ORIGINAL ARTICLE

A study on the evaluation of pneumothorax by imaging methods in patients presenting to the emergency department for blunt thoracic trauma

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ABSTRACT

BACKGROUND: Pneumothorax (PNX) is the collection of air between parietal and visceral pleura, and collapsed lung develops as a complication of the trapped air. PNX is likely to develop spontaneously in people with risk factors. However, it is mostly seen with blunt or penetrating trauma. Diagnosis is generally confirmed by chest radiography [posteroanterior chest radiography (PACR)]. Chest ultrasound (US) is also a promising technique for the detection of PNX in trauma patients. There is not much literature on the evaluation of blunt thoracic trauma (BTT) and pneumothorax (PNX) in the emergency department (ED). The aim of this study was to investigate the effectiveness of chest US for the diagnosis of PNX in patients presenting to ED with BTT

METHODS: This study was carried out for a period of nine months in the ED of a university hospital. The chest US of patients was performed by emergency physicians trained in the field. The results were compared with anteroposterior chest radiography and/or CT scan of the chest. The APCR and chest CT results were evaluated by a radiology specialist blind to US findings. The evaluation of the radiology specialist was taken as the gold standard for diagnosis by imaging methods. Clinical follow-up was taken into consideration for the diagnosis of PNX in patients on whom CT scan was not performed.

RESULTS: Chest US was performed on all two hundred and twelve patients (144 female and 68 male patients; mean age 45.8) who participated in this study. The supine APCR was performed on two hundred and ten (99%) patients and chest CT was performed on one hundred and twenty (56.6%). Out of the twenty-five (11.8%) diagnosed cases of PNX, 22 (88%) were diagnosed by chest US and 8 were diagnosed by APCR. For the detection of PNX, compared to clinical follow-up and chest CT, the sensitivity of chest US was 88%, specificity 99.5%, positive predictive value 95.7% and negative predictive value 98.4%.

CONCLUSION: Chest US has not superseded supine and standing chest radiography for PNX diagnosis yet in many healthcare centers, but it is performed by emergency physicians and it is an effective and important method for early and bedside diagnosis of PNX.

Keywords: Blunt thoracic trauma; pneumothorax; ultrasound.

INTRODUCTION

Pneumothorax (PNX) is the collection of air between parietal and visceral pleura,[1] and collapsed lung develops as a complication (a secondary event) of the collection of air.[2] PNX is likely to develop spontaneously in people with risk factors. However, it is mostly seen with blunt or penetrating trauma.[3] The rate of PNX prevalence in cases of blunt trauma is 15–50%.[4]

Diagnosis is generally confirmed by chest radiography [posteroanterior chest radiography – PACR].[3] The radiography performed when patient is in standing position is more conducive in detection of PNX. However, in most cases, chest radiography of trauma patients cannot be performed in standing position due to conditions such as the protection of cervical vertebras, hemodynamic instability, immobilization

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in case of orthopedic injuries, continuing resuscitation and/or altered state of consciousness.[5] In emergency departments, PNX might be left unnoticed at a rate of 7% to 30% with supine radiographs.[6] The gold standard in the detection of PNX is computed tomography (CT) scan. However, all trauma patients are not suitable for CT because of its certain disadvantages (e.g. transfer of critical patients to radiology department, long period of application, radiation and costs).[5,7] Chest ultrasound is a promising technique for the detection of PNX in trauma patients.[8] Several studies have indicated that US has higher sensitivity and selectivity than direct radiography for the detection of PNX,[3,9–11] and the reliability of US has been confirmed by CT in some series.[12]

The number of studies, which concentrate only on the detection of PNX by chest US performed by emergency physicians in blunt thoracic trauma (BTT) patients, is low,[13] and the group of patients in these studies is also small. The current study was designed considering the need for more comprehensive studies in the field.

The aim of this study was to prospectively and blindly compare bedside chest US with other diagnostic methods (APCR, chest CT) in order to evaluate its effectiveness in the diagnosis of PNX in patients presenting to ED with BTT.

MATERIALS AND METHODS

In this single-blind, prospective, clinical study, we compared US, APCR and CT scan of the chest, used for the diagnosis of PNX in patients presenting to ED with BTT.

The study was carried out in the emergency department of a university hospital – a tertiary healthcare institution – with an annual patient number of approximately 50,000 after it was approved by the ethics committee of the university.

All patients aged 18 and over presenting to the ED with BTT, for whom chest imaging was considered as a requirement by the emergency physician, were included into the study after they read and signed the "Patient Information Form" and "Patient Consent Form". When the patients lacked the capacity to consent when they had altered state of consciousness, we relied on an authorized surrogate for consent. The indications of chest imaging are shown in Table 1. The patients excluded from the study were those who were below 18, did not sign the informed consent form, were diagnosed with subcutaneous emphysema or tissue loss in the US scan, had already been diagnosed with a lung disease (pleural adhesion, pulmonary fibrosis, acute respiratory distress syndrome, bullous emphysema) and were immediately taken to surgery room due to a life-threatening condition and/or did not undergo chest imaging (US, APCR or chest CT).

The study was carried out between 15 May 2009 and 15 March 2010. For this study, Sonosite 5000 series portable USG device and 7.5 MHz linear probe were used. The patients were examined in supine position. The US probe was placed longitudinally, on the front chest wall in hemithoraces, 2^{nd}-4^{th} intercostal space on the midclavicular line (Fig. 1) and 4^{th}-8^{th} intercostal space on the midaxillary line. The probe was moved longitudinally in order to identify the acoustic shadow of two adjacent ribs and the location of intercostal plane on the real-time image. The hyperechogenic pleural line between the shadows of two ribs was detected (Fig. 2a). The criteria accepted to prove the presence of PNX were taken into consideration in the evaluation: non-presence of pleural sliding, lack of comet tail artifact, lack of seashore sign in M-mode and presence of stratosphere sign (Fig. 2b). Patient demographics, duration of tests and test results were recorded.

Table 1. Chest imaging indications in blunt thoracic trauma

a) Altered state of consciousness
b) Respiratory distress
c) Shortness of breath
d) Hypoxia-Cyanosis
e) Decreased or coarse respiratory sounds and/or lack of respiratory sounds
f) Subcutaneous emphysema
g) Krugman
h) Ecchymosis, deformity, tissue loss and lack of sensitivity in chest wall
i) Pain and pressure in chest when breathing
j) Tracheal deviation, distension in neck veins

Following the initial physical examination, the patients underwent chest US performed by an emergency physician trained in chest ultrasonography. Three emergency physicians took part in this study. Later, in accordance with their clinical conditions, the patients underwent supine APCR and/or chest CT.

In cases where PNX was detected and the patients were not clinically stable, needle thoracostomy (NT) and/or tube thoracostomy (TT) was performed. The presence of air bubbles in underwater drainage was considered as an evidence for PNX. In these patients, chest tube was deemed the gold standard. CT scan was performed in patients who had indications of thoracic trauma.

The patients who were diagnosed with PNX but were clinically stable underwent APCR in supine position. In cases where PNX was detected in APCR and the patients were clinically instable, needle thoracostomy (NT) and/or tube thoracostomy (TT) was performed. Chest US was performed in patients who developed indications. Chest CT was performed in the cases where PNX was detected in APCR and the patients

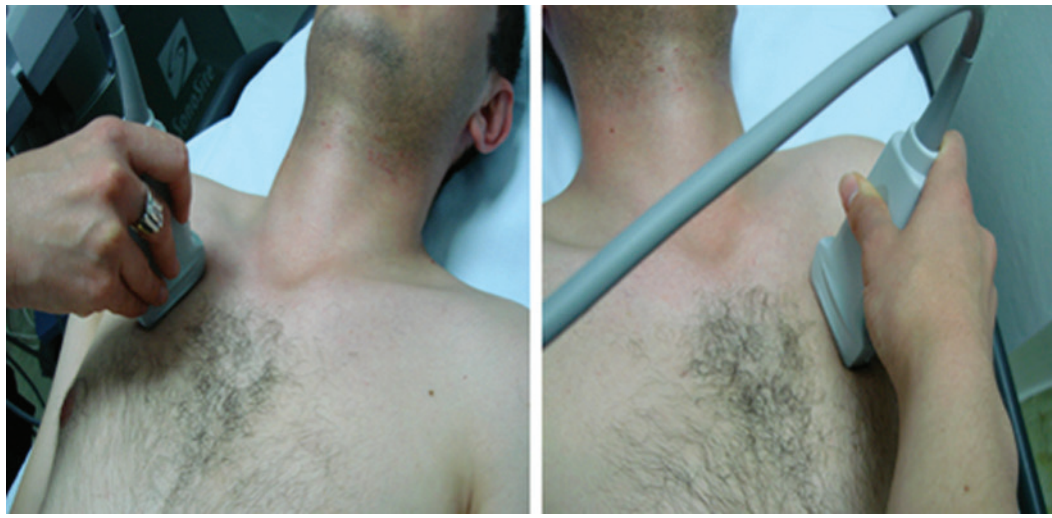

Figure 1. Longitudinalexamination of front chest wall (2nd–4th intercostal space on the midclavicular line).

were clinically stable. Chest CT was also performed in cases where chest US indicated PNX but APCR did not show PNX and the patient was clinically stable.

APCR was performed in cases where US did not indicate PNX but the patients had suspected PNX. In cases where PNX was detected and indicated as a result of APCR, NT and/or TT was performed. In accordance with the clinical conditions of these patients, chest CT was performed before or after thoracostomy. APCR was performed in cases where chest US and APCR did not show PNX but clinical suspicion continued. In cases where chest US and APCR did not show PNX and where PNX was not suspected clinically, the patient was transferred to the intensive care unit or to the relevant department in case hospitalization was required for any other condition. The patients, who were not required to be hospitalized due to trauma, were taken under observation in the ED. Twelve hours later; US and PACR were performed in these patients for control purposes. All patients in our study group,diagnosed with PNX as a result of all examinations and tests in the ED, were hospitalized in the intensive care unit or the service of the related department. The patients not diagnosed with PNX were hospitalized if they had additional problems. The patients without any additional disorders were discharged from the ED after observation for trauma. The evaluation plan of the patients is shown in Figures 3a, b.

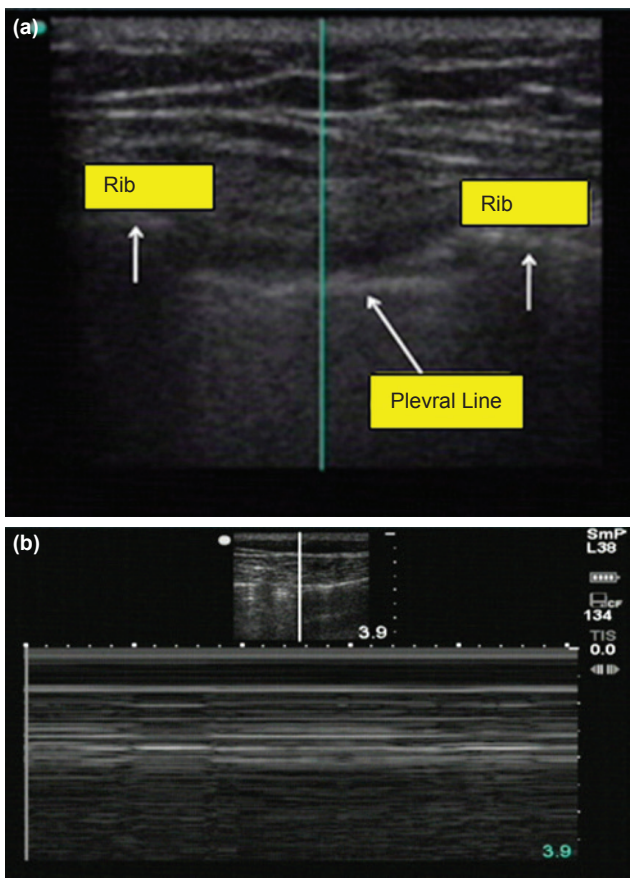

Figure 2. (a) Pleural US image between two ribs. **(b)** Pleural US image (M-mode and presence of stratosphere sign).

APCR and chest CT results were evaluated by a radiology specialist blind to the clinical results and chest US results of the patients. The evaluations of the radiology specialist were deemed the gold standard for the diagnosis with imaging tests.

Patient demographics, durations of the tests and the test results were recorded.

Primary Data Analysis

The Statistical Package for Social Sciences for Windows (SPSS) 17.0 was used for the statistical analysis of data collected in the study. In addition to descriptive statistics methods (frequency, percentage, mean, standard deviation), Pearson's chi-square test was used for the comparison of qualitative data. In order to examine sensitivity and selectivity, cross tables between two categorical variables were used. The results

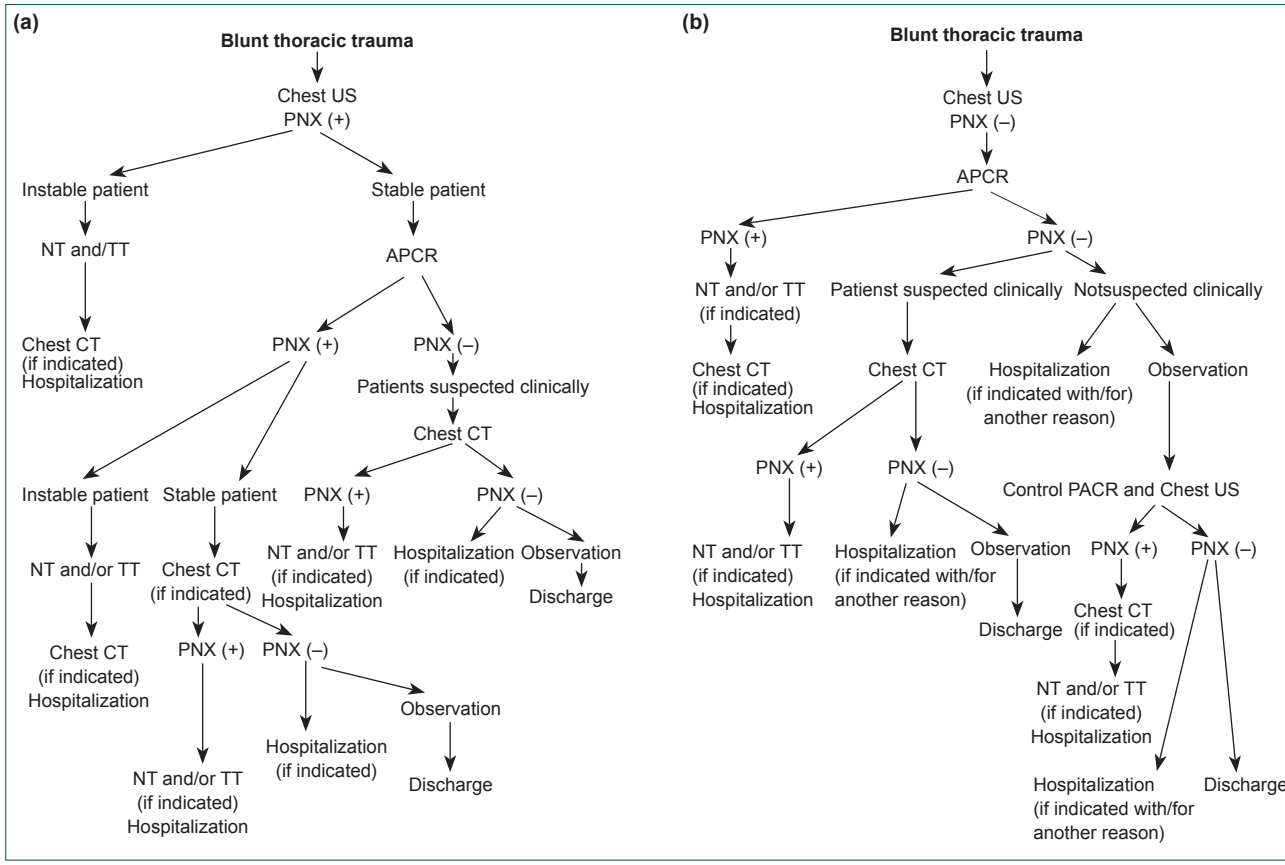

Figure 3. (a, b) Patient evaluation plan.

were evaluated bilaterally in confidence interval of 95% with the significance level of $p<0.05$.

RESULTS

During the period of this study, two hundred and sixty-three patients presented to the ED with BTT. The study was conducted with two hundred and twelve patients who complied with the predetermined inclusion criteria. Among the participants one hundred and forty-four (67.9%) were male and sixty-eight (32.1%) were female; and the mean age of the participants was 45.8±16.8 years. Chest US was performed on all two hundred and twelve patients (100%). Supine APCR was performed on two hundred and ten (99%) patients and chest CT was performed on one hundred and twenty (56.6%).

Furthermore, the periods between physical examination and radiological imaging were noted (Table 2).

PNX was detected in twenty-five (11.8%) of 212 patients. PNX diagnosis was made by CT scan in twenty-four patients. Since the condition of one patient was not stable, TT was performed before CT and the diagnosis of PNX was made upon the detection of air bubbles in underwater drainage. This patient then underwent chest CT. PNX area was observed.

PNX was detected by chest US in twenty-two (88%) of 25 patients diagnosed with PNX. One (0.5%) patient, who was considered to have PNX in chest US, was not diagnosed with PNX according to the gold standards. Statistical analysis showed that, for the detection of PNX, the sensitivity of

Table 2. Duration of radiological imagings

	Number of patients	Average duration (min.)±SD	Range
Between physical examination and chest US	212	11.60 ±5.62	5–40
Between physical examination and APCR	210	30.00±15.20	10–137
Between physical examination and chest CT scan	120	78.06±40.97	10–281

SD: Standard deviation; APCR: US: Ultrasound; Anteroposterior chest radiography; CT: Computed tomography.

Table 3. Evaluation of clinical follow-up and chest computed tomography and chest ultrasound in pneumothorax diagnosis

	Clinical follow up and computed tomography result				Total	
	Pneumothorax (–)		Pneumothorax (+)			
	n	%	n	%	n	%
Chest ultrasound result						
Pneumothorax (–)	186	99.5	3	12	189	89.2
Pneumothorax (+)	1	0.5	22	88	23	10.8
Toplam	187	100	25	100	212	100

X^2=174.421; df=1; p<0.05

Table 4. Evaluation of anteroposterior chest radiography compared to clinical follow-up and chest computed tomography for the detection of pneumothorax

	Computed tomography result				Total	
	Pneumothorax (–)		Pneumothorax (+)			
	n	%	n	%	n	%
APCR result						
Pneumothorax (–)	187	100	15	60	202	95.3
Pneumothorax (+)	0	0	8	32	8	3.8
No APCR	0	0	2	8	2	.9

X^2=78.530; df=2; p<0.05. APCR: Anteroposterior chest radiography.

chest US was 88%, specificity 99.5%, positive predictive value (PPV) 95.7% and negative predictive value (NPV) 98.4%. For the detection of PNX, the relationship between chest US and the gold standard procedures, clinical follow-up and chest CT, was found significant (p<0.05) (Table 3).

The dimensions of 3 PNX, which could not be detected in chest US, were small in chest CT (two of them 1% and one of them 5%). The dimensions of PNX, which were detected in US, were as follows: in twelve cases <10%, in eight cases 10–60%, in two cases >60%.

Out of the twenty-five cases of PNX diagnosed according to the gold standards, 15 (60%) could not be detected in APCR. For the diagnosis of PNX, compared to clinical follow-up and chest CT, the sensitivity of APCR was 34.8%, selectivity 100%, positive predictive value 100%, and negative predictive value 92.6% (Table 4).

DISCUSSION

Chest traumas constitute one third of the cases hospitalized due to trauma.[14] Until the age of 40, chest trauma constitutes 20-25% of the causes of deaths due to trauma and the mechanism of injury is blunt in 70% of the cases.[15,16]

PNX is encountered in 15% to 50% of cases of blunt trauma.[4,17,18] The rate of bilateral PNX was reported to be 8–10%.[17,18] In the results of our study, the rate of PNX due to BTT was 11.8%. In 52% of these cases, PNX developed in the right, in 44% it developed in the left and in 4% it developed bilaterally.

In the literature, there are a few studies on the duration of imaging techniques used in pneumothorax.[17,19,20] In the study of Mao et al., the average duration of US has been 2.3±2.9 min., APCR 12.4±6.7 min. and chest CT 16.3±7.8 min. In our study, the duration of US imaging was longer than the duration reported in the study of Mao et al. The reasons for this difference are as follows: there is only one US device in the ED where this study was conducted; more than one patient who needs US imaging might be presented in the ED at the same time; and US device is kept in an area other than the trauma room. The reasons for longer duration of APCR are as follows: there is not a portable x-ray device in the ED; the patient is taken to a radiology unit outside of the patient care area for the scan; more than one patient who needs x-ray scan might be presented in the ED at the same time; and the device in the radiology unit might sometimes be out of order. In our study the average duration for CT was also longer as

compared to the study in the literature. The reasons for this difference are as follows: The patient is taken to the radiology unit, which is located 200 m far from the ED, for the scan; the radiology physician must be called and informed before the CT scan; and there might be another patient in the CT room when the scan is requested for a patient in the ED.

The advantage of chest CT in the diagnosis of PNX is unquestionable. However, chest US is also a useful technique with advantages such as bedside applicability, lack of radiation, being non-invasive, swiftness, cost-effectiveness and being repeatable. That US is user dependent and requires experience constitutes a disadvantage in its use for PNX diagnosis. In the literature, there is no study indicating the minimum number of chest US examinations required for eliminating user-related mistake of US. However, the American College of Emergency Physicians' guides indicate that at least 25–50 chest US examinations are required to gain competence in this field.[13] In our study, all physicians were trained to use chest US for PNX diagnosis and each had already performed minimum 150 chest US examinations before our study. It is accepted that the effectiveness of US would increase if US is performed and interpreted by the physician who examines the patient.[21,22] Therefore, in our study, chest US was performed by the physicians who also examined the patients.

The use of US for PNX diagnosis in human beings was first mentioned in a study conducted by Wernecke et al. in 1987.[23] The sensitivity, selectivity, PPV and NPV of chest US and chest radiography in PNX diagnosis were also evaluated in some studies in the literature.[17,18,24,25] In our study group, for the detection of PNX, the sensitivity of chest US is 88%, specificity 99.5%, positive predictive value 95.7% and negative predictive value 98.4%. For the detection of PNX, the sensitivity of APCR was 34.8%, selectivity 100%, positive predictive value 100%, and negative predictive value 92.6%. These values are compatible with the literature for both US and chest radiography. Our study shows that chest US has high sensitivity and selectivity in the detection of PNX in patients with BTT.

Hidden pneumothorax – a radiological concept – is PNX that cannot be detected in ordinary radiography but requires chest CT for detection.[26,27] Hidden PNX incidence was 3.7% in trauma children presenting to the ED and was 64% after TT in multitrauma patients.[28,29] Hidden PNX diagnosis was reported in 54.8% of chest trauma cases.[18] In our study, out of the twenty-five PNX diagnoses, 15 (60%) could not be detected in APCR and 3 (12%) could not be detected in US. In these three patients, PNX in chest CT was small and regarded as hidden PNX.

The use of chest US in the detection of PNX has scientific grounds.[6] Liechtenstein has edited the studies that detect static and dynamic US findings of PNX.[30] The lack of pleural sliding sign and comet tail artifact has been reported to be diagnostic for PNX.[6,30] In our study, we also considered the lack of seashore sign and presence of stratosphere sign for the diagnosis of PNX in addition to these two diagnostic findings. Despite high accuracy rates of US, the lack of pleural sliding sign may occur without PNX in clinical conditions such as pulmonary fibrosis and severe pulmonary contusion. This may cause false positive results.[25] In our study, one patient did not have pleural sliding and seashore signs and had stratosphere sign in US. However, there was no PNX in APCR and chest CT. We found that the patient had pulmonary contusion, thus this case was revaluated as a false positive result.

Conclusion

PNX is a life-threatening clinical condition that makes its early diagnosis and treatment essential. Chest CT scan, which is the gold standard for PNX diagnosis, cannot be applicable for all trauma patients. Therefore, in most cases, the diagnosis is confirmed by chest radiography. Our study shows that chest US is a better method to diagnose PNX compared to APCR. Our study also proves that US is more reliable in the ED for the detection of PNX which cannot be detected in chest radiography.

Although chest US has not been preferred as frequently as chest radiography for the diagnosis of PNX yet, it is an important method for early bedside diagnosis of PNX, particularly in cases of clinically unstable patients.

Conflict of interest: None declared.

REFERENCES

1. Light RW, Broaddus VC. Pneumothorax, chylothorax, hemothorax and fibrothorax.In: Murray JF, Nadel JA, editors. Textbook of Respiratory Medicine. 3rd. Philadelphia: W.B. Saunders Company 2000. p. 2043–66.
2. Işıtmangil T, Balkanlı K. Pnömotoraks ve cerrahi tedavisi. İç: Yüksel M, Kalaycı G, editörler. Göğüs Cerrahisi. 1. Baskı. İstanbul: Bilmedya Grup 2001. s. 411–46.
3. Dulchavsky SA, Schwarz KL, Kirkpatrick AW, Billica RD, Williams DR, Diebel LN, et al. Prospective evaluation of thoracic ultrasound in the detection of pneumothorax. J Trauma 2001;50:201–5. CrossRef
4. Özçelik C. Penetran göğüs yaralanmaları. Yüksel M, Kalaycı G, editörler. Göğüs cerrahisi. 1. Baskı. İstanbul: Bilmedya Grup; 2001. s. 465–80.
5. Rowan KR, Kirkpatrick AW, Liu D, Forkheim KE, Mayo JR, Nicolaou S. Traumatic pneumothorax detection with thoracic US: correlation with chest radiography and CT-initial experience. Radiology 2002;225:210–4.
6. Soldati G, Testa A, Pignataro G, Portale G, Biasucci DG, Leone A, et al. The ultrasonographic deep sulcus sign in traumatic pneumothorax. Ultrasound Med Biol 2006;32:1157–63. CrossRef
7. Lichtenstein DA, Mezière G, Lascols N, Biderman P, Courret JP, Gepner A, et al. Ultrasound diagnosis of occult pneumothorax. Crit Care Med 2005;33:1231–8. CrossRef
8. Çevik AA, Ergün N, Sivrikoz C, Döner E, Kaya Ş, Arslan O, et al. Diagnosis of pneumothorax by ultrasonography. Türkiye Acil Tıp Dergisi 2006;6:176–80.
9. Alrajab S, Youssef AM, Akkus NI, Caldito G. Pleural ultrasonography versus chest radiography for the diagnosis of pneumothorax: review of the literature and meta-analysis. Crit Care 2013;17:208. CrossRef
10. Alrajhi K, Woo MY, Vaillancourt C. Test characteristics of ultrasonography for the detection of pneumothorax: a systematic review and meta-

analysis. Chest 2012;141:703–8. CrossRef
11. Ding W, Shen Y, Yang J, He X, Zhang M. Diagnosis of pneumothorax by radiography and ultrasonography: a meta-analysis. Chest 2011;140:859–66. CrossRef
12. Dente CJ, Ustin J, Feliciano DV, Rozycki GS, Wyrzykowski AD, Nicholas JM, et al. The accuracy of thoracic ultrasound for detection of pneumothorax is not sustained over time: a preliminary study. J Trauma 2007;62:1384–9.
13. Wilkerson RG, Stone MB. Sensitivity of bedside ultrasound and supine anteroposterior chest radiographs for the identification of pneumothorax after blunt trauma. Acad Emerg Med 2010;17:11–7. CrossRef
14. LoCicero J 3rd, Mattox KL. Epidemiology of chest trauma. Surg Clin North Am 1989;69:15–9.
15. Er M, Işik AF, Kurnaz M, Cobanoğlu U, Sağay S, Yalçinkaya I. Clinical results of four hundred and twenty-four cases with chest trauma. [Article in Turkish] Ulus Travma Acil Cerrahi Derg 2003;9:267–74.
16. Soysal Ö. Künt göğüs travmaları. İç: Yüksel M, Kalaycı G, editörler. Göğüs cerrahisi. 1. Baskı. İstanbul: BilmedyaGrup 2001. s. 447–64.
17. Zhang M, Liu ZH, Yang JX, Gan JX, Xu SW, You XD, et al. Rapid detection of pneumothorax by ultrasonography in patients with multiple trauma. Crit Care 2006;10:112. CrossRef
18. Soldati G, Testa A, Sher S, Pignataro G, La Sala M, Silveri NG. Occult traumatic pneumothorax: diagnostic accuracy of lung ultrasonography in the emergency department. Chest 2008;133:204–11. CrossRef
19. Abbasi S, Farsi D, Hafezimoghadam P, Fathi M, Zare MA. Accuracy of emergency physician-performed ultrasound in detecting traumatic pneumothorax after a 2-h training course. Eur J Emerg Med 2013;20:173–7.
20. Nandipati KC, Allamaneni S, Kakarla R, Wong A, Richards N, Satterfield J, et al. Extended focused assessment with sonography for trauma (EFAST) in the diagnosis of pneumothorax: experience at a community based level I trauma center. Injury 2011;42:511–4. CrossRef
21. Knudtson JL, Dort JM, Helmer SD, Smith RS. Surgeon-performed ultrasound for pneumothorax in the trauma suite. J Trauma 2004;56:527–30.
22. Sistrom CL, Reiheld CT, Gay SB, Wallace KK. Detection and estimation of the volume of pneumothorax using real-time sonography: efficacy determined by receiver operating characteristic analysis. AJR Am J Roentgenol 1996;166:317–21. CrossRef
23. Wernecke K, Galanski M, Peters PE, Hansen J. Pneumothorax: evaluation by ultrasound-preliminary results. J Thorac Imaging 1987;2:76–8.
24. Goodman TR, Traill ZC, Phillips AJ, Berger J, Gleeson FV. Ultrasound detection of pneumothorax. Clin Radiol 1999;54:736–9. CrossRef
25. Blaivas M, Lyon M, Duggal S. A prospective comparison of supine chest radiography and bedside ultrasound for the diagnosis of traumatic pneumothorax. Acad Emerg Med 2005;12:844–9. CrossRef
26. Ball CG, Hameed SM, Evans D, Kortbeek JB, Kirkpatrick AW; Canadian Trauma Trials Collaborative. Occult pneumothorax in the mechanically ventilated trauma patient. Can J Surg 2003;46:373–9.
27. Ball CG, Ranson K, Dente CJ, Feliciano DV, Laupland KB, Dyer D, et al. Clinical predictors of occult pneumothoraces in severely injured blunt polytrauma patients: A prospective observational study. Injury 2009;40:44–7.
28. Holmes JF, Brant WE, Bogren HG, London KL, Kuppermann N. Prevalence and importance of pneumothoraces visualized on abdominal computed tomographic scan in children with blunt trauma. J Trauma 2001;50:516–20. CrossRef
29. Guerrero-López F, Vázquez-Mata G, Alcázar-Romero PP, Fernández-Mondéjar E, Aguayo-Hoyos E, Linde-Valverde CM. Evaluation of the utility of computed tomography in the initial assessment of the critical care patient with chest trauma. Crit Care Med 2000;28:1370–5. CrossRef
30. Lichtenstein D. Pneumothorax and introduction to ultrasound sign in the lung. İn: Lichtenstein D, editors. General ultrasound in the critically ill. Germany: Springer-Verlag 2005. p. 105–15.

ORİJİNAL ÇALIŞMA - *ÖZET*

Acil servise künt toraks travması ile başvuran hastalarda pnömotoraksın görüntüleme yöntemleriyle değerlendirilmesi

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AMAÇ: Pnömotoraks (PNX) pariyetal ve visseral plevra arasına hava toplanması ve buna ikincil olarak gelişen akciğer sönmesi olarak tanımlanır. Risk faktörü olan kişilerde kendiliğinden gelişebilir. Ancak genellikle künt veya penetran travma ile birliktedir. Tanı genelde göğüs radyografisi (posteroanterior akciğer [PAAC] grafis) ile doğrulanır. Göğüsün ultrasonografi (USG) ile incelenmesi travmalı olgularda PNX'in saptanmasında umut veren bir teknik olarak göze çarpmaktadır. Acil serviste (AS) künt göğüs travması (KGT) ve PNX'in değerlendirilmesi ile ilgili literatürde çalışma sayısı fazla değildir. Bu çalışmanın amacı KGT ile AS'ye başvuran hastalarda PNX tanısında göğüs USG'nin etkinliğinin araştırılmasıdır.

GEREÇ VE YÖNTEM: Bu çalışma bir üniversite hastanesi AS'sinde dokuz aylık süre içerisinde yapıldı. Hastalara göğüs USG'leri bu konuda eğitimli acil tıp hekimleri tarafından uygulandı. Sonuçlar anteroposterior akciğer (APAC) grafisi ve göğüs bilgisayarlı tomografisi (BT) ile karşılaştırıldı. Anteroposterior akciğer grafisi ve/veya göğüs BT'si USG bulgularına kör bir radyoloji uzmanı tarafından değerlendirildi. Radyoloji uzmanının değerlendirmesi görüntüleme incelemelerinde tanı için altın standart olarak kabul edildi. Bilgisayarlı tomografi ile değerlendirilmeyen hastalarda pnömotoraks tanısı için klinik takip dikkate alındı.

BULGULAR: Çalışmaya alınan 212 (144 erkek, 68 kadın, ortalama yaş 45.8) hastanın tamamına göğüs USG yapıldı. İki yüz on (%99) hastaya supin APAC grafisi, 120 (%56.6) hastaya ise göğüs BT çekildi. Tanısı kesinleşen 25 (%11.8) PNX'in göğüs USG'de 22'si (%88), APAC grafisinde ise sekizi (%32) saptanabildi. Pnömotoraks tespit etmede göğüs USG'nin, klinik takip ve göğüs BT'ye göre duyarlılığı %88, özgüllüğü %99.5, olumlu öngörü değeri %95.7 olumsuz öngörü değeri ise %98.4 olarak bulundu.

TARTIŞMA: Çoğu merkezde PNX tanısında supin ve ayakta akciğer grafisinin yerini henüz almayan, acil tıp hekimleri tarafından yapılan göğüs USG, PNX'in yatak başı erken tanısı için oldukça etkin ve önemli bir araçtır.

Anahtar sözcükler: Künt toraks travması; pnömotoraks; ultrason.

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