

Recalcitrant Subcutaneous Emphysema: A Solution with A Simple Method

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Abstract

Objective: To report our experience in treating 10 consecutive patients with recalcitrant subcutaneous emphysema (SE) using two different types of subcutaneous drains.

Methods: A retrospective review of our experience in managing 10 cases of recalcitrant SE. The method that we employed consisted of creating a subcutaneous tunnelization of the pre-pectoral space, under previous local anesthesia, and inserting three Penrose drains (small rubber tubes) or a multifenestrated Argyle drain in the tunnels.

Results: The placement of the subcutaneous drains resolved SE in all 10 cases within a mean time of 5.3 days. No local or systemic complications were observed, but patients with the Argyle drain showed worse tolerance, presenting local pain that required treatment with additional analgesics.

Conclusion: The subcutaneous drain treatment of the recalcitrant SE is a simple, safe, and effective method that should be used in clinical practice for the better comfort of patients. In our series, Penrose drains were better tolerated than the multifenestrated Argyle drains.

Keywords: Air leak, emphysema, subcutaneous emphysema



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INTRODUCTION

Subcutaneous emphysema (SE) represents a frequent problem in thoracic surgery. It is caused by an air leak from the lung, causing accumulation of air in the subcutaneous tissues and creating a painless swelling of the skin. This migration of air is facilitated by many factors, including intermittently high positive intrapleural pressure, coughing, lung hyperinflation, inadvertent kinking or angulation of the chest drain, or by a combination of all four factors (1). Although it is rarely lethal, it causes esthetic deformity, anxiety, and voice alterations, all of which increase patient morbidity. It has the potential to compress both, the trachea and the great vessels, resulting in airway compromise, limiting venous return, and causing venous congestion of the head and neck (2). In rare cases, tracheostomy or intubation is required (3).

The method that we propose can be used to resolve the symptoms, esthetic consequences, and the loss of comfort that can affect patients following thoracic surgery. Recalcitrant emphysema leads to physical deformation that can sometimes even lead to patients not being recognized by their own family due to the excessive accumulation of air in the subcutaneous tissues of the face and neck. This ultimately causes anxiety and discomfort for both, the patient and their relatives.

Subcutaneous emphysema is considered recalcitrant when it progresses to cause esthetic deformity despite standard treatment, which includes the use of chest drains with high suction.

Several methods have been used to resolve recalcitrant SE, such as performing infraclavicular incisions, inserting subcutaneous drains with different materials, and increasing suction on a chest tube (4). All these methods have resolved SE in most cases, but vary in the level of aggressiveness and difficulty in their performance.

We report our experience in treating 10 consecutive patients with recalcitrant SE who were managed with a method that resulted in the clinical resolution of SE in all the cases. In the absence of a comparative study between the different methods, we choose the placement of subcutaneous drains as a simple, safe, less invasive, and effective method. The drains that we used were either Penrose drains (Redax, Poggio Rusco, Italy) or a multifenestrated Argyle drain (Medtronic, Dublin, Ireland).

The goal of the method proposed in this study is not to treat the cause of the SE, but rather to resolve the resulting clinical signs and symptoms that affect both, the length of admission and the perioperative morbidity.

METHODS

We retrospectively reviewed the experience of the Thoracic Surgery Department at the Fundación Jimenez Díaz University Hospital, Madrid, in managing 10 cases of recalcitrant SE.

The method we used consisted of creating a subcutaneous tunnelization of the pre-pectoral space, under previous local anesthesia, and inserting three Penrose drains (small rubber tubes) or a multifenestrated Argyle drain in the tunnels. To prevent the Argyle drains from coming off, we fixed them to the skin with a stitch, making sure to leave enough space for air drainage without blocking its way out (Figures 1, 2). The Penrose drains were moved daily to prevent their obstruction with blood clots. We explained to the family and the patient carers how to perform local massage twice a day to help air move through the subcutaneous space towards the drains.



Figure 1. Two Penrose drains located in the pre-pectoral space

The air leak that originated the SE was treated either with a chest tube in the pleural space or by placing an endobronchial valve. In these cases, the air leak is localized using the Chartist system (Pulmonx; Redwood City, CA, USA), which works by inserting a calibrated balloon into the selected bronchus to measure flow and airway resistance, enabling the detection of the exact site responsible for the leak. This is done by observing a decrease in the air leak through the water seal when the balloon is inflated. Once localized under direct vision, the valve is introduced through the working channel of the bronchoscope. Valve sizes range from 5–7 mm.

RESULTS

The mean age of the patients studied was 73.4 years (ranging from 41–91 years) (Table 1). The most frequent etiology was the presence of a prolonged postoperative air leak (7/10). The remaining three cases were caused by pneumothoraces secondary to multiple rib fractures, pacemaker implantation, and COPD exacerbation, respectively.

All patients had a chest tube in the pleural space to eliminate the air leak. In two cases, an endoscopic Spiration[®] valve (Olympus Medical, Tokyo, Japan) was placed in the pulmonary segment responsible for the air leak. Both these methods were insufficient by themselves to eliminate the SE and therefore, its consequences upon morbidity.

Due to the recalcitrant nature of SE, all 10 cases were treated with the insertion of a chest drain with a mean drain time of 9.4 days (ranging from 1–26 days). They were managed with the creation of three subcutaneous tunnels into the thoracic wall, followed by the placement of either Penrose drains (8/10) or a multifenestrated Argyle drain, which was the chosen material in the first two cases.



Figure 2. A closer view of the subcutaneous tunnel

Table 1. Summary of cases studied

Prolonged air leak	7 cases
Pneumothorax secondary to an exacerbation of COPD	1 case
Pneumothorax secondary to multiple rib fractures	1 case
Iatrogenic pneumothorax secondary to pacemaker implantation	1 case

COPD: chronic obstructive pulmonary disease

The average time prior to the placement of the drains was 2.8 days, and the mean time until resolution of SE was 5.3 days. There was no statistical difference in the time until resolution between the two drain types, determined using Mann-Whitney U test $p=0.85$ (SPSS software) (IBM.; New York, USA). The two patients that had the multifenestrated Argyle drains had worse tolerance to the treatment, presenting local pain that required treatment with additional analgesics. Massage of the area was performed daily in all the cases, and there was no local or systemic complication related to the subcutaneous drains.

DISCUSSION

Our study shows that the performance of subcutaneous tunnels, followed by the insertion of drains, is a simple, low-cost, and safe method for patients with recalcitrant SE. The method used in this study avoided repeating surgery as well as inserting additional chest drains, both of which often increase pain, morbidity, and may cause potential damage to the lung parenchyma.

There are many different types of drains that have been used for patients with recalcitrant SE, which have been reported in the literature (4). The differences between them may seem subtle, but they may result in clinical differences for the patients.

Sherif and Ott (5) described a case of SE that was successfully treated using a semi-rigid Jackson-Pratt drain. Similar results were achieved by other studies that described the use of micro drainage by inserting angiocatheters subcutaneously, and noticing a risk of occlusion after 3 days, which required drain replacement (6, 7).

Srinivas (8) and Ozdogan (9) described micro drainage with compressive massage. Both achieved rapid resolution of the SE without any complication.

Other authors recommend managing SE using the "gills" procedure, consisting of bilateral skin incisions over the clavicles (10) or alternatively, with the placement of VAC (11). In these cases, SE was effectively treated with local negative pressure therapy applied to a subfascial incision.

Cesaria (12) had already used the Penrose-type drains, and had performed a compressive massage that was used to assist the air drainage. Treatment was required for a mean of 3.5 days, and there were no complications.

Matsushita (13) used the technique described above by Cesaria (12), but adding a colostomy bag that was placed over the insertion site to prevent infection as well as providing measurement of the air drained, showing parallel results.

Intrabronchial placement of valves is helpful in cases that are not initially resolved by the placement of Penrose drains (14).

Our method was demonstrated to be efficient in draining the SE, using both, the Penrose and the Argyle drains, although we prefer the Penrose drain because it is less invasive and less painful to the patients. We also think that including daily massages of the affected regions to help air drainage is an easy-to-learn and effective maneuver that should be applied on a daily basis, which even the family

can perform after a quick lesson. The possible complications would be to provoke a local infection of the area and the obstruction of the catheter. None of them were present in our series.

The main limitation of our study is that it is a retrospective review, which reduces the obtention of clinical data. The patients were not randomized between the two types of drains that were used. Therefore, we cannot conclude that our method is superior to other methods.

With the available data and the results of our study, we conclude that the subcutaneous drainage of recalcitrant SE is a simple, safe, and effective method that should be used in clinical practice. In our opinion, Penrose drains are better tolerated than the multifenestrated Argyle drains. The superiority of each technique is debatable, but we found that the insertion of Penrose drains was at least as effective as other techniques. Future comparative and prospective studies should be performed in order to determine if one method is better than the rest.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Fundación Jimenez Díaz University Hospital.

Informed Consent: Verbal informed consent was obtained from patients who participated in this study.

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REFERENCES

1. Pompeo E. Multisite drainage of recalcitrant subcutaneous emphysema in thoracoscopic lung-volume reduction surgery. *J Thorac Cardiovasc Surg* 2013; 146: 722-4. [\[CrossRef\]](#)
2. Abu-Omar T, Catarino PA. Progressive subcutaneous emphysema and respiratory arrest. *JR Soc Med* 2002; 95: 90-1. [\[CrossRef\]](#)
3. Santalla M, Dacal R, Marcos P. Treatment with subcutaneous drainage in the pneumomediastinum and massive subcutaneous emphysema. *Arch Bronconeumol* 2013; 49: 127-8. [\[CrossRef\]](#)
4. Johnson C, Lang S, Bilal H, Rammohan K. In patients with extensive subcutaneous emphysema, which technique achieves maximal clinical resolution: infraclavicular incisions, subcutaneous drain insertion or suction on in situ chest drain? *Interact Cardiovasc Thorac Surg* 2014; 18: 825-9. [\[CrossRef\]](#)
5. Sherif HM, Ott DA. The use of subcutaneous drains to manage subcutaneous emphysema. *Tex Heart Inst J* 1999; 26: 129-31.
6. Beck PL, Heltman SJ, Christopher H. Simple construction of a subcutaneous catheter for treatment of severe subcutaneous emphysema. *Chest* 2002; 121: 647-9. [\[CrossRef\]](#)
7. Leo F, Solli P, Veronesi G, Spaggiari L, Pastorino U. Efficacy of microdrainage in severe subcutaneous emphysema. *Chest* 2002; 122: 1498-9. [\[CrossRef\]](#)

8. Srinivas R, Singh N, Agarwal R, Aggarwal AN. Management of extensive subcutaneous emphysema and pneumomediastinum by microdrainage time for a rethink? *Singapore Med J* 2007; 48: e323.
9. Ozdogan M, Gurer A, Gokakin AG, Gogkus S, Gomceli I, Aydin R. Treatment of severe subcutaneous emphysema by fenestrated angiocatheter. *Intensive Care Med* 2005; 31: 168. [\[CrossRef\]](#)
10. Kiefer MV, Feeney CM. Management of subcutaneous emphysema with "gills": case report and review of the literature. *J Emerg Med* 2013; 45: 666-9. [\[CrossRef\]](#)
11. Sciortino CM, Munding GS, Kuwayama DP, Yang SC, Sussman MS. Case report: treatment of severe subcutaneous emphysema with a negative pressure wound therapy dressing. *Jour Plastic Surg* 2009; 9: 1-7.
12. Cesaria A, Margaritora S, Porziella V, Granone P. Microdrainage via open technique in severe subcutaneous emphysema. *Chest* 2003; 123: 2162-3. [\[CrossRef\]](#)
13. Matsushita T, Huynh AT, Sing T, Thomson D. Management of life-threatening subcutaneous emphysema using subcutaneous penrose drains and colostomy bags. *Heart Lung Circ* 2007; 16: 469-71. [\[CrossRef\]](#)
14. Flandes Aldeyturriaga J. Tratamiento con válvulas endobronquiales en la fuga aérea prolongada. *Arch Bronconeumol* 2015; 5: 1-2. [\[CrossRef\]](#)