Case Report

A man who became breathless after tiling a bathroom

H Andrews, MM Khattak, A Beale & T Novak

Abstract

Inhalational lung injury should be considered in patients presenting with acute respiratory symptoms and a history of occupational or recreational exposure to toxic substances. We present the case of a 29-year-old patient who developed pneumonitis following usage of waterproofing sealant spray in an enclosed space, despite the use of a dust mask. The patient was managed with oxygen therapy, corticosteroids and bronchodilators. He made a complete clinical recovery with resolution of almost all changes seen on computerised tomography (CT) imaging within 7 days.

Keywords

Inhalational lung injury, waterproofing spray-associated pneumonitis, hydrocarbon, steroids

Learning points

- Pneumonitis from droplet inhalation typically spares the subpleural space
- Thorough history taking, including occupational history, is crucial, and suspicion for inhalational lung injury should remain high despite use of PPE
- Patients with a smoking history (active or passive) should be considered vulnerable to the toxic effects of waterproofing sprays
- Management is supportive with standard treatment of hypoxia and associated bronchospasm. There is no evidence for the routine use of corticosteroids or antibiotics
- Lung injury secondary to waterproofing spray is more common in fluoropolymer containing products however suspicion should also be raised with hydrocarbon containing sprays

Introduction

Waterproofing or leather protector compounds containing fluoropolymers, silicone resins, petroleum hydrocarbons, or other solvents are sprayed on to surfaces to repel water and dirt.[1] The inhalation of waterproofing spray containing fluororesin causes acute poisoning and lung injury, and is referred to as waterproofing spray-associated pneumonitis (WAP).[2] The common clinical findings in WAP are; shortness of breath (63%), cough (60%), chest pain (44%), wheezing (33%), and rales (23%).[2] Most documented case reports are based on patients inhaling fluororesin/fluorocarbon based sprays.[3] We present an interesting case where a patient developed pneumonitis from the use of a hydrocarbon based product, free from fluoropolymers.

Case presentation

A 29-year-old male smoker with a history of asthma and obstructive sleep apnoea presented to the emergency department with a 3-hour history of fever, cough and chest tightness. Working as a handyman, he reported having used waterproof sealant spray to tile a bathroom wall earlier in the day. Whilst working with the spray he had worn a dust mask and kept the bathroom window open. The patient reported using a new sealant spray for the first time. The spray contained heptane, hydrocarbons C9-C12, N-Alkanes, isoalkanes, cyclics, aromatics, xylene and cumene.[4] His symptoms developed 20 minutes after using the spray.

On arrival to the emergency department (ED) he was hypoxic (oxygen saturation 93% in air), tachycardic (heart rate 117bpm) and pyrexial (temperature 38.1 C). His physical examination was unremarkable. Blood test and relevant microbiological results are shown below.

Blood investigations

CRP 76mg/l, ESR 32mm in 1hr, WBC 18.1x10*9/l, neutrophils 13.58x10*9/l, lymphocytes 3.37x10*9/l, eosinophils 0.09x10*9/l. Connective tissue ANA screen negative.

Microbiology investigations

Covid-19 PCR negative, urinary legionella and pneumococcal antigens negative, sputum MC&S no growth.

After assessment and a short period of satisfactory observation by the ED team, a diagnosis of lower respiratory tract infection (LRTI) was made. The patient was discharged with a course of oral antibiotics, and safety net advice to return if symptoms worsen.

Only 3 hours after discharge the patient returned with worsening chest tightness, dizziness and shortness of breath. His respiratory rate on arrival was 27/min, heart rate 106 bpm and oxygen saturations 97% on 3 litres of oxygen. ECG showed sinus tachycardia. ABG results were consistent with a type 1 respiratory failure, with a pO2 of 10.2kPa on 2L of oxygen.

Chest X-ray (Figure 1) showed bilateral infiltrates with concerns raised regarding possible

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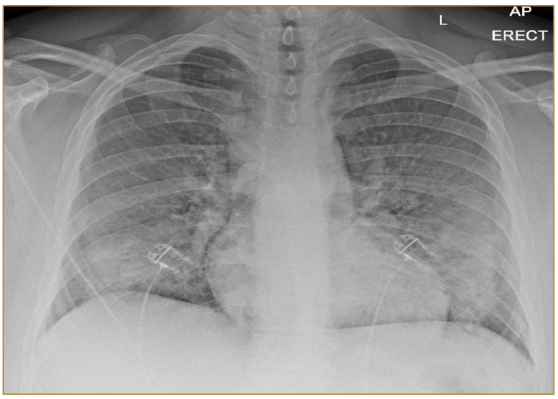

Figure 1. X-ray chest showing bilateral interstitial infiltrates

pneumomediastinum seen at the right lateral heart border. A CT thorax was subsequently performed for further evaluation (Figure 2). This showed extensive bilateral symmetric ground glass changes with sub-pleural sparing and a posterior gradient, particularly involving the lower lobes and representing an acute waterproofing spray-associated pneumonitis.

In view of the hypoxia, the patient was admitted under the respiratory team. His case was discussed with the National Poisons Information Centre (NPIS) who advised that treatment should be supportive with no evidence base to recommend steroid therapy. The patient remained an inpatient for 8 days and did receive high dose steroid therapy as prescribed by the respiratory team (60mg prednisolone once a day). At the point of discharge the patient showed significant symptomatic improvement and repeat CT imaging at day 7 (Figure 3) showed near complete resolution of all changes. The patient was discharged home with a short weaning course of prednisolone and outpatient respiratory follow up arranged.

Discussion

The majority of documented case reports are based on patients inhaling fluororesin/ fluorocarbon-based sprays. In our case the patient used a hydrocarbon-based product free from fluoropolymers. To the best of our knowledge there has been only one other documented case of acute respiratory failure associated with inhaled hydrocarbons in waterproofing sprays in a human,[5] and two in dogs.[6]

Despite there being so few documented case reports of lung injury secondary to hydrocarbon based waterproofing sprays, the constituent parts are deemed to have aspiration toxicity level 1 (H304 – may be fatal if swallowed and enters airways) by the United Nations 'Globally Harmonized System of Classification and Labelling of Chemicals' (GHS).

The pathophysiology by which the inhaled hydrocarbons cause lung injury is unclear, with previous research investigating the mechanism in fluoropolymer-based products.[7] Larsen et al investigated the mechanism of lung damage caused by nanofilm spray products (containing perfluorinated siloxanes), with findings that inhibition of lung surfactant caused liquid blocking of terminal bronchioles and resulted in

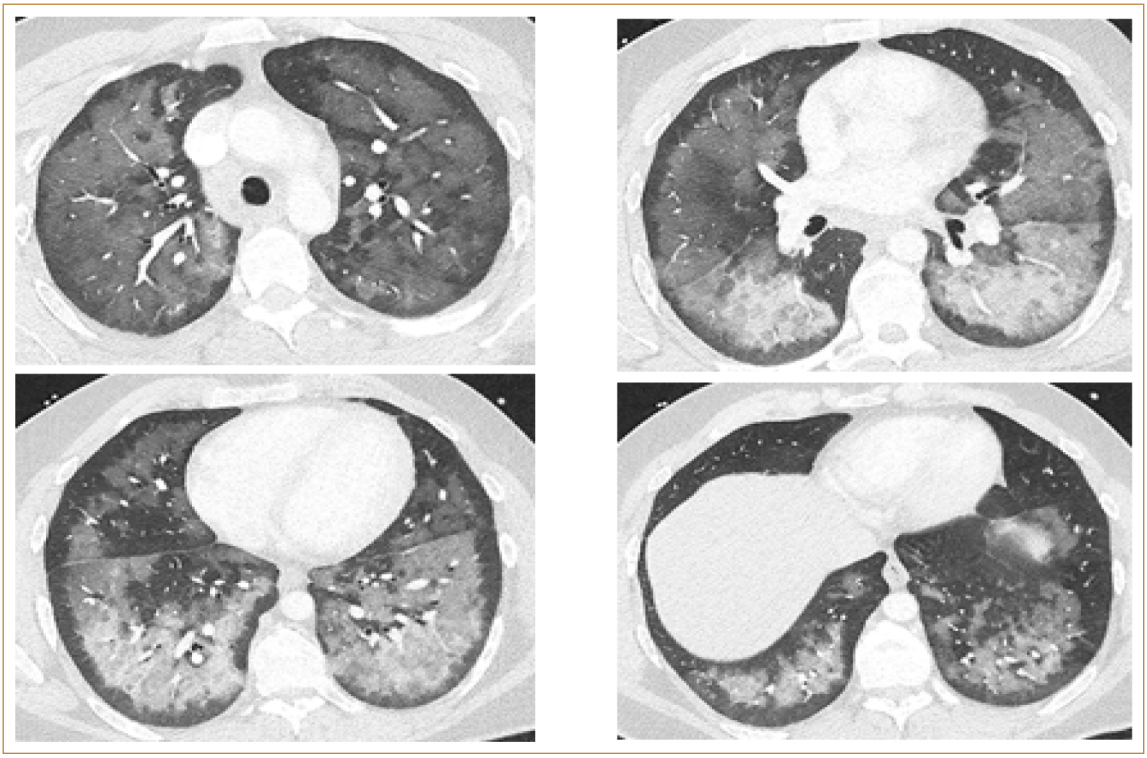

Figure 2. CT Thorax on admission demonstrating extensive bilateral pulmonary infiltrates representing severe acute waterproofing spray-associated pneumonitis

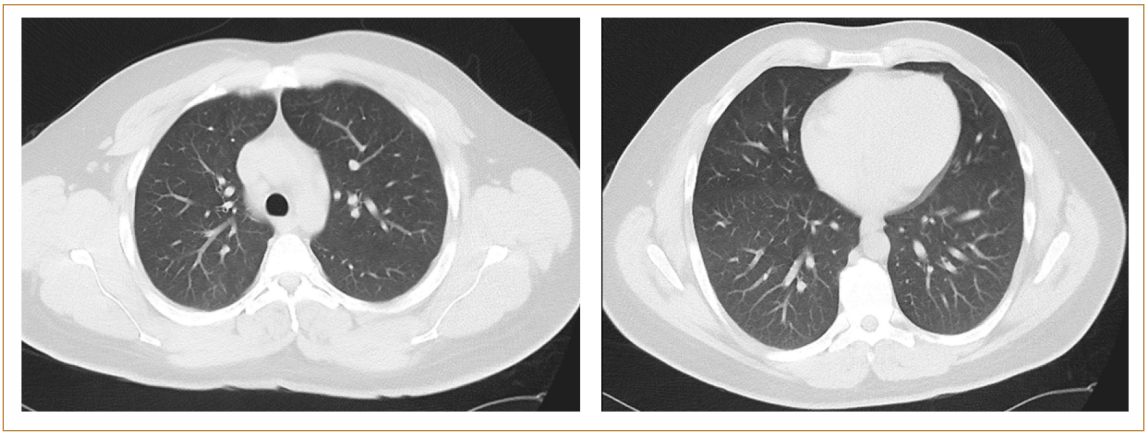

Figure 3. High resolution CT thorax performed 7 days after presentation showing almost complete resolution of lung injury

reduced expiratory flow rate in animals.[8] Yamashita et al investigated inhalation of waterproofing aerosol in mice and found this resulted in extensive microscopic abnormalities including alveolar hyperaemia, collapse, haemorrhage and cellular infiltration.[9]

Interestingly a history of smoking also suggests a vulnerability to lung injury from waterproofing spray.[10] A Japanese study found in 23 of 25 cases assessed patients were cigarette smokers. Proposed explanations for this include;

Direct impact of heat from cigarette smoke inhalation causing decomposition of spray ingredients leading to toxic substance production

Underlying pulmonary changes with disturbance of air-blood barrier due to smoking lead to increased risk of injury- including endothelial injury secondary to oxidative stress, disturbance of the epithelial membrane due to inflammation and increased activity of leucocytes

According to the NPIS, management of the condition should be supportive in nature. Hypoxia should be managed with oxygenation (in some cases continuous positive airway pressure (CPAP) may be indicated) and bronchospasm managed with nebulised steroids and bronchodilators. Despite multiple case reports suggesting use of intravenous corticosteroids as part of management[7] the NPIS advises there is no evidence base to suggest corticosteroids or antibiotics are of benefit.[11]

Conclusion

Lung injury secondary to waterproofing spray is more common in fluoropolymer containing products however suspicion should also be raised with hydrocarbon containing sprays. The clinical presentation is that of an acute pneumonitis. Smokers are vulnerable to the toxic effects of waterproofing sprays and the risk of lung injury is higher in enclosed spaces and when protective equipment is not used. Management of the condition is supportive with no evidence to justify the use of corticosteroids.[8]

Declaration of competing interests

Nothing to declare.

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