CASE REPORT

Diagnosing metal fume fever—an integrated approach

J. R. Cain¹ and R. M. Fletcher²

¹National Specialist Group (Occupational Hygiene), Health and Safety Executive, Marshalls Mill, Marshall Street, Leeds LS11 9YJ, UK, ²Corporate Medical Unit, Health and Safety Executive, Arden House, Gosforth, Newcastle on Tyne NE3 3JN, UK.

Correspondence to: J. R. Cain, National Specialist Group (Occupational Hygiene), Health and Safety Executive, Marshalls Mill, Marshall Street, Leeds LS11 9YJ, UK; e-mail: john.cain@hse.gsi.gov.uk

Background Exposure to high concentrations of zinc oxide fume can cause metal fume fever (MFF). Two cases occurring following the oxy-acetylene cutting of galvanised steel frames are reported.

Aims To show that integrated working is valuable as secondary health care staff may not be familiar with MFF.

Methods Site visits by Her Majesty's Medical, Health and Safety (H&S) and Specialist Occupational Hygiene Inspectors to gather information and cooperation with occupational health, primary and secondary health care staff to diagnose MFF.

Results Poor exposure control caused metal fume inhalation in these cases. Multidisciplinary working established diagnosis, causation and compliance with H&S legislation.

Conclusions Risk assessments are required to identify health risks and to determine required exposure control measures. Failure to do this resulted in an unusual case of MFF leading to hospital admission. Diagnosis can be delayed if a full occupational history is not taken. Successful investigation of such cases benefits from collaborative working.

Key words Collaborative working; control measures; metal fume fever; risk assessment.

Introduction

Ill-health associated with metal working has been recognized for many years [1]. Metal fume fever (MFF) is usually a benign, but unpleasant, short-term illness, following exposure to metal fume, usually zinc oxide [2,3]. It is typically flu like with predominant symptoms of respiratory tract inflammation, fever and myalgia. Sweating and shivering are common. Other symptoms include joint pain, muscle cramp, fatigue, malaise, headache, vomiting and a metallic taste [4]. Clinical signs are often minimal but may include pulmonary rhonchi and/or crepitations. Chest X-rays may be normal or show patchy infiltrates or increased vascular congestion. Polymorphonuclear leucocyte counts and blood zinc levels are typically elevated [5].

The Control of Substances Hazardous to Health Regulations (COSHH) 2002 (as amended) [6] requires workplace exposures to hazardous substances to be prevented or adequately controlled. Many hazardous substances are assigned a workplace exposure limit (WEL) that should not be exceeded [7]. Zinc oxide has no WEL, but prevention or adequate control of exposure is still required.

The Management of Health and Safety (H&S) at Work Regulations (1992) and the COSHH Regulations requires employers to do a suitable and sufficient risk assessment before commencing work to identify the health hazards, exposure sources and control measures and to provide information, instruction and training [8].

Case report

In this case study, two workers developed MFF following exposure to the highly volatile fume of zinc oxide. They were employees of a company manufacturing bricks who were asked to cut galvanised dryer trams using oxy-acetylene cutting equipment in a large shed with open roller shutter doors. This was a non-routine task.

Subject A was a 44-year-old non-smoker who had worked a 12 h shift. Forty-five minutes later, he developed flu-like symptoms, shivering, muscle stiffness, dizziness, central chest pain and a metallic taste. He was admitted
to hospital and noted to be in pain and generally unwell with slight pyrexia (38.3), calf tenderness, a Glasgow coma scale score of 14/15 and disorientation in place but not time. He did not cooperate with examination. Analgesia was prescribed. Next morning, he was photophobic, had an inflamed throat and again was difficult to examine. Past history revealed a varicose vein operation with subsequent deep vein thrombosis (DVT) and a pulmonary embolus.

By 18 h, he was apyretic with residual mild tachycardia, right basal crepitations, right basal shadowing on chest X-ray and a leucocytosis of 13 000 white blood cells/µl. Electrocardiogram, Doppler and computed tomography brain scan were normal. Differential diagnosis included a recurrent DVT with embolism or basal pneumonia. By 24 h, he had objectively improved but was very anxious and complained of head, leg and chest pain.

On Day 5, his wife contacted the hospital and informed staff that he had been welding on the day of admission. A blood zinc level was 16.4 mmol/l (normal range: 9.8–17.9 mmol/l). MFF was subsequently diagnosed. The patient was discharged a few days later but continued to complain of leg pains for several weeks. A neurologist found no abnormalities.

He returned to work later but was anxious and depressed with flashbacks. He received medication and counselling but was deemed unfit for work. His wife described how he had changed after his pulmonary embolism from being happy and extroverted to become introverted and anxious about his health, further exacerbated by the recent illness.

Subject B worked a 6 h shift. Forty-five minutes afterwards, he developed flu-like symptoms of headache, sweating and shivering. He did not seek medical advice and returned to work to resume cutting. His symptoms returned but resolved when he stopped.

Although the roller shutters were open, air movement was minimal. Subject A wore a drop-down welder’s visor not flush with his chin; subject B wore welding goggles. Effective local exhaust ventilation (LEV), suitable respiratory protective equipment and appropriate information, instruction and training were not provided.

A Health and Safety Executive medical inspector visited the site with investigating HM’s H&S and Specialist Inspectors to take full occupational and medical details and to assess compliance with the legislation. Further patient information was obtained from primary and secondary care staff and from the site occupational physician under written informed consent. Health and Safety Laboratory field scientists took samples of the trams to analyse fume produced during laboratory-simulated cutting; on-site measurements were not feasible [9].

Discussion

MFF can present with severe symptoms [10], including tracheobronchitis, chemical pulmonary oedema, respiratory failure and acute respiratory distress syndrome [11]. In Subject A, marked anxiety following a previous DVT and pulmonary embolism, fear of a possible recurrence and the unpleasant nature of MFF may have amplified his clinical symptoms.

The diagnosis of MFF in Subject A was overlooked by secondary health care staff for several days. This is because there was little initial consultation with occupational health personnel while workplace information was being collected. Once a full occupational history was obtained, there was close collaboration between primary and secondary health care personnel and an accurate diagnosis of MFF was confirmed. Collaborative work-aided diagnosis.

Flame cutting of galvanized steel removes both parent metal (carbon–manganese steel) and surface coating (zinc), generating fume from both constituent components [12]. Laboratory simulated cutting confirmed that a large amount of fume was generated containing 61% zinc oxide.

A suitable and sufficient risk assessment would have identified the potential for zinc oxide fume generation. Appropriate control measures to include working at the shed entrance and using portable LEV with a moveable capturing hood would have minimized exposure. A drop-down visor alone was not adequate to control exposure and suitable respiratory protection, for example a powered (fan-assisted) respirator with a visor, should have been worn. Information, instruction and training on the potential hazards, exposure risks and control were not provided.

These cases of MFF demonstrate that a long-known entirely preventable occupational disease can still occur unless effective health risk management principles are applied.

Key points

- Metal fume fever is generally a benign flu-like illness following exposure to metal fume.
- Severe symptoms may occur if there is poor exposure control.
- A full occupational history and close collaboration between primary and secondary health care personnel are required to make an accurate diagnosis.

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Conflicts of interest

None declared.
References