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KLİNİK ÇALIŞMA
RESEARCH ARTICLE

Look closer to welders' lung

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SUMMARY

Look closer to welders' lung

Introduction: *Welding produces miscellaneous gases and particles that has various impact on respiratory system and long term exposure may result "welders'lung". The aim of this study is to describe the radiological findings of welders' and make an awereness for welders radilogical findings.*

Materials and Methods: *The clinical and radiological findings of welders' who had hospital applications with respiratory symptoms between January 2010-January 2017 were evaluated retrospectively.*

Results: *A total of 16 male welders with mean age 37 ± 8 years had the mean duration of welding occupation 12 ± 7 years. The most common symptoms were coughing (87%), sputum production (63%) and dyspnoea (63%).Thirteen welders were working in shipyards and 3 in construction business and other workplaces. Three (19%) patients had rhonchi on physical examination and these patients had decreased FEV_1/FVC values below 70% on spirometry. Poorly-defined centrilobular micronodules that were not clearly visible on chest radiographs observed on thorax high resolution computed tomography. Bronchoscopy was performed to 7 patients. Iron-positive pigment granules and ferruginous bodies were revealed in 3 patients' bronchoalveolar lavage.*

Conclusion: *Welders' chest X-ray deserve a closer look. In pulmonary radiology, there may be radiographical findings ranging from small ill defined nodules to groundglass opacites. Physcians should look more careful to welders' chest X-ray and incase of suspicious findings best can be detected on high HRCT. An awareness for the radiological findings will also reduce interventional procedures in these patients hereby, occupational history must be included in daily practice of physicians.*

Key words: *Welding; Siderosis; Radiology; Pneumoconiosis; Occupational exposure;*

ÖZET

Kaynakçıların akciğerlerine daha dikkatli bakalım

Giriş: *Kaynak işlemi, ürettiği gaz ve partiküller ile solunum sistemi üzerinde etkiler yaratır ve uzun dönem maruziyet ile "kaynakçı akciğeri" oluşabilir. Bu çalışmanın amacı, kaynakçıların radyolojik bulgularını tanımlamak ve bu konuda farkındalık yaratmaktır.*

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Materyal ve Metod: *Ocak 2010-Ocak 2017 tarihleri arasında solunumsal yakınmalar ile polikliniğe başvuran kaynakçıların klinik, radyolojik özellikleri retrospektif olarak incelendi.*

Bulgular: *Ortalama yaşları 37 ± 8 toplam 16 erkek kaynakçının ortalama kaynakçılık süreleri 12 ± 7 yıldı. En sık rastlanan semptomlar öksürük (%87), balgam çıkarma (%63) ve dispne (%63) idi. On üç kaynakçı tersanede, üçü inşaat ve diğer işlerde çalışıyordu. Üç hastada (%19) fizik muayene ronküs saptandı, bu hastalarda spirometride FEV_1/FVC değerleri %70'in altına saptandı. Yüksek çözünürlüklü toraks bilgisayarlı tomografide (YRBT), akciğer filminde net olarak görülemeyen, silik sınırlı sentrilobüler mikronodüller görüldü. Yedi hastaya bronkoskopi yapıldı. Demir pozitif pigment granülleri ve ferriginöz cisimler 3 hastanın bronkoalveolar lavaj sıvısında saptandı.*

Sonuç: *Kaynakçıların akciğer grafileri daha yakından incelenmeyi hak etmektedir. Akciğer grafisinde, küçük sınırları net olmayan milimetrik nodüllerden, buzlu cam alanlarına kadar değişen radyolojik bulgular olabilir. Kaynakçıların akciğer filmlerine daha dikkatli bakılmalı ve şüpheli olgularda YRBT ile değerlendirme yapılmalıdır. Radyolojik bulgular için oluşacak farkındalık ile bu hastalarda girişimsel işlemler azaltacaktır. Buradan da yola çıkarak mesleki öykü hekimlerin günlük pratiğine dahil edilmelidir.*

Anahtar kelimeler: *Kaynak; Siderozis; Radyoloji; Pnömokonyoz; Mesleki maruziyet*

INTRODUCTION

Welding is a method of joining metals and similar alloys together, consequently it is widely used in industry. Welding produces miscellaneous gases and particles that has various impact on respiratory system. Long-term exposure to welding fumes may result "welders'lung" (1,2).

Welders' lung is a result of complex effects of welding fumes which together affect the airways and parenchyma together, et all levels of the respiratory tract (2,3). Siderosis develops by deposition of iron oxide in alveolar macrophages and interstitium which result in prolonged exposure to welding fumes (2,4). Respiratory complaints such as chronic cough, dyspnoea, secretions increase in welders (3).

The most common types of pneumoconiosis are silicosis, coal worker pneumoconiosis, and asbestosis whereas, berylliosis, siderosis, stannosis, and baritosis are more rare that are also known as nonfibrotic forms of pneumoconiosis. Siderosis involves poorly defined nodules on chest X-ray, and centrilobular nodules which have blurred borders or ground-glass opacities on computed tomography (5,6).

In daily life practice occupational exposure is occationaly ignored in these poorly defined nodules.

The aim of the study is to describe the radiological findings of welders' that are not prominent on chest X-ray and make an awereness for welders radilogical findings.

MATERIALS and METHODS

This is a retrospective study performed in a tertiary chest disease hospital between January 2010- January 2017. The clinical and radiological findings of welders' who had hospital applications with respiratory symptoms were evaluated.

The study was approved by the local Ethics Committee. Ethical approval was provided in accordance with the Declaration of Helsinki. The informed consent was not obtained due to the retrospective nature of the study.

Patients symptoms, exposure time, smoking status, radiological findings, spirometry were recorded.

High resolution computed tomography (HRCT) was performed during inspiration with 1 mm collimation without intravenous contrast medium.

Spirometry was performed with (ZAN 300)

Bronchoalveolar lavage (BAL) was performed during bronchoscopy with 120-200 cc saline. Cell count; neutrophils, alveolar macrophages, eosinophilia, lymphocytosis, CD4/CD8 ratio (he ratio of T helper cells to cytotoxic T cells), presence of ferriginous body in BAL were recorded.

Statistical Analysis

The SPSS portable 20.0 package program (IBM Corporation, Armonk, NY, USA) was used for analysis. The mean ± standard deviation was used for parametric continuous variables. Count and percentage were used when applicable.

RESULTS

A total of 16 male welders were included in the study. The mean age was 37 ± 8 years and the mean duration of welding occupation was 12 ± 7 years. Twelve (75%) patients were smokers. The mean smoking pack year was 14 ± 8. The most common symptoms were cough-

ing (87%), sputum production (63%) and dyspnoea (63%). Table 1 shows the patients demographics.

The distribution of patients according to their work is; 13 welders were working in shipyards and 3 in construction business and other workplaces. Patients had used manual metal arc welding and gas metal arc welding.

Table 1. The demographics of welder patients (n= 16)

Age (years)*	37 ± 7
Exposure time (year)*	12 ± 7
Smokin (pack/year)*	14 ± 8
Symptoms, n (%)	
Cough	14 (87)
Sputum	10 (63)
Dyspnoea	10 (63)
Spirometry*	
FVC (%)	96.8 ± 17.5
FEV_1 (%)	86.5 ± 24
FEV_1/FVC (%)	81 ± 17.5
DLCO	109 ± 22
Micronodules on chest X-ray	8 (50)
HRCT findings, n (%)	
Centrilobular Micronodules	16 (100)
Reticulonodular	5 (31)
Groundglass Areas	2 (6)

* Mean ± SD, HRCT: High resolution computed tomography.

Three (29%) patients had rhonchi on physical examination and these patients had decreased FEV_1/FVC values below 70% on pulmonary function tests. The rest of the patients had pulmonary function tests within the normal limits.

According to the patients' own expressions they did not regularly use masks during welding. They were working in doors, even in small spaces and sometimes outside.

Radiological Findings

There were lesions compatible with pneumoconiosis (p or q) in the chest X-ray of 8 (50%) welders.

HRCT was present in all of the patients. Poorly-defined centrilobular micronodules that were not clearly visible on chest radiographs observed on thorax HRCT. Sixteen patients had centrilobular micronodules, five patients also had retikulonoduler pattern and 2 had groundglass areas. Figure 1 shows the poorly-defined centrilobular micronodules and ground glass areas on chest X-ray and HCRT of welders.

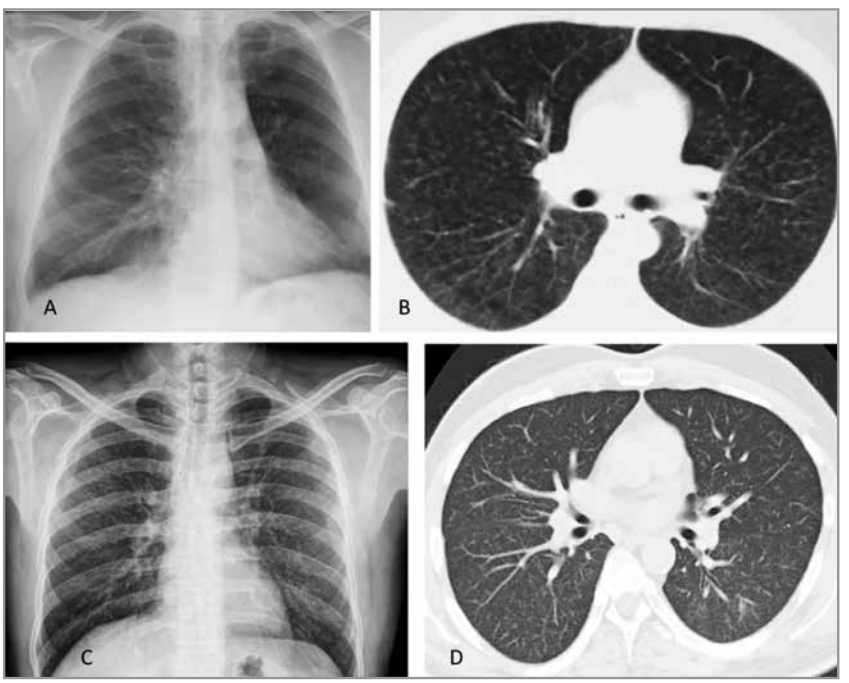

Figure 1. Chest X-ray and HRCT of welders showing centrilobular micronodules and ground glass areas. A, B: Case 1 chest X-ray and HRCT, C, D: Case 2 chest X-ray and HRCT.

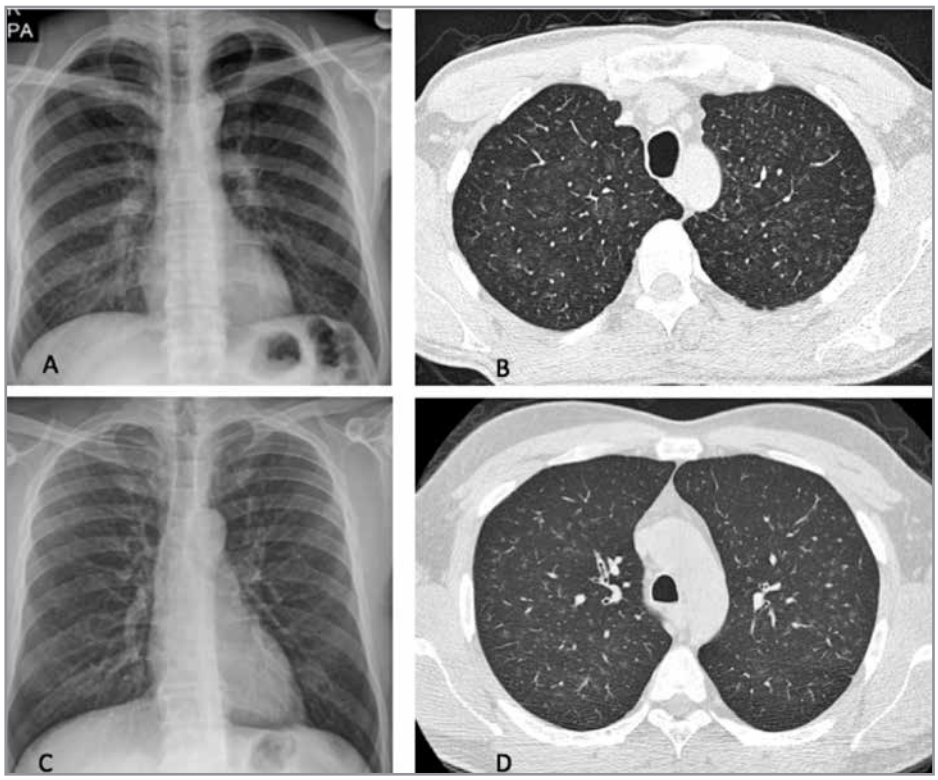

Figure 2. Chest X-ray and HRCT of 2 welders showing ground glass areas. A, B: Case 1 chest X-ray and HRCT, C, D: Case 2 chest X-ray and HRCT.

Figure 2 demonstrates chest X-ray and HRCT findings of 2 welders showing ground glass areas.

Bronchoscopic Findings

Fiberoptic bronchoscopy was performed to 7 (44%) patients. BAL was evaluated in 6 patients; 5 had mixed alveolitis and one had lymphocytic alveolitis. Iron-positive pigment granules and ferruginous bodies were revealed in 3 patients' BAL. There was no endobronchial abnormalities were observed in bronchoscopy. Table 2 shows the BAL chacteristics of the patients.

DISCUSSION

Welders' chest X-ray deserve a closer look. Welders may have less noticeable radiological findings than other pneumoconiosis (4,5). In pulmonary radiology, there may be radiographical findings ranging from small indistinct millimetric nodules to groundglass opacites (5,6).

Welding fumes can create metal fume, siderosis and chemical pneumonitis in the respiratory system (4,7). In formation of the welders' lungs, the content of the source of smoke, the working environment (closed area, ventilation status, other exposures in the workplace), personal factors (use of protective materials, smoking) play important role (7,8). In this study the most of the welders were working in shipyard, so they were also exposed to processes such as paint, asbestos and scraper.

The main component of welding dust is iron–oxide that causes "welders' siderosis". Welders' lung is a result of mixed inhalant exposures that effect airways and parenchyma together. Long-term exposure may result welders' lung (benign pneumoconiosis/siderosis) (7-9). Siderozis has widespread bilateral poorly defined centrilobular nodules and branched small linear opacities but not fibrosis. Fibrosis is expected if silica is also present with iron exposure or as a result of high exposure to welding fumes or gases (10-12).

Siderosis (silver polisher's lung) is a non-fibrogenic form of pneumoconiosis as a result of exposure of iron particles which is also called as "benign pneumoconiosis". Iron and steel rolling mills, steel grinding, elec-

Table 2. The BAL characteristics of the welder patients

Case	BAL Lymphocyte %	BAL Neutrophil %	BAL Eosinophil %	CD4/CD8	Ferriginous body
1	25	14	1		
2	25	14	2		
3					1
4	17	8	3	0,78	1
5	18	13	4	0,74	1
6	15	20	7	0.98	
7	12	30	12	0,88	

BAL: Bronchoalveolar lavage, CD4/CD8: The ratio of T helper cells to cytotoxic T cells.

tric arc welding, silver polishing, mining and crushing iron ores can cause this kind of pneumoconiosis (5,6,13,14).

Welders' lung may have small millimetric nodules, groundglass areas, and late-onset radiological findings such as fibrosis and honeycombing (8,9). Pulmonary lesions often seem to be confused with hypersensitivity pneumonia and other interstitial lung diseases. If occupational history is ignored, advanced interventional procedures may be required for diffrential diagnosis. Therefore we emphasize the importance of occupational history one again as early recognition radiological features will reduce invasive interventional procedures in these patients. Tutkun et al. mentioned that HRCT rather than CXR to evaluate parenchymal changes much better in early diagnosis of welders (14). In the present study bronchoscopy was performed in 7 patients. Bronchoscopies and BAL (no transbronchial biopsies performed) had been made to exclude other interstitial lung diseases in this period when our awareness was still developing.

Moa L et al. followed the welders with welders' pneumoconiosis by time and reported that small round opacities get, improved after a time (2-10 years), supporting the diagnosis of siderosis (7). In an animal study of Sung et al. they reported that the pulmonary fibrozis due to welding fumes would be preventable when the exposure is moderate (4).

Temel et al. reported occupational asthma (22%) among welders working in a by cycle factory (15). Tunç et al. reported chronic bronchitis (21.9%) among welders working in sugar factory (11). This can be explained by the contents of the electrodes used during the welding process, the composition of the welded surfaces, their dyes and the exposure to welding gases.In the present study coughing, sputum and dyspnoea were present (63-87%) of the patients. One issue that is discussed in welders is that there are more symptoms such as coughing and sputum in smoker welders. Emphysema may develop due to cigarette smoke or welding fumes, but differential diagnosis is not easy (11-13). In this study 12 (75%) patients were smokers with mean smoking pack year 14 ± 8. In our study we observed mainly reserved FEV_1, FEV_1/FVC, DLCO, beside that 19% of the patients had rhonchi on physical examination and decreased FEV_1/FVC values below 70%.

Welding also creates a risk for lung cancer (16-18). Ambroise et al. reported in a meta-analysis that 26% lung cancer risk for welders (17). At this point it should also be noted that exposure to other carcinogenic agents such as smoking and asbestos.

One of the limitations of our study is that this is a retrospective study, in addition, the study covered welders applied to outpatient clinics not in a certain workplace of welders. Furthermore, the follow up of the patients are missing, there is no control group. On the other hand, a strength of our study is that it was conducted to make an awereness to welders lung and decrease the invasive procedures for these patients.

In conclusion radiological findings on chest X-ray is not rich in welders' lung, chest physcians should look more careful to welders' chest X-ray incase of suspicious findings even at best can be detected on HRCT. Good awareness for the radiological features will reduce interventional procedures in these patients.

Chest X-rays of welders should be evaluated carefully for welders that may not be rich in radiological findings, therefore suspicious cases can be evaluated well in HRCT. Considering the importance of occupational exposure, history must be included in daily practice of chest physicians.

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