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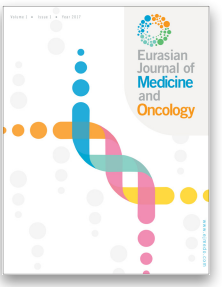

Research Article

A Cross-sectional Study; 2015 Evaluation of Lung Graphs

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Abstract

Objectives: This study was an evaluation of posteroanterior chest radiographs taken of residents of Konya determined by the cluster sampling method.

Methods: This study was a descriptive cross-sectional study, conducted in cooperation with the Konya Education and Research Hospital, the provincial health directorate, and the metropolitan municipality. The sociodemographic characteristics of 2015 individuals participating in the study were recorded. The standard chest radiographs, which were taken with a traditional analog system during inspiration in the standing position, were evaluated by 2 radiologists. The most obvious pathological finding was recorded.

Results: Of the participants, 1075 (53.40%) were female and 940 (46.60%) were male. The mean age was 45.89±0.45 years for the women and 46.20±0.54 years for the men. In the group, 340 (16.90%) were retired, 492 (24.40%) were farmers and/or laborers, 144 (7.10%) were white-collar employees, and 1039 (51.60%) were housewives or unemployed. In all, 580 (28.80%) were cigarette smokers. While 249 (12.36%) had pathological findings on the chest radiograph, 1766 (87.64%) had normal results. The pathological findings were hilar fullness (n=50, 2.48%), emphysematous appearance (n=48, 2.38%), nodule (n=29, 1.44%), increased reticulonodular density (n=26, 1.29%), increased bronchovascular branching (n=9, 0.44%), bronchiectasis (n=4, 0.20%), and other changes (n=83, 4.12%). The incidence of emphysematous appearance was 2.77 times greater in the smokers than in the non-smokers ($p<0.05$; odds ratio [OR]: 2.77, confidence interval [CI]: 1.56-4.91). While the chest X-ray was normal in 93.50% of the individuals under the age of 40 years, the rate decreased to 84.60% in the individuals over the age of 40 years. The incidence of a pathological chest radiograph was also 2.62 times higher in individuals over the age of 40 years ($p<0.001$; OR: 2.62, CI:1.90-3.61).

Conclusion: The incidence of pathological lung findings was greater in individuals over the age of 40 years, and in workers and retirees.

Keywords: Age, posteroanterior chest radiograph, smoking

Epidemiological studies, which are defined as the examination of the incidence of diseases in society and the factors affecting it, are aimed to reveal the incidence and causes of the disease, to eliminate the disease agents, and to manage the resources efficiently and correctly.[1]

Posteroanterior (PA) chest radiograph, one of the earliest practical methods used to detect thoracic pathologies, is used in imaging the trachea, mediastinum, the heart, the diaphragm, subdiaphragmatic areas, hilus, pulmonary vasculature, fissures, sinuses, lung parenchyma, pleura, soft

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tissues, bones, and upper abdomen. X-ray, which is a form of ionizing radiation, is used for this imaging, and a two-dimensional image is obtained as projection radiography.[2] The usual dose for adults is approximately 0.02 milliSievert (mSv).[3]

As in developed countries, lung cancer is the leading cause of cancer-related death in our country as well.[4] Lung cancer can be divided into two main histopathological subtypes: small-cell lung cancer (25%) and non-small-cell lung cancer (75%).[5] While 50%–60% of lung cancers are detected as parenchymal nodule or mass, 40%–50% of them are detected as central endobronchial, hilar, or mediastinal mass.[6] More than half of the patients have distant metastases at the time of diagnosis; however, unfortunately, only 20%–25% of them can be resected.[7] It has been shown in screened individuals that especially non-small-cell lung cancer was caught at an early stage, can be resected more frequently and had a higher 5-year survival rate.[8]

In this study, we aimed to evaluate the results of posteroanterior (PA) chest radiographs taken in 2015 individuals who were diagnosed using cluster sampling method in Konya.

Methods

For this descriptive cross-sectional study, 49 settlement units were selected from the city center, districts, and villages using the systematic and stratified population-based sampling method. A sample volume was created in proportion to the population in each settlement center. Overall, 2015 individuals from these settlements were targeted to be evaluated.

Ethics Committee approval was obtained for the study, which was conducted in cooperation with the Konya Education and Research Hospital, the Provincial Health Directorate, and the Metropolitan Municipality. Next, a bus equipped with a portable digital X-ray machine was allocated for screening between April 2011 and April 2012. After informed consent was obtained from each participant, the sociodemographic data form, which included age, gender, height, weight, occupation, place of residence, and habits, was filled. Body mass index (BMI) was calculated as weight (kg)/height (m^2). According to the World Health Organization (WHO, 1999), general population is classified into five categories: underweight (BMI <18.5 kg/m^2), normal weight (BMI 18.5–24.9 kg/m^2), grade I obesity (overweight; BMI 25.0–29.9 kg/m^2), grade II obesity (obesity; BMI 30.0–39.9 kg/m^2), and grade III obesity (extreme obesity; BMI>40 kg/m^2).[9, 10] Next, posteroanterior (PA) chest radiograph was performed for each participant during inspiration in standing position in case that the beam source would be behind the person and the distance between the beam source and the cassette would be 180 cm. The posteroanterior (PA) chest radiographs were evaluated by two radiologists. The most obvious pathological finding was recorded.

Statistical analysis of data was conducted using SPSS 15 (Statistical Package for Social Sciences, SPSS Inc.) software. Kolmogorov–Smirnov test was used to investigate whether the continuous variables were normally distributed. The normally distributed variables were compared between the groups using the Independent Samples t-test. For the categorical variables, Pearson's chi-square and Fisher's exact tests were used. The continuous variables were expressed as mean−standard deviation, and the categorical variables were expressed as the number and percentage. Logistic regression analyses were used to evaluate the effect of variables on the odds of smoking on chest radiography. P value <0.05 was considered statistically significant.

Table 1. Sociodemographic characteristics of participants

	n (%)
Gender	
Woman	1.075 (53.40)
Man	940 (46.60)
Average age	
Woman	45.89±14.45
Man	46.20±17.54
Age groups	
18-30	385 (19.10)
31-40	432 (21.40)
41-50	455 (22.60)
51-60	342 (17.00)
61-70	234 (11.60)
>70	167 (8.30)
Place of residence	
Provincial center	1.000 (49.60)
District	804 (39.90)
Village	211 (10.50)
Occupation	
White-collar	144 (7.10)
Farmers / workers	492 (24.40)
Retired	340 (16.90)
Housewife / unemployed	1.039 (51.60)
BMI (kg/m^2)	
<18.5	23 (1.20)
18.5-24.9	432 (21.40)
25.0-29.9	633 (31.40)
30.0-39.9	444 (22.00)
≥40.0	483 (24.00)
Alcohol	
User	20 (1.00)
Not User	1.995 (99.00)

BMI: body mass index.

Results

The sociodemographic characteristics of the participants are presented in Table 1. Of the participants, 1075 (53.40%) were female and 940 (46.60%) were male. The mean age was 45.89±14.45 for women and 46.20±17.54 for men. Most cases (63.10%) were aged less than 50 years. Of the participants, 1000 (49.60%) lived in the city center, 804 (39.90%) lived in the districts, and 211 (10.50%) lived in the villages. Moreover, 340 (16.90%) were retired, 492 (24.40%) were farmers and/or workers, 144 (7.10%) were white-collar employees, and 1039 (51.60%) were housewife or unemployed. While 580 (28.80%) were cigarette smokers, 20 (1%) consumed on alcohol. The mean BMI of the participants was 27.7±5.0 kg/m^2. In addition, 23 participants (1.20%) had BMI<18.5 kg/m^2, 432 (21.40%) had BMI 18.5–24.9 kg/m^2, 633 (31.40%) had BMI 25.0–29.9 kg/m^2, 444 (22.00%) had BMI 30.0–39.9 kg/m^2, and 483 (24.00%) had BMI>40.0 kg/m^2.

The results of posteroanterior (PA) chest radiographs of the participants are summarized in Table 2. According to this, while 249 participants (12.36%) had pathologic findings on chest radiograph, 1.766 (87.64%) had normal findings on chest radiograph. The pathological findings were hilar fullness (n=50, 2.48%), emphysematous appearance (n=48, 2.38%), nodule (n=29, 1.44%), increased reticulonodular density (n=26, 1.29%), increased bronchovascular branching (n=9, 0.44%), bronchiectasis (n=4, 0.20%), and other changes (n=83, 4.12%). Other pathologic findings were blunting of the left sinus, eventration of the left hemidiaphragm, undulating of the right hemidiaphragm, bronchiectasis, fibrotic changes, fat pad in the right paracardiac region, and blunting of the left costodiaphragmatic sinus. Rare pathologic findings (<0.1%) were prominent pulmonary cone, undulating of the left hemidiaphragm, mediastinal expansion, thickening of the right minor fissure, ground-glass opacity of the parenchyma, skeletal dysplasia, cavitary mass, mass, air cyst, and hiatus hernia. Pathological chest radiography was detected in 13.60% participants (79) among the smokers (Table 2). Of these, 2.20% (13) had hilar fullness, 4.30% (25) had emphysematous appearance, 2.20% (13) had nodule, 1.90% (11) had increased reticulonodular density, 0.30% (2) had increased bronchovascular branching, 0.50% (3) had bronchiectasis, and 2.10% (12) had other changes.

The incidence of emphysematous appearance was 2.77 times higher in the smokers than in the non-smokers (p<0.05, odds ratio 2.77, CI=1.56–4.91).

The incidence of pathological chest radiography by occupation was 21.80% (74) in the retired participants, 11.40% (56) in the workers or farmers, 9.60% (100) in the unemployed people or housewives, and 4.90% (7) in the officers. The incidence of pathological chest radiography by occupation was statistically significant (p<0.001) (Table 3).

When we evaluated the results of posteroanterior (PA) chest

Table 2. Comparison of chest radiographic findings between smokers and non-smokers

n (%)	Smoker (n=580) (28.80%)	Non-smoker (n=1.435) (71.20%)	p	Odds-ratio (95 CI%)
Normal 1766 (87.64)	501 (86.40)	1265 (88.20)	0.109	0.85 (0.64-1.13)
Pathologic 249 (12.36)	79 (13.60)	170 (11.80)	0.295	1.17 (0.88-1.56)
Hiler fullness 50 (2.48)	13 (2.20)	37 (2.60)	0.753	0.87 (0.46-1.64)
Emphysematous appearance 48 (2.38)	25 (4.30)	23 (1.60)	<0.05*	2.77 (1.56-4.91)
Nodule 29 (1.44)	13 (2.20)	16 (1.10)	0.063	2.03 (0.97-4.25)
Reticulonodular density 26 (1.29)	11 (1.90)	15 (1.00)	0.131	1.83 (0.84-4.01)
Bronchovascular branching 9 (0.44)	2 (0.30)	7 (0.50)	0.864	0.71 (0.15-3.41)
Bronchiectasis 4 (0.20)	3 (0.50)	1 (0.10)	0.075	7.46 (0.77-71.83)
Other changes 83 (4.12)	12 (2.10)	71 (4.90)	<0.05*	0.41 (0.22-0.75)

*Statistically significant.

Table 3. Chest radiographic findings according to age, BMI and occupation

	Normal chest radiography n (%)	Pathologic chest radiography n (%)	p
Age	44.73±14.89	55.82±17.54	<0.001*
≤40 age	765 (93.50)	53 (6.50)	<0.001*
>40 age	1.013 (84.60)	184 (15.40)	
BMI (kg/m^2)	27.71±4.99	27.94±5.15	0.541
<18.5	20 (87.00)	3 (13.00)	
18.5-24.9	383 (88.79)	49 (11.30)	
25.0-29.9	551 (87.00)	82 (13.00)	0.176
30.0-39.9	384 (86.50)	60 (13.50)	
≥40.0	440 (91.10)	43 (8.90)	
Occupation			
White-collar	137 (95.10)	7 (4.90)	
Farmers/workers	436 (88.60)	56 (11.40)	<0.001*
Retired	266 (78.20)	74 (21.80)	
Housewife/unemployed	939 (90.40)	100 (9.60)	

BMI: body mass index; * Statistically significant.

radiographs according to BMI, the incidence of pathological chest radiography was 13.50% in the obese group and 11.30% in the normal weight group. The difference between them was not statistically significant (p=0.176) (Table 3).

When the results were analyzed according to age, 59.40% (1.197) of the participants were aged more than 40 years. While chest X-ray was normal in 93.50% of the individuals aged less than 40 years, this rate decreased to 84.60% in the individuals aged more than 40 years. The difference between them was statistically significant (p<0.001). The incidence of pathological chest radiography was 2.62 times higher in the individuals aged more than 40 years (p<0.001, odds ratio 2.62, CI=1.90–3.61) (Table 3).

Discussion

In our study, which was a descriptive cross-sectional study conducted in 2015 individuals in Konya, the incidence of pathological chest radiography was increased in the smokers, in the individuals aged more than 40 years, and in the retired people and workers.

Posteroanterior (PA) chest radiograph is the most common, the most practical, and usually the first-line imaging method in imaging the chest cavity, chest wall, diaphragm, pleura, lung parenchyma, and mediastinum.[2] Chest X-ray screening was performed in London in the 1960s and in the US and Czechoslovakia in the 1970s.[11-14] In these screenings, the group at high risk for lung cancer was included as the screening group and the group at low risk for lung cancer was included as the control group. The effects of chest X-rays taken at regular intervals and chest X-rays taken at rare intervals on the mortality were investigated. In addition to posteroanterior (PA) chest radiograph, sputum cytology was performed in studies conducted in the USA and Czechoslovakia. Most cases of lung cancers were caught by posteroanterior (PA) chest radiograph, and sputum cytology did not contribute to it. The common finding in these studies is that the cancers are caught in the early stages in the screening groups according to the control groups. However, it has been found that mortality and advanced-stage cancers were similar in both groups. Despite some limitations, these studies showed the effectiveness of screening with posteroanterior (PA) chest radiograph.[15] In the Prostate, Lung, Colorectal and Ovarian Cancer Screening Trial that has recently been performed, posteroanterior (PA) chest radiograph was conducted four times (once a year) in 67.000 people aged 55–74 years who had a smoking history of at least 20 pack years. In the same study, 77.000 people were included as control group and 126 people (2.1%) were found to have cancer. Of these, 44% had stage 1 non-small-cell lung cancer. There was no significant difference in the incidence of cancer between the screening and control groups.[16] In the analysis made in the following years, both groups were compared in terms of mortality; however, but there was no significant difference between them.[17]

In the Early Lung Cancer Action Project (ELCAP) that was performed by Henschke et al. in the USA, 1.000 people aged more than 60 years who had a history of more than 10 pack years of smoking were included. In the first screening performed with low-dose computed tomography, non-calcified nodule was detected in 23% of the participants, and 27

(2.7%) of them were found to have cancer. Moreover, 26 of these were reported to be resectable (23 cases of stage 1). Only 7 of the 27 cancer cases detected in the first screening could be seen on posteroanterior (PA) chest radiograph.[18] In our study, emphysematous appearance, which is an important radiological finding of the chronic obstructive pulmonary disease, was found to be higher in smokers than in non-smokers. Despite of the percent of nodule existence being two times higher in smokers than in non-smokers, the difference was not statistically significant because of the small sample size. Of the participants included in our study, 59.40% were aged more than 40 years. While chest X-ray was normal in 93.50% of the individuals aged less than 40 years, this rate decreased to 84.60% in the individuals aged more than 40 years. The incidence of pathological chest radiography was 2.62 times higher in the individuals aged more than 40 years

In a study involving marble factory workers, the workers were divided into four groups according to the following criteria: block cutting, polishing, tile cutting, and office worker. Pathological findings on posteroanterior (PA) chest radiograph were higher in the first three groups than in the office group; however, the difference between them was not statistically significant. However, chest X-ray pathologies were more frequent in those employed for more than 10 years in the marble factory. In this study, it was concluded that the intensity and duration of dust exposure in the marble factory workers were associated with respiratory symptoms and chest X-ray findings.[19] In our study, the incidence of pathological lung finding was higher than in the workers and retired people than in the officers or housewives/unemployed people.

It is possible to assess the efficacy of a medical intervention with the life span and quality of life provided by that intervention. The cost effectiveness of an intervention is defined as the cost required to improve the years of quality living by that intervention.[4] According to the recent studies, low-dose computed tomography is cost effective for lung screening in high-risk group, and it was reported that cost effectiveness can increase by an additional 20%–45% if smoking cessation programs are implemented.[20]

In conclusion, the incidence of pathological lung findings in individuals aged more than 40 years and in workers and retired people and the incidence of emphysematous appearance in the smokers significantly increased.

Disclosures

Ethics Committee Approval: The study was approved by the Local Ethics Committee.

Peer-review: Externally peer-reviewed.

Conflict of Interest: None declared.

Authorship contributions: Concept – E.A., I.T.; Design – E.A., S.P.; Supervision – E.A., Z.O.I.; Materials – E.A.; Data collection &/or processing – E.A., Z.O.I.; Literature search – E.A., H.K.; Writing – E.A., Z.O.I.; Critical review – E.A., Z.O.I.

References

1. Eryılmaz MA, Baktık S, Ay S, Karahan Ö, Tolu İ, Okuş A, et al. Karın Ultrasonografi Taraması ile Tespit Edilebilen Hastalıkların Sıklıkları. Genel Tıp Dergisi 2014;30:19–22.
2. Çağatay Çimşit N, Rabia E. Posteroanterior Akciğer Grafisi: Optimal Teknik Ve Yorumlama. Bulletin of Thoracic Surgery 2013;4:122–6.
3. Wall BF, Hart D. Revised radiation doses for typical X-ray examinations. Report on a recent review of doses to patients from medical X-ray examinations in the UK by NRPB. National Radiological Protection Board. Br J Radiol 1997;70:437–9. [CrossRef]
4. Başaran Demirkazık F. Akciğer Kanserinde Bilgisayarlı Tomografi ile Tarama: Güncel Bilgiler. Trd Sem 2014;2:290–303.
5. Henschke CI, Yankelevitz DF, Smith JP, Miettinen OS; ELCAP Group. Screening for lung cancer: the early lung cancer action approach. Lung Cancer 2002;35:143–8. [CrossRef]
6. International Early Lung Cancer Action Program Investigators, Henschke CI, Yankelevitz DF, Libby DM, Pasmantier MW, Smith JP, Miettinen OS. Survival of patients with stage I lung cancer detected on CT screening. N Engl J Med 2006;355:1763–71.
7. Aberle DR, Gamsu G, Henschke CI, Naidich DP, Swensen SJ. A consensus statement of the Society of Thoracic Radiology: screening for lung cancer with helical computed tomography. J Thorac Imaging 2001;16:65–8. [CrossRef]
8. Fontana RS, Sanderson DR, Woolner LB, Taylor WF, Miller WE, Muhm JR, et al. Screening for lung cancer. A critique of the Mayo Lung Project. Cancer 1991;67:1155–64. [CrossRef]
9. World Health Organization. Obesity: preventing amd managing the global epidemic. Available at: http://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/. Accessed Nov 28, 2017.
10. Pekcan G. Definition and assessment of obesity. III. International congress of nutrition and dietetics, 12-15 April 2000 Congress proceeding. Ankara: Hacettepe University; 2000. p. 93–104.
11. Flehinger BJ, Melamed MR, Zaman MB, Heelan RT, Perchick WB, Martini N. Early lung cancer detection: results of the initial (prevalence) radiologic and cytologic screening in the Memorial Sloan-Kettering study. Am Rev Respir Dis 1984;130:555–60.
12. Fontana RS, Sanderson DR, Taylor WF, Woolner LB, Miller WE, Muhm JR, et al. Early lung cancer detection: results of the initial (prevalence) radiologic and cytologic screening in the Mayo Clinic study. Am Rev Respir Dis 1984;130:561–5.
13. Tockman MS. Survival and mortality from lung cancer in a screened population. The Johns Hopkins Study. Chest

1986;89:324–5. [CrossRef]
14. Kubik A, Parkin DM, Khlat M, Erban J, Polak J, Adamec M. Lack of benefit from semi-annual screening for cancer of the lung: follow-up report of a randomized controlled trial on a population of high-risk males in Czechoslovakia. Int J Cancer 1990;45:26–33. [CrossRef]
15. Bach PB, Niewoehner DE, Black WC; American College of Chest Physicians. Screening for lung cancer: the guidelines. Chest 2003;123:83S–8. [CrossRef]
16. Oken MM, Marcus PM, Hu P, Beck TM, Hocking W, Kvale PA, et al; PLCO Project Team. Baseline chest radiograph for lung cancer detection in the randomized Prostate, Lung, Colorectal and Ovarian Cancer Screening Trial. J Natl Cancer Inst 2005;97:1832–9. [CrossRef]
17. National Lung Screening Trial Research Team, Aberle DR, Adams AM, Berg CD, Black WC, Clapp JD, Fagerstrom RM, et al. Reduced lung-cancer mortality with low-dose computed tomographic screening. N Engl J Med 2011;365:395–409.
18. Henschke CI, McCauley DI, Yankelevitz DF, Naidich DP, McGuinness G, Miettinen OS, et al. Early Lung Cancer Action Project: overall design and findings from baseline screening. Lancet 1999;354:99–105. [CrossRef]
19. Abakay Ö, Önder H, Selimoğlu Şen H, Abakay A, Kaya H, et al. Mermer fabrikası işçilerinde solunum fonksiyonları ve radyolojik bulgular. Journal of Clinical and Experimental Investigations 2012;3:251–4.
20. Villanti AC, Jiang Y, Abrams DB, Pyenson BS. A cost-utility analysis of lung cancer screening and the additional benefits of incorporating smoking cessation interventions. PLoS One 2013;8:e71379. [CrossRef]