. That reviewed thorax CT interpretation was compared with the initial CR findings. Thorax CT scans were performed on W950SR [Hitachi, Kurt, Japan] scanners (single slice) and chest radiograph were performed with Continental TM 50 [USA]. Scans were performed with the administration of 100 mL of Telebrix [Guerbet, France] injected at 5 ml/s and injection was beginned just before scannig. Images through the chest were reconstructed at 10 mm slice thickness. Thorax CTs were obtained all in stable patients.

Associated injuries were identified by further studies. Abdominal ultrasonography and/or abdominal CT was studied in patient suspected an abdominal trauma or in those having abdominal tenderness on physical examination. In patient having obvious head trauma or in the condition of unconscious, a cranial CT was taken. Additional examinations were carried out according to symptoms and physical findings of patients.

Management options of trauma patients included medical therapy with outpatient follow up, hospitalization and follow up, thorasenthesis, tube thoracostomy, and thoracotomy. Any change from one to another recorded as management change according to patients' chart data.

Tube thoracostomy indications were; pneumothorax occupying more than 15.2% of one hemithorax, bilateral lesion, causing cardiopulmonary symptoms, associated with poor condition with ventilatory requirement. In patiens with minor trauma, pneumothorax was managed with follow up or thoracenthesis. Minor nonexpanding haemothoraces were followed conservatively.

Existence or absence of life threatening lesions were evaluated according to guidance of arrangement forensic reports in Turkish criminal code.[6] According to this criminal code; existence of hemopneumothorax, pneumomediastinum, lung contusion or diaphragmatic rupture evaluated as life threatening lesions.

Mc Nemar test was used to compare the injury counts between CR and thorax CT. p value less than 0.05 was considered significant. Injury counts were presented as a count and percentage. All analysis were performed using commercially software package [SPSS 15.0 demo].

Results

Fifty patients were identified as having had concurrent chest radiograph and thorax CT as part of their initial trauma evaluation. The majority of the patient were male (40 male, 10 female) and had an average age of 49.1±17.4 (18.79 years) years. Etiology of trauma was

traffic accidents due to being hit by a vehicle in 48%, traffic accidents while they were inside of the vehicle in 26 %, falls in 18%, assault in 6% and butt of a cow in 2%. Eight patients were AIS-1 (abbreviated injury scale), 17 were AIS-2, 10 were AIS-3 and 15 were AIS-4 (average:2.64).

Rib fractures were the most common thoracic injury. We found 142 fractured ribs with CR and 129 with thorax CT. Associated injuries were present in 33 (66%) patients. Pelvic and extremity fractures were the most common associated injuries present in 14 (28.5%) patients, and head injury was the second commonest injury in 11 (22.4%) patients. Demographics of patients were seen at Table 1.

Table 1. Demographics for blunt trauma patients

Sex	
Male	40 [80%]
Female	10 [20%]
Average age	49.1±17.4 [18.79 years]
Mechanism	
Motor vehicle crash	37 [74%]
Falls	9 [18%]
Assault	3 [6%]
Butt of a cow	1 [2%]
Associated Injuries	
Pelvic and extremity fractures	14 [28.5%]
Head injury	11 [22.4%]
Abdominal trauma	9 [18.3%]
Facial trauma	9 [18.3%]
Spinal trauma	6 [12.2%]

Thorax CT was significantly superior to CR in detecting pneumothorax , hemothorax and lung contusion (Table 2). No statistical evaluation could be done because of inadequate number of patients in scapula fracture, clavicula fracture and pneumomediastinum. All atelectasis were identified with thorax CT (n = 16.100%), but values could not be evaluated statistically. More of rib and clavicula fractures, pneumomediastinum and subcutaneous emphysema could be identified with CR, whereas more scapula fractures with thorax CT. Sixty eight (33%) of 254 detected thoracic lesions were occult. We also detected significantly more occult pneumothorax in patients with dyspnea ($P < .01$), and significantly more hemothorax in patients with associated injuries ($P < .05$), compared to others.

Nine patients followed outpatient and others hospitalized. Chest tube drainage was performed in 12 patients, and thoracentesis in 7. One patient required thoracotomy for diaphragmatic rupture. He died peroperatively due to cardiopulmonary event. He was excluded the study. No patients required tracheal entubation, tracheostomy or mechanic ventilatory support. The clinical management was changed in 15 patient (30%). Changes in management decision include hospitalization in 2 patients, thorasynthesis in 4 patients, tube thoracostomy in 9 patients.

Totally, 81 life threatening lesions were detected, and 50 (61%; pneumothorax 13, hemothorax 24, lung contusion 9, and pneumomediastinum 4) of these lesions could not be seen with plain CR. Final forensic reports were changed in 14 (28%) of 50 patients after thorax CT assessment.

Table 2. Classifying detected thoracic lesions with CR and thorax CT.

Injury	Total		CR		Thorax CT		p¶
	n	%	n	%	n	%	
Rib fracture	142	55.9	142	100	129	90.9	>0.05
Scapula fracture	5	2.0	3	60.0	5	100	n/a
Clavicula fracture	5	2.0	5	100	2	40.0	n/a
Hemothorax	33	13.0	10	30.3	33	100	<0.05*
Pneumothorax	22	8.7	8	36.3	22	100	<0.001*
Pneumomediastinum	5	2.0	1	20.0	5	100	n/a
Lung contusion	18	7.1	9	50.0	18	100	<0.05*
Atelectasia	16	6.3	0	0	16	100	<0.05*
Subcutaneous Emphysema	8	3.0	6	75.0	8	100	>0.05
Total	254	100	184	72.4	238	93.7	...

[¶]: Mc Nemar test result, [*]: Statistically significant, [n/a]: not available

Discussion

Our findings showed that thorax CT is highly sensitive for the diagnosis of pneumothorax, hemothorax, and pulmonary contusion as compared with supine chest radiography. These findings have been clearly proven by previous studies.[3,5,7,8] Thorax CT detects malpositioned drainage tubes than does CR[9,10] and is useful to make changes when necessary. Thorax CT is highly superior to CR in evaluation of parenchyma injuries, pleural space and mediastinum[5] and in the identification of sternal and vertebral fractures, but is not indicated for the examined of other bone injuries.[9] We find a superiority of thorax CT to CR in detecting scapula fractures, but not rib and clavicula fractures. On the other hand, thorax CT has some disadvantages. Thorax CT studies require patient transportation and more time. Average 38% of the total chest exploration time of a patients was spent in thorax CT suite.[5] The time spent outside the intensive care unit may increase the complication risk. Additionally, thorax CT studies are expensive and cause more irradiation exposure than does CR.

There has been a marked increase in use of thorax CT for the initial evaluation of both blunt and penetrating chest injury. The necessity of thorax CT for initial assessment has still been debated. Some authors advocated routine thorax CT examination. Exadactylos et al.[11] have shown that 50% of patient with a normal CR result have multiple

chest injuries on thorax CT, including aortic lacerations. Because of this, thorax CT is becoming routine for trauma patient with a significant mechanism of injury and almost any symptom. It can be argued that if a patient is stable enough to go to thorax CT, then a CR is not necessary.[11,12] The rate of occult lung lesion was 33% in our series. In contrast, Guerrero,López et al.[5] reported that, thorax CT should have not been used routinely, but would have been indicated only when there was a serious suspicion of a severe injury. Plurad et al.[4] concluded that thorax CTs obtained for patients with high risk mechanisms who may also have other injuries or clinical presentations (such as pelvic fractures and respiratory failure) could result in enhanced clinical yield and resource utilization. Our findings also show that thorax CT examination was significantly more effective to detect occult chest lesions in severe trauma patients. We also detected significantly more occult pneumothorax in patients with dyspnea, and significantly more hemothorax in patients with associated injuries, as compared with others.

Some studies suggest that the use of thorax CT may lead to a change in therapy of patients and improved outcomes.[3,13] This change ranges from 8 to 70% of the cases in the literature.[14,3] We change the management in 30% of our cases. However, therapeutic approach to a trauma patient may show variation clinic by clinic, and no detailed data available about the therapeutic options performed before and after thorax CT examination in the published reports.[5] Although therapeutic approach seems to follow from the thorax CT findings, the decision depend on many additional data, such as the prior CR, clinical status and course of the patients, type and extent of injury.[5] Significance of occult lesions is also questionable. Many lesions may resolve without any intervention. Hence, many little changes in management options may not carry a clinical significance on patient outcome.

Another delicate issue is the forensic evaluation of these trauma patients. Many chest lesions are defined as "life threatening lesion" according to forensic termination. Life threatening injury means injury involving a substantial risk of death that results in loss or substantial impairment of the function of a bodily member or organ.[15] The sentences, as determined by this article, increase in line with the severity of the injury which is medically determined and reported by specialists in forensic medicine. Existence or absence of the life threatening lesion constitutes the main issue of a forensic report. Overlooking an occult chest lesion may cause a crucial misinterpretation and a deprivation of justice of injured person. We conclude that 56% of the life threatening lesions could not be identified by CR, and final forensic report changed in 28% of patients. This is not a neglectable condition. Therefore, thorax CT may carry a differ importance to constitute a meticulous forensic evaluation of trauma patients.

In conclusion, thorax computed tomography is superior to chest radiography in detecting chest lesions in trauma patients. In severe trauma patients thorax computed tomography is more sensitive to detect occult chest lesions. Management may be changed. Furthermore, thorax computed tomography is necessary for a meticulous forensic evaluation, because life threatening lesions have been overlooked in the half of trauma patients. Therefore, routine thorax computed tomography examination in the initial evaluation of chest trauma patients may be a necessity for a forensic evaluation more than trauma management.

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