



## Case report

## Massive hemoptysis due to welding fumes

Oğuz Uzun\*, Ozgur Ince, Veli Bakalov, Tibel Tuna

Faculty of Medicine, Department of Pulmonary Medicine, Ondokuz Mayıs University, Samsun, Turkey

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## ABSTRACT

Many pulmonary problems such as lung cancer, occupational asthma, and pneumoconiosis have been described due to welding in the literature until now. This is the first case report of alveolar hemorrhage due to welding fumes presented with massive hemoptysis. We report a rare case of massive hemoptysis associated with welder's lung, with a discussion based on a review of the literature.

**Established facts:** Many pulmonary diseases such as lung cancer, occupational asthma, and pneumoconiosis have been attributed welding fumes in the literature. Alveolar hemorrhage due to welding fumes has never defined before.

**Novel insights:** We herein report a case of alveolar hemorrhage presented with massive hemoptysis due to welding fumes.

Clinicians should be aware of such rare but serious clinical picture which can occur in welding workers. Palliative measures and bronchoscopic Ankaferd Blood Stopper® application may help to stop bleeding.

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## 1. Introduction

Welding is a process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the workpieces and adding a filler material to form a pool of molten material that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. Although many pulmonary and non-pulmonary health hazards of welding have been described in the literature,<sup>1</sup> this is the first case report of alveolar hemorrhage due to welding fumes.

## 2. Case presentation

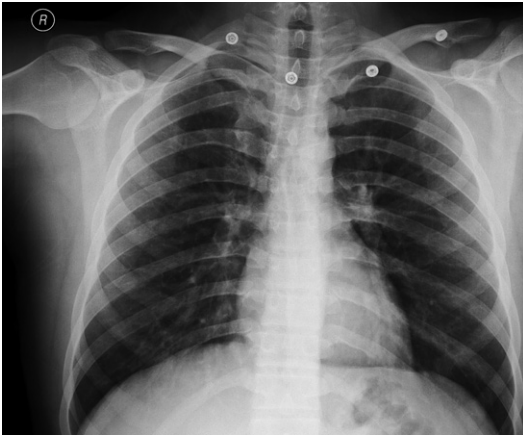
A 40 years-old welder presented with sudden episode of massive hemoptysis without hemodynamic failure. Hemoptysis, in an amount of 4 cups, occurred suddenly after 8 h of welding in time of a few hours. The patient described the amount of bleeding as 1 L. He denied dyspnea, sputum production, fever, chest pain and any contact with tuberculous patients. Patient further reported

a monthly headache with 6–7 days periods which increased especially after spending a long time with welding.

He had no history of drug use, systemic or pulmonary disease or coagulopathy, and reported no alcohol use. There was no family history of coagulopathy, or tuberculosis. He had a smoking history of 2 pack/years, and has been working as a welder for 8 years. On physical examination, he was anxious and mildly dyspneic with a pulse rate of 110/min, respiratory rate of 24/min and a blood pressure of 130/80 mmHg and oxygen saturation 95% on room air. There was no clubbing or lymphadenopathy. Oral or genital aphthous ulcers were not detected in physical examination or presented in past medical history. Bilateral hyperemic conjunctivas and basal crackles on auscultation were remarkable on physical examination. Rest of the physical examination was unremarkable. Although there was nothing then mild diffuse ground-glass opacity on his chest radiography, high resolution computed tomography scans revealed diffuse poorly defined centrilobular nodules with patchy ground-glass opacity predominantly on the lower lobes and right side (Figs. 1 and 2). Laboratory investigation showed a hemoglobin level of 12 gr/dL, a WBC count of  $10.4 \times 10^3/\mu\text{L}$  (92% neutrophils, 5% lymphocytes), haematocrit of 0.40, a platelet count of  $162 \times 10^3/\mu\text{L}$ . Prothrombin time and international normalized ratio were within normal limits. Sedimentation was 60 mm/h. His routine biochemical investigations including renal and liver functions, and urine analysis were all normal. Atypical cells in peripheral smear were not detected, platelets were aggregated. Antinuclear antibody, rheumatoid factor and anti-double-strand DNA, and anti-neutrophil cytoplasmic antibodies were all

\* Corresponding author. 19 Mayıs Üniversitesi, Tıp Fak, Gögüs Hst. AD, Atakum-Samsun 55139, Turkey. Tel.: +90 362 3121919; fax: +90 362 4576041.

E-mail addresses: [oguzuzun67@yahoo.com.tr](mailto:oguzuzun67@yahoo.com.tr) (O. Uzun), [dr.ozgurince@hotmail.com](mailto:dr.ozgurince@hotmail.com) (O. Ince), [velibakalov@gmail.com](mailto:velibakalov@gmail.com) (V. Bakalov), [ttuna@omu.edu.tr](mailto:ttuna@omu.edu.tr) (T. Tuna).



**Fig. 1.** Posteroanterior chest radiography of the patient at presentation showed mild diffuse ground-glass opacity.

negative. Fiberoptic bronchoscopy revealed active bleeding bilaterally from the lower lobes and right middle lobe, with major bleeding on the right side. We made iced saline and Ankaferd Blood Stopper<sup>®</sup> (2 mL) lavage to the both of the lower lobes from the bronchoscope probe. Bleeding was decreased after this procedure. Hemoptysis diminished day by day, and disappeared on sixth day after acceptance. No other specific treatment for hemoptysis was used. Control bronchoscopy on fifteenth day of presentation was completely normal without any potential cause of bleeding such as intrabronchial mass or foreign body. Culture of bronchoalveolar washing was negative for fungal and acid-fast bacteria. The patient discharged on tenth hospital day without hemoptysis. There has been no recurrence for two years.

### 3. Discussion

Many different energy sources can be used for welding, including a gas flame, an electric arc, a laser, an electron beam,



**Fig. 2.** High resolution computed tomography scan revealed diffuse poorly defined centrilobular nodules with patchy ground-glass opacity predominantly on the lower lobes and right side.

carbon arc, gas, gas metal, plasma arc and ultrasound, however electric arc welding has been predominant method in industry since its first introduction in 1940.<sup>1</sup> Temperatures can reach as high as 12,000 °C in the arc and heat both the base metal piece and a filler metal coming from a consumable electrode.<sup>2</sup> The adverse health effects of welding comes from chemical, physical, and radiation hazards. Common chemical hazards include metal particulates and gases. However, the fume and noxious gases formed during the welding process are considered to be the most harmful exposure in comparison with the other byproducts of welding. Significant levels of different toxic gases (i.e., carbon monoxide, ozone, nitrogen oxides) and metal fumes (i.e. aluminum, barium, cadmium, chromium, copper, iron, magnesium, nickel and tin) may be formed during common arc welding processes.<sup>3</sup>

Many pulmonary problems, usually attributed to these toxic fumes and gases, have been described in the literature until now. Lung cancer, occupational asthma, rhinitis, cough, dyspnea, obstructive and restrictive lung disease, pneumoconiosis, lung function impairment and pneumonia are among the most frequent respiratory problems due to welding process.<sup>4</sup> In addition, welding workers suffer from non-pulmonary health problems such as eye irritation, photokeratitis, cataract, skin irritation, erythema, pterygium, non-melanocytic skin cancer, malignant melanoma, reduced sperm count, motility and infertility.<sup>1</sup>

There are a lot of pulmonary and systemic diseases reasons of hemoptysis,<sup>5</sup> however, to our knowledge, welding has not been listed as an etiology in any study. Alveolar hemorrhage due to welding fumes has never been defined before. We attributed alveolar hemorrhage to welding fumes in our patient in three ways: 1) We exclude all possible reasons of the pulmonary hemorrhage (i.e. Behcet's Syndrome and other vasculitides, tuberculosis, benign and malign tumors, acute and chronic bronchitis, hemorrhagic diatheses, systemic diseases) clinically, radiologically and with serological markers; 2) The patient was working as welder for a long time and he has been suffering diseases such as chronic headache and chronic conjunctivitis demonstrating chronic welding fumes exposure; 3) Patient's alveolar hemorrhage was reduced after avoidance welding fumes in a few days without any specific treatment, and no relapse was observed in 2-year follow-up period.

The pathogenesis of hazardous effects of welding fumes has not been studied extensively before. However, many pulmonary effects of welding fumes has been connected to carcinogenic, fibrinogenic and irritative effects of metal constituents such as barium, cadmium, chromium, zinc and nickel, etc. of welding fumes. In animal studies,<sup>6,7</sup> it has been shown that welding fumes especially manuel metal arc welding using a stainless steel electrode cause an elevated toxic lung response by means of enhanced macrophage production of highly reactive oxygen radicals and inflammatory cytokines. We think that welding fumes may produce an inflammatory and irritative response resulting with bronchial epithelial damage finally causing hemoptysis and even alveolar hemorrhage as in our patient.

This case shows that welding fumes can hazard alveolar epithelium and vasculature and lead to massive hemorrhage. Thus, clinicians should be aware of such rare but serious clinical picture which can occur in welding workers. Therefore, welders should take personal protection measures including, mask and safety goggles, and the process should be performed in well-ventilated areas, and use local-exhaust ventilation to remove fumes and gases at their source in still air.

### Conflict of interest

None of the authors of this manuscript has declared any conflict of interest.

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