

KÜNT TRAVMANIN ERKEN DÖNEMİNDE STERNUM VE KABURGA KIRIKLARININ SAPTANMASINDA DİREKT GRAFİ VE SİNTİGRAFİ ARASINDAKİ TANISAL UYUMUN DEĞERLENDİRİLMESİ

THE EVALUATION OF DIAGNOSTIC ACCORDANCE BETWEEN PLAIN RADIOGRAPHY AND BONE SCINTIGRAPHY FOR THE ASSESSMENT OF STERNUM AND RIB FRACTURES IN THE EARLY PERIOD OF BLUNT TRAUMA

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ÖZET: Amaç. Künt toraks travmasında erken dönemde sintigrafi ve direkt grafi arasındaki tanısal uyumun değerlendirilmesi Tasarım. Çift kör, prospektif klinik çalışma Yöntem. Acil Servise künt toraks travmasıyla başvuran 34 erişkin hasta travmayı takip eden ilk 24 saat içinde toraks sintigrafisi ve direkt akciğer grafisiyle incelendiler. Bulgular. Konvansiyonel radyografi 25 hastada (%73,5), Tc-99m kemik sintigrafisi ise 24 hastada (%70,5) patoloji belirlendi. Radyografiyle 16 hastada (%47), sintigrafiyle 17 hastada (%50) kot fraktürü saptandı. Sternum fraktürü şüphesi olan 19 hastanın 10'unda (%52,6) lateral sternum grafisinde ve 14'ünde (%73,6) sintigrafide sternum kırığı izlendi. Tartışma. Çalışmamızda, travmanın erken döneminde sternum kırıklarının saptanmasında sintigrafi direkt grafiye göre daha iyi sonuç vermiştir. Ancak acil koşullarda konvansiyonel radyografi hem hızı, hem de kemik patolojilerinin yanı sıra plevral boşluğun da değerlendirilebilmesi açısından daha pratiktir.
Anahtar kelimeler. Toraks travması, sintigrafi, radyografi, sternum, kaburga, kırık.

SUMMARY: Objective. To evaluate the diagnostic accordance between scintigraphy and radiography in the early period following blunt thoracic trauma. Design. Double-blind, prospective clinical study Methods. Thirty-four adult patients with blunt thoracic trauma were examined by plain radiography and scintigraphy within 24 hours of trauma. Results. Radiography displayed pathologies in 25 (73,5%), while scintigraphy suggested pathologies in 24 (70,5%) patients. Rib fractures were identified radiographically in 16 (47%) and scintigraphically in 17 (50%) patients. Lateral radiograph of the sternum showed fracture in 10 (52,6%), while scintigraphy suggested fracture in 14 (73,6%) patients with suspected sternal trauma. Conclusion. Scintigraphy gave better results in the evaluation of sternal fractures during the early period of thorax trauma. Conventional plain radiography is thought to be the initial imaging modality, because it saves time and shows hemothorax or pneumothorax besides the osseous abnormality
Key Words. Thoracic trauma, scintigraphy, radiography, sternum, rib, fracture.

Trauma is a major cause of morbidity and mortality worldwide and chest trauma is one of the leading causes of trauma-related deaths (1). Severe blunt chest trauma and especially pulmonary contusion have negative prognostic effects in patients who sustain polytrauma. The management of patients with chest trauma is based upon clinical and radiographic findings. Chest radiographs

remain the initial imaging modality to screen patients with blunt chest trauma. While x-rays remain the modality of choice in demonstrating many traumatic lesions of bone, scintigraphy has the ability to identify fractures in sites at which radiography encounters difficulties and also the feasibility of diagnosing a variety of injuries which are difficult or even impossible to demonstrate radiographically such as undisplaced cortical bone fractures of the sternum or ribs (2). The normal trabecular pattern of the medullary axial transradiant areas of the sternum and ribs may initially mask their presence. However, at a later date a repeated roentgenogram may show evidence of new cortical bone formation at the fracture site (3). Therefore, in the present study, radiographic and scintigraphic findings were evaluated in patients having thorax trauma with possible suspected rib

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or sternal fractures within 24 hours after trauma.

MATERIALS AND METHODS

Thirty-four adult patients with suspected blunt thoracic trauma were examined at the Emergency Department of Ege University Hospital between December 1997 and May 1998. Unconscious patients with cranial trauma, who could not be mobilized due to pelvic or vertebral injuries and long-bone skeletal traumas and pregnant women were excluded from the study. Radiographic examination of patients with suspected thorax trauma was performed following physical examination at the emergency room. Anteroposterior chest radiographs and in cases of suspected sternal fracture, lateral view radiographs of the sternum were taken. In the presence of thorax trauma or any other coexisting pathology, the patient was hospitalized. Patients were treated at the critical care unit of the Emergency Department. Twenty-four hours following trauma, skeletal scintigraphy was performed using Technetium 99m pertechnetate methylene diphosphonate (Tc-99m MDP). Planar images of thorax were acquired from anterior, posterior, bilateral anterior oblique and bilateral lateral projections by using a single head gamma camera (Sopha DSX gamma camera, Paris, France) equipped with low energy all purpose collimator. Spot images of only the thorax were taken. The increased uptake over the injured rib was accepted as fractures.

RESULTS

Demographic data of the patients are seen in Table-1. Fractures of the radius, ulna, humerus, clavicle, scapula and ilium were among the coexisting pathologies of patients with suspected thorax trauma.

Anteroposterior thorax radiographs identified rib

Table 1. Demographic data of the patients.

AGE	37 (MİN.18- MAX.71)
TRAUMA CAUSE	
TRAFFIC	23 PATIENTS (67.6 %)
ACCIDENT	8 PATIENTS (23.5 %)
FALL	2 PATIENTS (5.8 %)
SPORTS	1 PATIENT (2.9 %)
BURGLARY	
HOSPITAL STAY	2 DAYS (MİN.1-MAX.7)

fractures, hemothorax, pneumothorax or pulmonary contusion in 19 of 34 patients (55.8 %) with suspected thorax trauma. Including sternal fracture, conventional radiography displayed the abnormality in 25 of 34 trauma

patients (73.5 %). Twenty-four hours following trauma, bone-scan imaging with Tc-99m was performed in 34 patients admitted to hospital. Bone scintigraphy identified thoracic pathologies such as rib or sternal fractures in 24 of 34 patients (70,5%) with suspected thorax trauma

Fractures of the ribs were identified radiographically in 16 of 34 patients (47%) and scintigraphically in 17 of 34

Figure 1a. Increased uptake of Tc-99m MDP is seen in the right fifth, sixth, seventh and eight (more intense) ribs in the anterior planar image of thorax.

Figure 1b. The posterior thorax scan shows increased uptake in the medial parts of the left ninth and right tenth ribs.

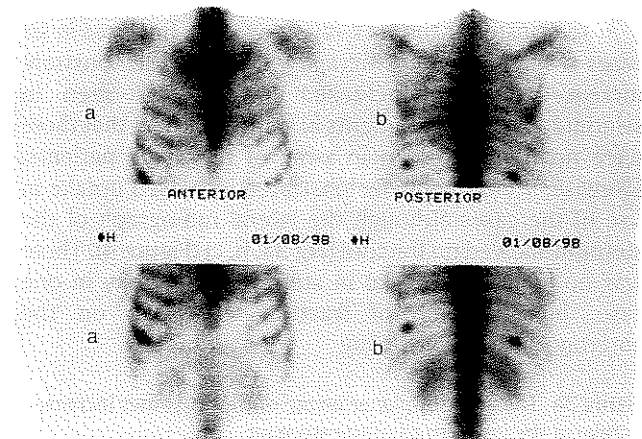
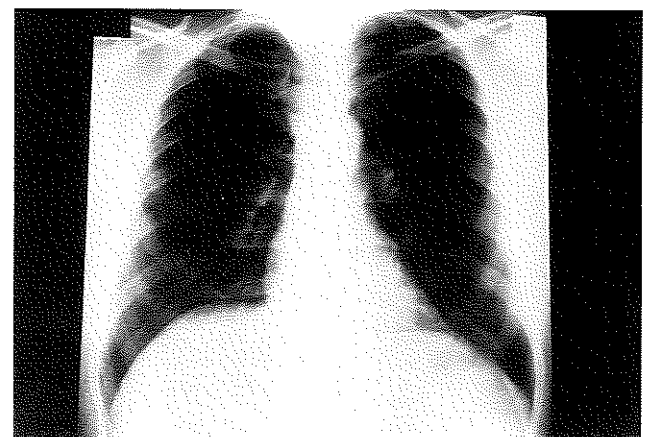


Figure 2. The anteroposterior thorax radiograph of the same patient shows no abnormality.



patients (50%) with suspected thorax trauma (Table 2).

Among 34 patients with suspected thorax trauma, standard lateral radiograph of the sternum was taken in

Table 2. Comparison of the results of bone scintigraphy and anteroposterior thorax x-ray for rib fractures.

	Scintigraphy (+)	Scintigraphy (-)
Anteroposterior Thorax x-ray (-)	7 Patients	11 Patients
Anteroposterior Thorax x-ray (+)	10 Patients	6 Patients

only 19 patients with clinical suspicion of sternal trauma. Standard lateral radiograph of the sternum identified sternal fracture in 10 patients (52,6%), while bone scintigraphy identified sternal fracture in 14 patients (73,6%) with suspected sternal trauma (Table 3).

Table 3. Comparison of the results of lateral sternum radiography and bone scintigraphy for cases with suspected sternal fracture.

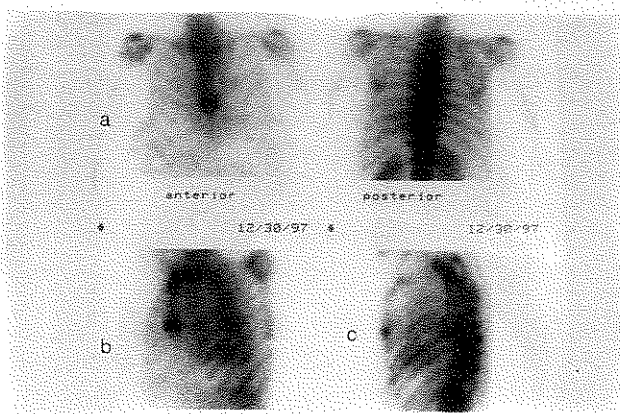
	Sternum x - Ray (+)	Sternum x - Ray (-)
Sternum Scintigraphy (-)	1 Patient	4 Patients
Sternum Scintigraphy (+)	9 Patients	5 Patients

Anteroposterior thorax x-ray showed rib fractures in six cases while bone scintigraphy did not demonstrate increased uptake. Increased uptake was seen in scintigraphy of seven patients in spite of the fact that there were no fractures seen in x-ray of the same patients. Likewise, scintigraphy demonstrated increased uptake in five of the cases although the lateral radiograph of the sternum showed no fracture (Fig 3a, b, c) (Figure 4). There was no increased uptake in sternal scintigraphy in one case, but the line of fracture was seen on the anteroposterior thorax x-ray.

Figure 3a. The anterior planar image of thorax shows increased uptake in the lower third of the sternum

Figure 3b. The left anterior oblique image of thorax shows increased uptake

Figure 3c. The left lateral planar images shows increased uptake

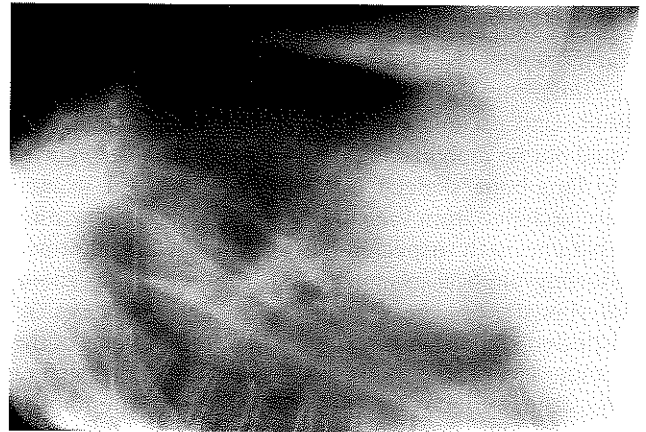


DISCUSSION

Trauma continues to be a major cause of morbidity and mortality worldwide. Groskin reported trauma is the leading cause of death of young adults (4). Trauma to the chest may cause fractures of the thoracic skeleton, contusion or laceration of pulmonary parenchyma, damage to the tracheobronchial tree, diaphragmatic rupture or cardiac contusion (5). Rib fractures and other chest wall injuries can cause weak ventilation, respiratory failure, atelectasis and even death.

Management of thoracic injuries necessitates early

Figure 4. There is no fracture on the lateral radiograph of the sternum of the same patient.



diagnosis and subsequent therapy. Radiological diagnosis is as important as clinical diagnosis in patients with thoracic trauma. It is sometimes difficult to diagnose lesions of the thoracic skeleton by plain radiography. Persistent chest wall pain without radiographic evidence of an osseous fracture is often seen by physicians. Such occult radiographic fractures should be evaluated by other imaging modalities. Holden et al. reported bone scintigraphy is sensitive in detecting stress fractures, bone metastases and suspected injury that is difficult to see on plain films (6). LaBan et al. evaluated seven patients with motor vehicle accidents and complaining of chest wall pain. All patients had normal x-rays of the osseous thorax but bone scintigraphy subsequently showed that all had a healing fracture of either the sternum or the ribs. They reported that bone scintigraphy significantly enhanced the detection of occult fractures that could not be recognized by routine planar x-ray (3). Gahr et al. reported that blunt chest trauma formed 92% of all thorax traumas and plain chest x-ray identified only a quarter of all pathological findings in comparison to the computerized tomography of the thorax (7). Ultrasonographic detection of the sternum is also reported to be a valuable tool for emergency diagnosis of sternal fractures (4).

Although more advanced imaging techniques are available, plain radiography remains the standard means of rapidly documenting blunt thorax trauma. Matin et al. reported that healing stress fractures of the sternum and/or ribs with their enhanced blood supply and active mineralizing osteoid are readily imaged by gamma camera scanning in both the anterior and posterior projections and can be visualized in 80% of cases within 24 hours of trauma (8). Since there is still not any gold standard for evaluating sternum and rib fractures exactly, determining the comparison of the actual sensitivity and specificity of these two methods is difficult in terms of statistics.

In the present study, the results of bone scintigraphy with Tc-99m was found to be similar as plain radiography for the assessment of rib fractures. Bone scintigraphy gave

better results when compared with the results of sternal fractures in plain radiography in the early period of trauma (within the first 24 hours) although repeated roentgenograms at a later date which may show evidence of new cortical bone formation at the fracture site were not seen and the results were not statistically significant.

Although the bone scintigraphy is more sensitive than plain radiography, the disadvantage for emergency diagnosis is that the results can not be taken before three hours. Therefore, conventional plain radiography in emergency diagnosis may be the initial imaging modality in patients with thorax trauma because it also has the advantage of showing hemothorax or pneumothorax besides the osseous abnormality. In cases of the negative plain radiography in strong clinical suspicion, bone scintigraphy should be done.

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