



Loop-Shaped Placement of Subcutaneous Drain for Extensive Subcutaneous Emphysema

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Abstract

Subcutaneous drain for extensive subcutaneous surgical emphysema is performed for patients, who are not adequately responsive to chest drainage on suction, especially those without lung collapse and sufficient space for placement of another chest tube in thoracic cavity. We describe the use of the minimally invasive drain with puncture needle, placement in a loop shape, puncture and division of the tunica muscularis, and use of a sustained suction bottle for extensive subcutaneous surgical emphysema.

Introduction

Although subcutaneous surgical emphysema is typically self-limiting with no life-threatening complications after lung resection, it is extremely uncomfortable for the patient because it extends into the neck and face, causing distress to the patient in the form of temporary visual impairment and neck tightness with dyspnea. Multiple methods of subcutaneous drain have been reported [1-4]. We report a new, minimally invasive method of subcutaneous drain with puncture needle, placement in a loop shape, and use of a sustained suction bottle for extensive subcutaneous surgical emphysema.

Technique

Subcutaneous drain for extensive subcutaneous surgical emphysema is performed for patients who are not adequately responsive to chest drainage on suction, up to -20 cm H₂O, without lung collapse and sufficient space for placement of another chest tube in the thoracic cavity.

After local anesthetic along the route of the subcutaneous drain, a 5-mm transverse skin incision was made at the anterior axillary line, lateral to the nipple; then, a 10-mm transverse skin incision was made at the midclavicular line, lateral to the axilla, and a 5-mm transverse skin incision was made at the level of the sternocostal joint, lateral to the nipple (Figure 1 and 2). Muscle layer was exposed at each skin incision. The muscle layer under each skin incision was punctured and divided by using a Pean Forceps to deair submuscular and muscle-layer emphysema. A 19-Fr drain with puncture needle was inserted between the subcutaneous and the muscle layer by using the puncture needle to pass through the incision at the anterior axillary line. It was pushed forward through the skin incision at the midclavicular line, passing between the subcutaneous and muscle layers, and then placed outside of the body from the skin incision at the midclavicular line (Figure 1A). The puncture needle of the drain was returned between the two layers through the skin incision at the midclavicular line; it was then pushed forward through the skin incision at the level of the sternocostal joint, passing between the two layers and placed outside of the body from the skin incision at the level of the sternocostal joint (Figure 1B). After the procedure, the drain was placed in a loop shape. This is similar to the technique required to make an artificial vascular shunt. The loop-shaped placement facilitated deairing of the wide area of the emphysema. After the puncture needle was cut, the skin incisions were sutured and the drain was connected to a sustained suction bottle (Figure 2).

The chest drain provided continuous suction and the subcutaneous drain also applied sustained negative pressure. After the air leak disappeared from the chest tube, negative pressure was not stopped in the subcutaneous drain suction bottle; thus, the patient's symptoms of subcutaneous emphysema were improved on chest X-ray examination. Therefore, the chest drain was removed first (Figure 3A, 3B). The subcutaneous drain was removed a few days later, as the subcutaneous emphysema had continuously improved.

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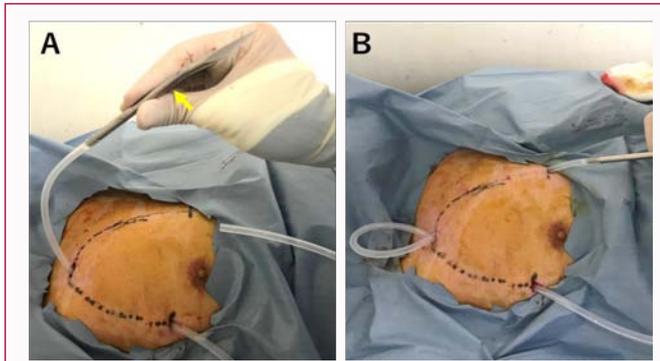


Figure 1: (A) Drain with puncture needle through the 5-mm skin incision at the anterior axillary line, lateral to the nipple, to the 10-mm skin incision at the midclavicular line, lateral to the axilla, passing between the subcutaneous and muscle layers (arrow indicates the puncture needle); (B) needle returned through the skin incision at the midclavicular line to the 5-mm skin incision at the level of the sternocostal joint, lateral to the nipple, passing between the subcutaneous and muscle layers.



Figure 2: View after placement of the subcutaneous drain (*indicates the chest drain and arrow indicates the subcutaneous drain and suction bottle).

Comment

Subcutaneous surgical emphysema occurs because of the tracking of air into subcutaneous tissue via the drain site and surgical wounds. Furthermore, development of extensive subcutaneous emphysema is frequently accompanied by a persistent air leak. Although chest drainage on suction is standard treatment for extensive subcutaneous emphysema, it is occasionally insufficient for symptoms of subcutaneous emphysema. Cerfolio et al. [5] reported that 33% of subcutaneous surgical emphysema patients exhibited recalcitrant subcutaneous emphysema, despite maximizing chest tube suction; they suggested that single-incision video-assisted thoracoscopic surgery with pneumolysis and chest tube placement was effective treatment that significantly shortened the duration of hospital stay for those patients. Boulemden et al. [2] reported that 67% of patients with extensive surgical subcutaneous emphysema exhibited associated prolonged air leakage; within 2 days, subcutaneous drain improved the symptoms of all patients with extensive surgical subcutaneous emphysema. Patients with extensive subcutaneous surgical emphysema who experience difficulty in the initial operation (because of severe pleural adhesion and/or pulmonary emphysema) have a high risk of complications in the second operation for subcutaneous surgical emphysema. The subcutaneous drain may be considered for management of extensive subcutaneous surgical emphysema before surgical treatment.

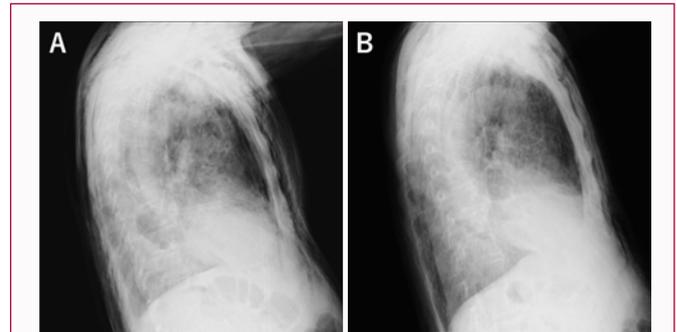


Figure 3: (A) Lateral view chest radiograph at the time of subcutaneous drain placement, which shows extensive emphysema without lung collapse; (B) chest radiograph at 10 days showing improvement of subcutaneous emphysema.

A few methods of subcutaneous drain placement for subcutaneous emphysema have been reported [1-4]. Sherif et al. [1] recommended a subcutaneous drain method that comprised Jackson-Pratt drains placed on each side of the midclavicular line with 15-mm skin incisions. Beck et al. [2] reported the use of two 14-gauge angiocatheters created fenestrations when inserted bilaterally into the chest subcutaneous space. Funakoshi et al. [4] suggested management of subcutaneous emphysema by the use of penrose drains. Here, we describe a new method of subcutaneous drainage for extensive subcutaneous surgical emphysema by the use of a 19-Fr drain with puncture needle, inserted between the subcutaneous and muscle layers. The puncture needle is useful for easy insertion between the two layers. Furthermore, the puncture and division of the tunica muscularis was effective for deairing the submuscular and intramuscular emphysema. In our technique, the loop-shaped portion of the subcutaneous drain can be placed in the wide space of the chest by using three small skin incisions to facilitate deairing of the subcutaneous emphysema.

In conclusion, we report a new, minimally invasive method for extensive surgical subcutaneous emphysema by use of the drain with puncture needle for subcutaneous drain, placement in a loop shape, puncture and division of the tunica muscularis, and use of a sustained suction bottle for extensive subcutaneous surgical emphysema.

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