

## CASE REPORT

# Valsalva manoeuvre effect on distribution of lung damage in heroin inhalation

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**ABSTRACT.** This article reports the case of a patient demonstrating acute bilateral pneumonitis almost completely confined to the upper lobes as a result of inhaling heroin. We attribute this distribution to the patient performing the Valsalva manoeuvre immediately after inhaling heroin. This pattern has not been reported before and we believe it may be seen more frequently owing to a switch amongst drug users from intravenous to inhaled heroin.

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We describe a case of a patient demonstrating acute bilateral pneumonitis almost completely confined to the upper lobes as a result of inhaling of heroin. We attribute this distribution to the patient performing the Valsalva manoeuvre immediately after inhaling heroin. This pattern has not been previously reported.

### Case report

A 53-year-old female patient presented with a 2 week history of productive cough, increasing shortness of breath, markedly reduced exercise tolerance, chills and rigors. The patient had been an intravenous heroin user, but had switched to smoking heroin 20 years ago. She was also currently on a methadone programme. She smoked 30 cigarettes a day (45-pack year history) and drank approximately 42 units of alcohol per week. She had no other significant medical problems and did not take any regular medication besides methadone. Physical examination revealed a wheeze predominating over the upper zones. Her oxygen saturation was 94% on 28% oxygen.

Blood gas analysis while breathing room air demonstrated Type 2 respiratory failure (pH 7.4, PaO<sub>2</sub> 6.6 kPa and PaCO<sub>2</sub> 9 kPa). Her significant laboratory results included a C-reactive protein (CRP) of 146 mg l<sup>-1</sup> and white cell count (WCC) of 10.2 × 10<sup>9</sup> l<sup>-1</sup>. Her chest radiograph on admission revealed a focal consolidation in the right lower lobe, which was related to lung contusion with rib fracture adjacent to the peripheral consolidation. Sputum culture did not grow any significant

pathogens. Subsequent investigations included *Pneumocystis jiroveci* (*carinii*) polymerase chain reaction (PCR), negative; human immunodeficiency virus (HIV), 1+2 Ab negative; and tuberculosis stain, negative (twice). During her stay in hospital she was given amoxicillin, prednisolone, salbutamol and oxygen.

Acute deterioration triggered a repeat chest radiograph on day 5, which showed bilateral infiltrates in the upper zones and persistence of the focal contusion in the subpleural region of the right lower lobe. A CT of the chest revealed extensive homogeneous areas of ground-glass attenuation with sparing of multifocal centriacinar emphysema. The distribution of the ground-glass attenuation was obviously demarcated by the fissures as it was



**Figure 1.** Axial CT showing upper lobe ground-glass opacification with centriacinar emphysema.

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**Figure 2.** Coronal CT again showing upper lobe ground-glass opacification sparing the apices.

confined to both upper lobes (Figure 1 and 2). Focal subpleural consolidation adjacent to rib fractures was confirmed in the right lower lobe. The recent use of inhaled heroin with the Valsalva manoeuvre was confirmed by the patient when interviewed after the CT.

No ventilatory support was needed and the patient's condition improved rapidly with complete resolution of the upper lobe infiltration, while the focal lower lobe consolidation persisted in a follow-up radiograph 1 week later. She was discharged approximately 20 days following admission.

CT examination was performed using Siemens Sensation 16 (Siemens, Den Haag, the Netherlands), 2 mm slice thickness, pitch 1, 120 kVp, 180 mA, convolution kernel FC30 and FC40.

## Discussion

Since the HIV epidemic of the 1980s the misuse of heroin has progressively evolved from intravenous administration to an inhaled technique known as "chasing the dragon" [1]. A recent European report suggested some 75–85% of Dutch heroin users inhale the drug [2].

Inhalational drug-induced lung disease is caused by a variety of pathological processes, including interstitial

pneumonitis, bronchiectasis, aspiration pneumonitis, non-cardiogenic pulmonary oedema, pulmonary eosinophilic pneumonia, pulmonary haemorrhage, acute respiratory distress syndrome and emphysema [3–5].

Typically, the radiological manifestations are bilateral, perihilar areas of increased opacity, usually without pleural effusion or cardiomegaly. CT demonstrates multifocal ground-glass attenuation associated with septal thickening and this typically occurs within hours of drug use [3].

However, the pattern of interstitial lung disease demonstrated in this case shows an upper lobe predominance, which we postulate is as a result of the patient performing the Valsalva manoeuvre immediately after inhaling the drug. The manoeuvre is well described in heroin and marijuana smokers and has been attributed to cause pneumomediastinum in these patients [6, 7]. Raising intrathoracic pressure causes a consequent increase in the diffusion of the drug across the alveolar membrane into the blood stream. The increase in intra-abdominal pressure results in decreased expansion of the lower lobes and hence they are relatively spared.

## Conclusion

This case demonstrates a characteristic pattern of upper lobe pneumonitis attributed to inhaling heroin while performing the Valsalva manoeuvre. With the increased misuse of the drug in this way this picture is likely to be seen more commonly.

## References

1. Strang J, Griffiths P, Gossop M. Heroin smoking by 'chasing the dragon': origins and history. *Addiction* 1997;92:673–83.
2. Hendriks VM, van den Brink W, Blanken P, Bosman IJ, van Ree JM. Heroin self-administration by means of 'chasing the dragon': pharmacodynamics and bioavailability of inhaled heroin. *Eur Neuropsychopharmacol* 2001;11:241–52.
3. Gotway MB, Marder SR, Hanks DK, Leung JW, Dawn SK, Gean AD, et al. Thoracic complications of illicit drug use: an organ system approach. *Radiographics* 2002;22:S119–35.
4. McCarroll KA, Roszler MH. Lung disorders due to drug abuse. *J Thorac Imaging* 1991;6:30–5.
5. Tsapas A, Paletas K, Vlachaki E, Bekiari E, Spanos C, Economidis D. Eosinophilic pneumonia associated with heroin inhalation: a case report. *Wien Klin Wochenschr* 2008;120:178–80.
6. Mattox KL. Pneumomediastinum in heroin and marijuana users. *JACEP* 1976;5:26–8.
7. Shyamsunder AK, Gyaw SM. Pneumomediastinum: the Valsalva crunch. *Md Med J* 1999;48:299–302.