

## Case Report

### Hypersensitivity Pneumonitis Due To Soldering: A Rare Case Report

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**Abstract:** 41 Year old male who had long term exposure to lead soldering fumes presented with dyspnea on exertion for two months duration. He had cough with sputum production in the previous 7 months period. No history of asthma or any other respiratory diseases before the present job. On examination he had clubbing and conjunctival congestion. Respiratory system examination showed bilateral crackles and occasional rhonchi.  $SpO_2$  was 92% without oxygen. Chest Xray showed bilateral reticulonodular shadowing. HRCT thorax revealed interstitial pattern with nodular shadows consistent with hypersensitivity pneumonitis. PFT showed moderate restrictive pattern. Based on these patient was given oral corticosteroids and on regular follow up there was significant exercise tolerance with objective improvement

**Keywords:** Soldering , Hypersensitivity pneumonitis, Occupational lung disease

#### INTRODUCTION

Occupational lung diseases are group of lung diseases with affection of respiratory tract, interstitium, alveoli, pleura resulting from the constant occupational exposure to the gases, fumes, chemicals, dusts and other occupational pollutants. Though soldering fume induced asthma is seen commonly, presentation of soldering fume induced hypersensitivity pneumonitis as occupational interstitial lung disease is rarely reported.

#### CASE REPORT

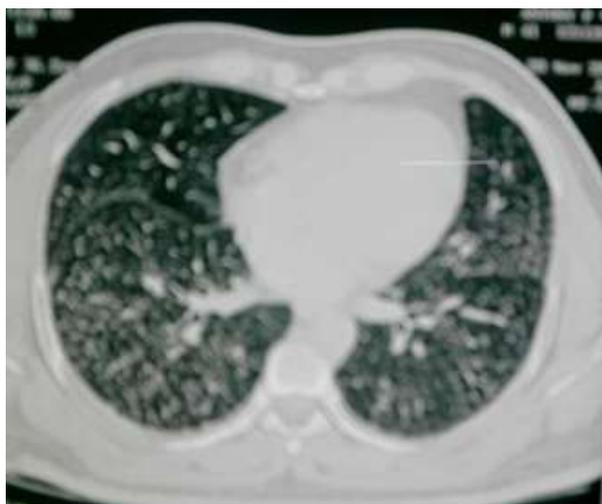
Fourty one year old non diadetic non hypertensive patient who was working in lead soldering for 15 years duration with heavy exposure to lead soldering fumes presented with dyspnea on climbing stairs for 2 weeks duration along with cough and sputum production. This lead soldering fume exposure was for more than 8 hours per day. There was no previous history of respiratory diseases. There was associated paraesthesia of both lower limbs. On examination there was finger clubbing but no cyanosis or anemia or jaundice or lymph adenopathy. He was afebrile with blood pressure of 132/82 mm of Hg, pulse rate and respiratory rate of 86 per minute and 23 breaths per minute respectively. Respiratory system examination revealed bilateral crepitations with occasional rhonchi. Cardiovascular system examination revealed no abnormality.  $SpO_2$  without oxygen was 92%. Blood routine examination showed hemoglobin of 17 grams per dL, total WBC count of 6100 cells per cmm, with differential of 70 % polymorphs and 30 % lymphocytes. ESR was 20 mm in the first hour. Renal and liver function tests were within normal limits. HIV and HBsAg were negative. Sputum AFB was negative. Mantoux was non reactive. Antinuclear antibody was negative. Ultrasound abdomen showed minimal

hepatomegaly with fatty change. Chest X-ray showed bilateral reticulonodular opacities. Pulmonary function testing revealed moderate obstruction with individual values as follows FVC 61%, FEV1 60%, FEV1/FVC 106%. FEF 25-75 was 53% .

HRCT thorax showed centri lobular nodular lesions and interstitial thickening with relative sparing of lower zones and with pleural thickening. Multiple enlarged mediastinal lymph nodes noted in the prevascular, precarinal and para tracheal regions. Findings were consistent with hypersensitivity pneumonitis .Patient received oral prednisolone 40 mg per day along with oral bronchodilators. On follow up patient had symptom resolution gradually with improvement in lung function test values and radiologically. Gradual tapering of steroids was done with stable lung function and radiological status .



Figure 1: CXR PA view showing the bilateral interstitial shadows



**Figure 2 :HRCT thorax showing centrilobular nodular lesions with interstitial thickening**

## DISCUSSION

Occupational - environmental lung diseases describes a diverse group of conditions that are caused or aggravated by exposures in the workplace or environment. The respiratory tract is often the site of injury from occupational exposures because it has direct contact with the ambient environment. Inhalation of potentially toxic materials in the workplace can lead to all major lung diseases with the exception of pulmonary vascular ones.

Soldering is the process of combining two metals via a third metal (the "joint") with a lower melting point than the base metals. In this procedure, the two base metals are not distorted and only the filler metal is melted. There are numerous filler metals, or solder, available for soldering applications. According to OSHA, lead is used in the soldering process in the form of lead/tin and lead/silver filler metals. When heated, lead oxide fumes are formed. Flux is a chemical cleaning agent that is used in conjunction with solder in order to remove oxidation from the base and filler metals involved in soldering. It improves the overall flow and effectiveness of the solder. Rosin-based flux is made from extracts of pine tree sap and can cause health problems if fumes from soldering are inhaled. Short term problems can include nose, sinus, eye and throat irritation and skin rashes, and long term problems may include asthma and dermatitis.<sup>[5]</sup> Colophony is the base product of flux. Colophony is the translucent amber-colored rosin obtained when turpentine is distilled from resin of pine trees. It is composed of roughly 90% resin acid and 10% neutral material. When the flux is heated, colophony has been known to generate fumes including aliphatic aldehydes (like formaldehyde) and hydrochloric acid and other gases containing benzene, toluene, styrene, phenol, chlorophenol and isopropyl alcohol [6].

Occupational interstitial lung diseases due to lead soldering fumes presenting as hypersensitivity pneumonitis is very rare. Because of differences in the metabolism and susceptibility of hosts, one occupational agent may cause many diseases. The recognition of occupational causes can be made difficult by delayed responses that occur at home after work and by years of latency between exposure in the workplace and the occurrence of disease. The airways, from nares to alveoli, come into contact with 14,000 liters of air in the workplace during a 40-hour workweek. Physical activity can increase ventilation, and thus exposure to contaminants, up to 12 times the levels at rest. As ventilation increases, breathing shifts from nasal to a combination of oral and nasal, allowing a greater volume of air to bypass the cleansing nasopharynx and further increasing the exposure of the lower airways to inhaled materials. Strong irritants produce an aversive response, whereas materials with little sensory effect can be inhaled for prolonged periods and result in serious injury. Most occupational respiratory illnesses can be diagnosed on the basis of the history<sup>[1]</sup>, physical examination, chest x-ray film, and pulmonary function tests. An effective approach is first to determine the diagnosis and then to use the occupational history to identify possible causes. Present case is having chronic heavy exposure to the lead soldering fumes with interstitial lung disease pattern by HRCT thorax with restrictive pulmonary function abnormality.

Hypersensitivity pneumonitis as occupational interstitial lung disease is caused by following like amebae, animal proteins, (from pigeon, chicken, turkey, duck, and rat), fungi (e.g., *Aureobasidium pullulans*), metalworking fluid aerosols (used in metal-parts machining shops), thermophilic bacteria (e.g., *thermoactinomyces*, *Saccharopolyspora rectivirgula*), other bacteria (*Bacillus subtilis*, *B. cereus*, and *Pseudomonas fluorescens*), toluene diisocyanate, diphenylmethane diisocyanate, and hexamethylene diisocyanate (in polyurethane paints, adhesives, and foam production), trimellitic anhydride and phthalic anhydride (in epoxy resins, coatings, and paints). Hypersensitivity pneumonitis secondary to occupational exposure of lead fumes for long duration as in the present case is rare.

The patient's history can be supplemented by Material Safety Data Sheets (from the employer or poison-control centers), which list the chemical components of commercial materials. The results of previous measurements of air from the patient's work area may be obtained [2] or the physician may advise the employer to consult a certified industrial hygienist for air measurements and remediation.[3] Referral to an occupational-medicine specialist may be helpful for patients whose illness requires detailed investigation. Employers often wonder why disease develops in only one of many similarly exposed persons. Polymorphisms

in genes produce variation in the rate and pathway of metabolism, which results in marked differences in susceptibility to occupational substances among workers, just as polymorphisms affect responses to some medications. Interactions among occupational exposure, atopic predisposition, nutrition,[4] home or avocational exposure, and host factors (such as gastroesophageal reflux, cigarette smoking, and viral infections) are common, and they help to explain the occurrence of disease in certain persons.

A lifetime occupational history is essential for the recognition of some exposures, because 10 or more years pass from the initial exposure until the first manifestations. Management of the disease includes either a change in the work practices that led to the disease or restrictions regarding what the patient can and cannot do. These measures can be discussed with both the patient and the employer in order to prevent future harmful exposures. Treatment is usually identical to treatment for nonoccupational forms of the illness. With the patient's permission, the employer should be notified of the hazard in order to prevent further occurrences, to initiate compensation. Reasonable accommodation to allow a patient with a disability to keep working is now encouraged.

Because of the high risk of worker/operator exposure during soldering, OSHA suggests ventilation as a key to controlling lead exposures. Ventilation, either local or dilution (general), is probably the most important engineering control available to the safety and health professional to maintain airborne concentrations of lead at acceptable levels. Local exhaust ventilation, which includes both portable ventilation systems and shrouded tools supplied with ventilation, is generally the preferred method. If a local exhaust system is properly designed, it will capture and control lead particles at or near the source of generation and transport these particles to a collection system before they can be dispersed into the work environment [7]. Source capture also works effectively for soldering that does not involve lead-based solder. Organizations from The Health and Safety Executive of Great Britain

to solder equipment manufacturers, suggest a fume extraction system while soldering.

## CONCLUSION

In conclusion, heavy occupational soldering fume exposure may later cause occupational interstitial lung disease. Occupational safety measures like ventilation as a key to controlling lead exposures and a fume extraction system while soldering are needed to prevent this occupational lung disease.

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