SAJS
Review

A review of non-obstetric spontaneous pneumomediastinum and subcutaneous emphysema

M. BRAND, M.B. CH.B., F.C.S. (S.A.), M.R.C.S., M.MED. (SURG.)
B. BIZOS, M.B. B.CH., F.C.S. (S.A.), F.R.C.S. (ENG.). M.MED. (SURG.)
Department of Surgery, University of the Witwatersrand, Johannesburg

L. BURNELL, M.B. B.CH.
Department of Ear, Nose and Throat Surgery, University of the Witwatersrand

A man in his early twenties was admitted from the streets. He was hallucinating and incoherent. His vital signs were normal and there was no sign of injury. There was subcutaneous emphysema over the neck and anterior chest. The breath sounds were good and the heart sounds were audible. Chest X-ray showed extensive subcutaneous emphysema extending into the neck, but no pneumomediastinum or pneumothorax. A Hexabrix swallow demonstrated no leak. A computed tomography (CT) scan showed extensive surgical emphysema but no underlying pathology. Over the following 48 hours he was treated with a 40% oxygen mask. He remained stable and the surgical emphysema settled completely. Urine testing for cannabis and cocaine were negative. He was certified and admitted to a closed psychiatric ward. No further surgical problems occurred during the following month.

Review

Louis Hamman originally reported the syndrome that bears his name in 1939,[1] describing it in women in labour ('postpartum pneumomediastinum'). More recently, the syndrome has been loosely applied to all cases of spontaneous pneumomediastinum and subcutaneous emphysema. This review includes an overview of 561 cases, nearly 10 times more than in any other study.

Spontaneous pneumomediastinum (SPM) is an uncommon and usually benign entity, characterised by the presence of free air in the mediastinum, in the absence of traumatic or iatrogenic causes or preceding pulmonary pathology such as emphysema, chronic bronchitis or lung cancer.[2] Macklin[3] elucidated the pathophysiology of this condition based on animal laboratory studies in 1944; this was revised by Maunder *et al.*[4] SPM produces a dramatic increase of endopulmonary pressure[5] that results in rupture of alveolar septa, which causes interstitial air to extend along peribronchial and perivascular spaces into the mediastinum.[3,4] Frequently, air extends to the neck along the cervical fascia, developing into subcutaneous emphysema.[6] Valsalva manoeuvres have been implicated as the cause of SPM.[7-9] If prolonged, they result in acute, intermittent lower airway obstruction and increased intra-alveolar pressure resulting in rupture of alveoli.[10]

'Hamman's crunch' (Hamman's sign) is a precordial crunching sound, heard best when the patient is in the left lateral decubitus position.[1] It is, however, not pathognomonic, and can occur with bullous emphysema, pneumothorax and dilatation of the distal oesophagus.[8]

Pneumomediastinum is seen on chest X-ray. On P-A projections there are radiolucent streaks in the mediastinum that can surround the pericardium and reveal the thin dense line of the anterior mediastinal pleura. The lateral view often demonstrates retrosternal free air, with clear definition of mediastinal structures such as the aorta.[11]

Before spontaneous subcutaneous emphysema and pneumomediastinum can be attributed to 'Hamman's syndrome', potentially lethal causes shold be considered and excluded. Some of these conditions are:

- oesophageal: rupture, spasm, oesophagitis
- cardiac: ischaemia, pericarditis
- pulmonary: embolism, pneumothorax, pneumonia
- musculoskeletal: costochondritis, inflammatory joint disorders.

Most can be excluded with a good history, thorough clinical examination and targeted special investigations. Munsell[8] maintained that the presence of subcutaneous emphysema without apparent cause, together with pneumomediastinum on chest X-ray, was sufficient to diagnose SPM.

Treatment includes the administration of 95% oxygen to relieve the dyspnoea and to facilitate the reabsorption of nitrogen.[10] The oxygen decreases the partial pressure of nitrogen in the blood, which then promotes the diffusion of nitrogen from the interstitium back into the blood. This increases the resorption of the mediastinal air.[12]

We performed a Pubmed search to identify and review all cases of non-obstetric SPM. The search was confined to English-language journals, and the only initial limit was the exclusion of paediatric cases. Key words were Hamman's syndrome, spontaneous pneumomediastinum and spontaneous subcutaneous emphysema. This resulted in 295 references. All papers with obstetric cases were excluded. We also excluded papers in which there was a predisposing condition, or possible aetiological agent, since these were not spontaneous, as well as papers without case studies. This resulted in 57 articles[2,5-7,9-11,13-61] for analysis. We were able to acquire all the original articles.

A total of 561 non-obstetric patients were included in our analysis; the majority of papers were reports of a single case. The mean patient age was 23 years and 70.2% were male. Most cases were related to activities that resulted in a prolonged Valsalva manoeuvre such as coughing, strenuous sport, or the use of inhaled drugs

such as cocaine and marijuana (10%). Psychiatric disorders were reported in 6% of patients, but the association is not clear; it may in fact be the consequence of an unrecognised Valsalva episode.

The three most common symptoms were chest pain (61.3%), dyspnoea (38.3%) and dysphagia (14.5%). Clinical examination revealed subcutaneous emphysema (56.1%) and Hamman's crunch (17.1%). Of note is that subcutaneous emphysema only occurred in half the patients, and that Hamman's sign was positive in less than 1 in 5 patients.

As far as radiological investigations were concerned, chest X-ray was diagnostic in 76.4%. Chest CT scans were positive in all of the 172 scans performed (i.e. 100%); not a single oesophagogram showed any contrast leak (211 performed); and the bronchoscopies performed (108) were uniformly negative. The inference is that, given a suggestive history and adequate CT studies, invasive procedures are not required.

Management was successful using high concentrations of oxygen in all cases. Only 3.1% of patients required an intercostal drain for pneumothorax. The mean hospital stay was 3.5 days. There was only 1 death, in a patient who developed a stroke during his admission. There were 7 (1.3%) recurrences: 3 in scuba divers, and 1 in a skydiver. The remaining 3 recurrences appear to have been genuinely spontaneous as there was no repetitive activity.

Conclusion

Non-obstetric SPM is a benign entity that should be diagnosed when the history suggests a prolonged Valsalva manoeuvre, with cervical or thoracic subcutaneous emphysema. A chest X-ray should confirm the pneumomediastinum and subcutaneous emphysema, but chest CT is the standard for diagnosis. Invasive investigations are usually not required. Management is conservative, with oxygen; all cases resolve spontaneously. Intercostal drain insertion for a pneumothorax is seldom required. Recurrence is rare, but individuals involved in a professional sport that induces repetitive prolonged Valsalva manoeuvres should be warned that they could possibly experience a recurrence.

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In all, 61 papers were analysed for this review. The first 12 and most important references are listed in the printed version of the *SAJS*, while the full number have been included in the online version of the August 2011 *SAJS*, which is available at the open-access website www.sajs.org.za.

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