COMPUTED TOMOGRAPHY SCENOGRAM, FOLLOWED BY LOW DOSE TOMOGRAPHY -IF NECESSARY- IN PLACE OF CHEST RADIOGRAPHY: IS CHEST RADIOGRAPHY NOT NECESSARY ANYMORE?

Original Artıcle

AKCİĞER GRAFİSİ YERİNE ÖNCE BİLGİSAYARLI TOMOGRAFİ SKENOGRAM, SONRA GEREKİRSE DÜŞÜK DOZ TOMOGRAFİ: AKCİĞER GRAFİSİ ARTIK GEREKSİZ Mİ?

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ÖZET

Amaç

Akciğer grafisinde, sadece iki boyutlu bir düzleme bakarak, tüm torasik kemik-yumuşak doku, bronkovasküler işaretleri hakkında karar vermek zorundayız. Bu çalışma ile bizim amacımız, topogram ile değerlendirmenin dijital grafiye denk olup olmadığını araştırmaktır. Eğer öyle ise, topogram sonrası çok düşük doz bilgisayarlı tomografi (BT) ile devam etmek veya sadece topogram ile çalışmayı bitirmek mümkün olacaktır. Bu durumda, direkt grafi, acaba hala gerekli olacak mı...

Materyal ve Metod

Çalışmaya 100 olgu dahil edildi. Olguların dijital ön-arka akciğer grafisi, toraks ve parankim penceresinde görüntüleri elde edilmiş çok düşük dozlu BT kesitleri mevcut idi. Olguların tanıları, epikriz bilgileri dikkate alınarak değerlendirildi. Bu tanılar ile birlikte BT kesitleri altın standart olarak kabul edilip; akciğer grafi bulguları ile BT-topogram bulguları, iki ayrı radyoloji uzmanı tarafından bağımsız olarak değerlendirildi. Benign (hamartom, fibronodül, kalsifik nodül) ve metastatik nodüller için değerlendirmede; 1 cm'den küçük lezyonlar ve 1 cm'den büyük çaplı lezyonlar ayrı ayrı değerlendirildi. Her iki test için de patolojinin varlığının tespiti durumunda pozitif (p), saptanmaması durumunda negatif (n) olarak işaretlendi. İstatistiksel değerlendirmeler de buna göre yapıldı.

Bulgular

Bronşiektezide topogram verileri daha üstün iken; 1 cm'den büyük benign ve malign nodüllerde, 1 cm'den küçük malign nodüllerde ise hem topogram hem de direkt dijital akciğer grafisi lezyonları eşit oranda tespit etmiş idi. Buzlu cam tarzında patolojiler ise her iki test ile de tespit edilememişti. Lezyon grupları içindeki diğer tüm patolojilerin tespitinde ise; direkt dijital akciğer grafisi ile tespit edilen

bulgular topogram verilerinden anlamı derecede daha üstün idi.

Sonuç

Pulmoner patoloji için ileri evaluasyonda, BT sistemlerinde teknoloji ne kadar iyi gelişmiş olursa olsun, topogramdan önce alınan dijital direkt grafiler ile incelemeler gereksiz olmayıp, belki de sonsuza kadar alınmaya devam edecektir. Birbirine benzer görüntüler sunmalarına karşın, bronşiektazi dışında çoğu önemli pulmoner ya da torasik patolojide dijital akciğer grafisi, topograma göre ya benzer ya da daha sıklıkla üstün bilgiler sunmaktadır.

Anahtar Kelimeler: *Pulmoner nodül; pulmoner kitle; bilgisayarlı tomografi; direkt grafi.*

ABSTRACT

Purpose

When performing chest radiography, a decision needs to be taken on all thoracic bone-tissue and bronchovascular markers by examining a two dimensional plane. The aim of this study was to investigate whether topogram-based assessment is equivalent to digital radiography. If so, it may be possible to continue to the exam by ultra low dose computed tomography (CT) or finish it. May the direct radiography would still be necessary if so...

Materials and Methods

100 cases were included in this study. Digital antero-posterior chest radiographies and thoracic CT images (meadiastinal and parenchymal windows) taken using ultra low dose, two-tube CT scan were available for the cases. These diagnosis of the cases was based on epicrisis. The diagnosis and CT scans were considered gold standard and chest radiographies and CT topogram findings were evaluated by two independent radiology experts. For benign (hematoma, fibrous nodule and calcified nodule) and metastatic nodules, lesions with a diameter smaller and greater than 1 cm were evaluated separately. For both tests, the radiographs and CT topograms were labeled as positive (p) and negative (n) depending on the presence and absence, respectively, of the pathological abnormality. Statistical analysis was undertaken accordingly.

Results

While topogram findings were superior in cases of bronchiectasis, for benign and malignant nodules larger than 1 cm and for malignant nodules smaller than 1 cm, both topogram and digital chest radiography detected lesions with similar efficiency. Neither of the two methods detected ground glass opacities. For all other pathologies, information obtained via digital chest radiography was significantly superior to that obtained via topogram.

Conclusion

For the advanced evaluation of pulmonary pathologies, despite the fact that CT technologies are well developed, digital radiographies taken prior to topogram are not unnecessary and will possibly be used forever. While they provide similar images, for most of the important pulmonary or thoracic pathologies except bronchiectasis, digital chest radiography provides information similar or more frequently superior to topogram.

Keywords: *Pulmonary nodule; pulmonary mass; computerized tomography; X-Ray graphy.*

INTRODUCTION

When performing chest radiography, a decision needs to be taken on all thoracic bone-tissue and bronchovascular markers by examining a two dimensional plane. Furthermore, radiography has been shown to have a reduced sensitivity for the detection of lung cancer. In this study, we compared the information obtained via digital chest radiography to CT topogram findings. Our aim was to investigate whether topogram-based assessment is equivalent to digital radiography and whether radiography would still be necessary if ultra low dose CT units become prevalent.

Materials and Methods

100 cases were included in this study. Digital antero-posterior chest radiographies and thoracic CT images (meadiastinal and parenchymal windows) taken using ultra low dose, two-tube CT scan were available for the cases. The diagnosis of the cases was based on epicrisis. The diagnosis and CT scans were considered gold standard and chest radiographies and CT topogram findings were evaluated by two independent radiology experts who were blinded to the diagnosis. At the beginning of the study, lesions were classified to reach an agreement for the nomenclature of the pathology. For the evaluation of benign (hematoma, fibrous nodule and calcified nodule) and metastatic nodules, this classification was further taken into consideration. Furthermore, for the statistical evaluation of both benign and malignant nodules, lesions with diameter smaller and greater than 1 cm were evaluated separately. In other groups lesions were classified as follows: infiltration (pneumonic infiltration, consolidation); bronchiectasis; emphysema (hyperaeration; air cyst); mass; bone pathology (rib fracture, tumor or anomaly); ground glass opacity; atelectasia; pleural pathology (effusion, thickening; calcification). The findings were then analyzed by a third author and compared to the thoracic CT findings present on the epicrisis report. For both tests, the radiographs and CT findings were labeled as positive (p) or negative (n) depending on the presence and absence, respectively, of the pathological abnormality. Following the evaluation of all lesions, the presence (positive-p) or absence (negative-n) of the pathology was indicated in a table. The consistency between the evaluations of the two radiologists and the efficiency of the scout and digital radiography modalities for detecting the pathology in each group was statistically assessed.

RESULTS

Lesions were classified in 14 categories

(Table 1)

Group Number	Lesion	Group Number	Lesion
1	Malignant mass	8	Emphysema (hyperaeration; air cyst)
2	Nodule (benign-stable, fibrous nodule, calcified nodule)>1 cm	9	Atelectasia
3	Nodule (benign-stable, fibrous nodule, calcified nodule)<1 cm	10	Ground glass opacity
4	Nodule (metastatic) >1 cm	11	Hilar lymphadenopathy
5	Nodule (metastatic) <1 cm	12	Cardiac pathology (pericardial effusion, anomaly, mass)
6	Infiltration (pneumonic infiltration, consolidation)	13	Pleural pathology (effusion, thickening, calcification)
7	Bronchiectasis	14	Bone pathology (rib fracture, tumor or anomaly)

Table 1. *Lesion categories evaluated in the study.*

For "bronchiectatic changes", topogram findings were significantly superior to those from digital radiography. This interesting finding was shown in images taken from a demonstrative case (**Figure 1**).

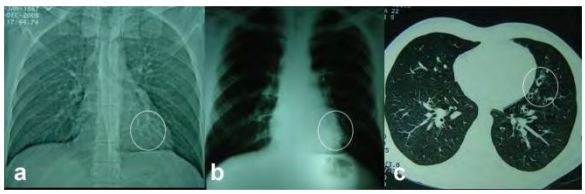

Figure 1. *a) Topogram, b) Direct radiography and c) CT (with the adjustment of parenchymal window setting) images taken from a patient. With thickening of the peribronchial wall and ectasia of the left lingular lobe segmental bronchi. CT provided the highest detection level for this pathology, followed by topogram and radiography.*

For "benign and malignant nodules larger than 1 cm" and for "malignant nodules smaller than 1 cm", both topogram and digital chest radiography detected lesions with similar efficiency. Both methods were inefficient for the detection of "ground glass opacities". For the detection of all other lesions indicated in Table 1, information obtained via digital chest radiography was significantly superior to that obtained via topogram.

All detection ratios obtained using both modalities (positive indicating presence of lesion and negative indicating absence of lesion) are indicated below in a separate table. **(Table 2).**

	Positive		Negative	
	Radiography	Topogram	Radiography	Topogram
Mass (>1 cm)	**100,0%**	85,7%	0,0%	14,3%
Nodule (benign-stable, fibrous nodule, calcified nodule) > 1 cm	**100,0%**	**100,0%**	0,0%	0,0%
Nodule (benign-stable, fibrous nodule, calcified nodule) <1 cm	60,0%	50,0%	40,0%	50,0%
Nodule (metastatic) >1 cm	**100,0%**	**100,0%**	0,0%	0,0%
Nodule (metastatic) <1 cm	28,6%	28,6%	71,4%	71,4%
Infiltration-consolidation)	92,9%	71,4%	7,1%	28,6%
Bronchiectasis	23,1%	53,8%	76,9%	46,2%
Emphysema (hyperaeration; air cyst)	57,1%	28,6%	42,9%	71,4%
Atelectasia	**100,0%**	80,0%	0,0%	20,0%

Table 2. *Detection ratios of chest radiography and CT topogram for different lesion groups.*

DISCUSSION

While digital radiography systems are highly developed, their sensitivity for detecting pathologies of the lung parenchyma and capturing lesions, particularly those with sub-centimeter dimensions, is questionable especially due to differences between readers. Furthermore, the detection ratio of a malignant mass using radiography varies between 37-78 %; and this ratio does not exceed 90 % even when the analysis is performed by the most experienced eyes (4, 5). Therefore, comprehensive studies were undertaken with the awareness of the possibility of missing an important and frequent malignancy -lung cancer- even at a stage characterized by the presence of an evident nodule. In these studies, it was shown that low dose CT lung screening can detect parenchymal nodular pathologies at an early stage and make the implementation of various treatment options possible (6).

In this study, we undertook our investigation by taking advantage of the opportunity for obtaining ultra-low dose scout images (scenogram, topogram) using new generation systems. Our cases were registered by the institution and we had access to their final diagnosis and follow-up information. We undertook our investigation by comparing images taken from patients using chest radiography and CT scout in the same week. In this study we investigated whether radiography is still a necessary imaging method amongst current technological options. Our findings show that, despite the low sensitivity level indicated in the literature and a significant inconsistency between readers, when compared with CT scenogram, radiography, whether it is followed by a CT scan or not, is still the routine lung examination which should be performed at the first stage. The reason for this is that the dose required for CT scenogram is still higher than that for radiography and according to our findings, it does not provide more accurate information than radiography, except in the case of

bronchiectasis. Moreover, low-dose CT scans do not appear to be useful due to the exposure to the ionizing radiation which is 50-100 times more than radiography and their high cost (7). However, it is possible that the fast developing technology will provide a more secure lung malignancy scan using low dose CT scenogram in the future, with exposure to a low level of radiation similar to that of radiography.

CONCLUSION

For the advanced evaluation of pulmonary pathologies, despite the fact that CT technologies are well developed, digital radiographies taken prior to topogram are not unnecessary and will possibly be used forever. While they provide similar images, for most of the important pulmonary or thoracic pathologies except bronchiectasis, digital chest radiography provides information similar or more frequently superior to topogram.

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