

# Surgical emphysema of the neck following arthroscopic shoulder surgery

## Introduction

Surgical emphysema of the neck after intubation is an extremely rare complication of one of the more common medical interventions. This article reports a case of a patient who presented with left-sided neck pain and crepitus, several days after discharge from hospital for an elective arthroscopic rotator cuff repair performed under general anaesthesia.

Immediate postoperative radiographs showed subcutaneous air near the operated shoulder which junior medical staff believed to be related to the arthroscopy.

Further investigations upon readmission revealed a posterior wall tracheal tear at the level of the carina most likely related to the documented difficult gum elastic bougie tracheal intubation.

The patient was referred urgently to a tertiary cardiothoracic centre for ongoing management and subsequently had a good clinical outcome. Had this rare complication remained undetected, the consequences may have been fatal.

## Discussion

Arthroscopic shoulder surgery is an increasingly common diagnostic and therapeutic procedure that is associated with a relatively low rate of complications (Weber et al, 2000).

The development of subcutaneous emphysema and other pulmonary complications following arthroscopy of the shoulder is extremely rare with very few documented cases. When it has been reported, the proposed mechanism of injury is always related to the shoulder surgery or local anaesthetic block, not to anaesthetic intubation itself.

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Lee et al (1992) hypothesized that during arthroscopy, air may enter the subcutis as a result of changes in pressure within the sub-acromial space. Low grade infection and delayed tissue healing at port sites have also been postulated as mechanisms by which surgical emphysema may appear (Deshmuckh and Shah, 2002).

Regional anaesthetic complications associated with shoulder arthroscopy have also been reported to cause subcutaneous emphysema. Interscalene brachial plexus blocks can cause inadvertent puncture of the prevertebral fascia causing subcutane-

ous and mediastinal emphysema (Calvisi et al, 2009), but the main anaesthetic complication causing this pathology is direct airway injury.

Post-intubation tracheal rupture is an extremely uncommon complication of elective intubation, with an incidence of 0.005–0.19% (Medina et al, 2009) and only 16 cases reported between 1966 and 1994 (Regragui et al, 1994).

Post-intubation tracheal rupture is most commonly seen in elderly women, and is associated with serious potential complications including subcutaneous emphysema, pneumothorax and respira-

## Case Report

A 68-year-old Caucasian woman, with a history of Crohn's disease, successfully treated breast cancer and well-controlled hypertension, was discharged from the orthopaedic ward 48 hours after an elective left-sided arthroscopic rotator cuff repair. The procedure was performed in the beach chair position, under general anaesthesia and the patient had a gum elastic bougie-assisted endotracheal intubation performed under general anaesthesia. The Mallampati score was class 3 and no regional anaesthesia was used.

The operative procedure was uneventful, but postoperatively the patient complained of left shoulder pain. A postoperative shoulder radiograph (*Figure 1*) showed some subcutaneous air near the operative site and this was attributed to the surgery. The patient's pain settled within 48 hours and she was discharged home with no other adverse clinical symptoms or signs.

Four days after discharge she was readmitted to hospital via the emergency department with sudden onset severe left-sided neck pain, swelling, difficulty swallowing and breathing. Clinical findings were subcutaneous crepitus and fullness around the left supraclavicular fossa and neck. A posteroanterior chest radiograph (*Figure 2*) revealed extensive subcutaneous gas in both supraclavicular fossae but no pneumothorax. Examination of the shoulder was unremarkable but for some expected discomfort on active movement typically found 8 days after rotator cuff repair surgery. There were no local or systemic signs of infection.

The possibility of a tracheal tear was investigated as the intubation had been documented as being difficult. Flexible laryngoscopy was performed on the ward which failed to demonstrate a proximal tracheal lesion. A subsequent computed tomography scan of the mediastinum and neck detected a 22 mm posterior out-pouching of the trachea at the level of the carina, beyond the reach of the fiberoptic scope, and extensive surgical emphysema extending from the chest to the inferior orbital margin and within the mediastinum.

The patient was transferred to a tertiary cardiothoracic centre where she underwent a flexible bronchoscopy, which confirmed a 'large tear' at the level of the carina, towards the right hand side (*Figure 3*). The appropriate management was deemed non-operative and consisted of intravenous antibiotics for 5 days and a soft diet, followed by oral antibiotics for 2 weeks until repeat bronchoscopy.

Surveillance bronchoscopy on day 6 showed clear progress with healing and she was discharged home on day 11. Two further surveillance bronchoscopies at 2 weeks and 3 months after discharge revealed the tear had healed with no subsequent stricture formation and she was discharged from cardiothoracic follow up.

Her recovery from the initial shoulder operation was substantially delayed by the complicated postoperative course, and at 6 months she was still struggling with normal postoperative rehabilitation.



**Figure 1. Postoperative radiograph showing surgical emphysema around the shoulder and in the supraclavicular fossa.**

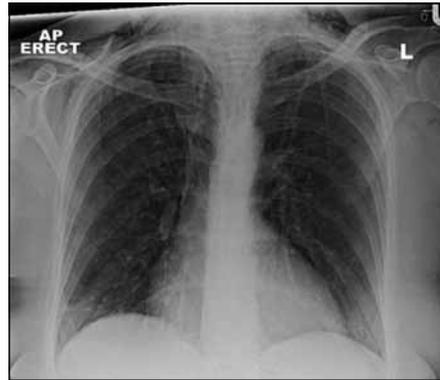
tory failure. It is associated with significant morbidity and an overall mortality of 22%. Increasing patient age and male gender are associated with increased mortality, as is delayed diagnosis. Emergency intubation is the principal risk factor, however, with a three-fold increased risk of death compared with tracheal rupture following elective intubation (Miñambres et al, 2009).

There have been many reported mechanisms predisposing to tracheal wall injury during intubation. Mechanical causes include over-inflation of the endotracheal tube cuff, multiple attempts at intubation, forced insertion of an over-sized tube, abrupt head and neck movements while intubated, repositioning the tube without deflating the cuff, coughing during intubation, and protrusion of the stylet from the endotracheal tube.

Anatomical factors include congenital tracheal abnormalities, weakness of the membranous trachea, mediastinal pathology causing distortion of the trachea and chronic airways disease (Harris and Joseph, 2000; Fan et al, 2004).

In the current case, the injury may have been exacerbated by use of a gum elastic bougie to aid intubation and subsequent tracheal injury. This is only speculation – the injury may have been caused by a combination of some of the above mechanical and anatomical factors.

Diagnosis of tracheal rupture is multifaceted. Clinical suspicion begins with symptoms such as breathlessness, difficulty swallowing, neck pain or swelling,



**Figure 2. Chest radiograph on readmission showing extensive surgical emphysema in supraclavicular fossae.**

Clinical signs include subcutaneous emphysema, respiratory insufficiency, pneumothorax and haemoptysis. Common radiological signs seen on plain radiographs include pneumomediastinum, subcutaneous emphysema and pneumothorax.

Bronchoscopy is required for diagnostic confirmation and to allow characterization of the type and extension of any laceration (Harris and Joseph, 2000; Miñambres et al, 2009). Flexible laryngoscopy may be inadequate (as was the case in this patient) because of its limited visualization of the trachea.

Management of tracheal wall perforation is controversial, although it appears that conservative management is associated with preferential outcomes compared with surgical intervention, particularly in those with small ruptures associated with minimal non-progressive symptoms and no respiratory difficulty (Medina et al, 2009; Miñambres et al, 2009). **BJHM**



**Figure 3. Bronchoscopy image showing defect at the level of the carina.**

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## LEARNING POINTS

- Following the development of pulmonary complications after shoulder arthroscopy, particularly subcutaneous emphysema, both anaesthetic- and arthroscopic-related variables must be considered in determining the cause.
- Following a difficult intubation, it may be of value to perform a chest and neck examination. The type of equipment used in intubation and details of any difficulties encountered should always be clearly documented.
- Patients undergoing an operation requiring general anaesthetic should always be warned about possible anaesthetic complications, with specific reference to airway damage.
- It is important to identify postoperative complications in the early stages following joint surgery. Delayed recognition and treatment can complicate postoperative physiotherapy and rehabilitation, prolonging the postoperative recovery period and increasing the risk of functional limitation and a poor outcome following surgery.