

Surgical Treatment of Subcutaneous Emphysema. In Which Cases?

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Abstract

Introduction: Subcutaneous emphysema is generally a benign condition treated conservative. Yet, several cases that surgical management is also reported in the literature.

Aim: The present study identifies the characteristics of the cases managed surgically.

Methods and Material: We conducted a literature search in Pubmed database, in order to find out the general characteristics of the surgical treated cases of subcutaneous emphysema and to record the type of intervention chosen.

Results: The search revealed information about 104 cases, mostly men in post-operative period. Two main method are chosen – subcutaneous drain and/or infraclavicular incisions; with several modifications. Despite the severity of emphysema in the majority of cases, very low fatality is reported.

Conclusion: Surgical management of subcutaneous emphysema is a relative safe option; thus, it should be considered early in such conditions.

Keywords: Subcutaneous emphysema; Surgical therapy

Introduction

Subcutaneous emphysema (SE) refers to air in the subcutaneous tissues. Clinical manifestation is generally benign, yet in several cases it can provoke serious complications such as airway compromise, respiratory failure, pacemaker malfunction and tension phenomena.

Treatment is usually aims at the underlined cause, while the air is gradually absorbed from interstitial tissues. However, in extensive cases, surgical intervention may also needed [1]. Moreover, when subcutaneous emphysema causes progressive

dyspnoea, definitive airway management with tracheostomy may be required [2].

The present article consists of a short literature search about the different surgical techniques used for the management of extensive subcutaneous emphysema. They only review know today (2017) concludes that infraclavicular incisions, drain insertion and increasing suction on an in situ drain are all good choices [3]; and still there is no comparative study of any kind about the subject [4].

We hereby try to detect the characteristics of those cases that were managed surgically.

Method

A literature search was conducted for the terms “subcutaneous emphysema” (MesH terms) and “therapy” (MesH terms) and “surgical” (MesH terms)” in PubMed Meshable (112 results) [5-8]. As inclusion criterion surgical intervention for the SE was used. Articles with therapeutic measures for other comorbidities (like e.g. Pneumothorax) that may have also improved secondary SE were excluded; thus only 27 papers were included for further review [9].

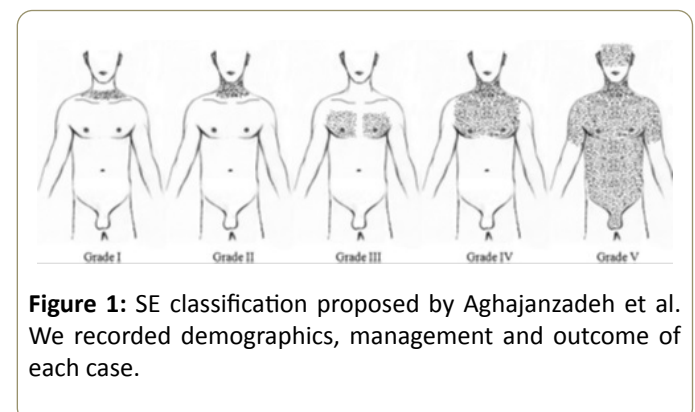


Figure 1: SE classification proposed by Aghajanzadeh et al. We recorded demographics, management and outcome of each case.

We used SE classification of Aghajanzadeh et al. 3 for characterisation of SE. They divided SE in five grades: including the (1) base of the neck, (2) all of the neck area, (3) subpectoralis major area, (4) chest wall and all of the neck

area, and (5) chest wall, neck, orbit, scalp, abdominal wall, upper limbs, and scrotum (Figure 1).

Results

The search revealed some interest findings. While there were reported 104 cases in total, the mean age was 51 yrs old (range: newborn-82 yrs) and the vast majority of them were male patients (85 cases or 88.4%). In the majority of the cases, SE took several hours to occur (12-24 h) after the supposed cause-incident. The latter may be related with the fact that, most of the cases (56 or 58.4%) were post-operative

complications [10,11]. The other two major causes were trauma (16 cases) and mechanical ventilation (14 cases).

According to Aghjanzadeh et al. [3] SE classification, the majority of cases considered grade V SE, while apart from the SE, other co-existing conditions/complications reported were pneumothorax (PTx), pneumomediastinum (PM), abdominal compartment syndrome (ACS) and one case with cardiac arrest (CA) (Table 1). Interestingly, fatality is reported in only one case, regarding a 77 year old male patient with tension SE during laparoscopic surgery treatment of colon cancer [5]. For the rest of the patients, clinical improvement period varied.

Table 1: Type of SE cases.

References	Type	Grade			Co-ex.	Impr.
		V	IV	III	Cond.	Period
[4]	21 Surgical	16	5			19:24 h
						2:48 h
[3]	11 Trauma	11	12	12		
	3 Barotrauma*					
	9 Surgical					
	12 COPD					
	pneumothorax					
[5]	1 Surgical	1			PTx	
[6]	1 foreign body aspiration	1			PM	24 h
[7]	1 Trauma	1				48 h
[8]	1 MV	1			PM, PTx	16 d
	(Lung cancer)					
[9]	1 Accidental chest tube removal	1			PM	48 h
[10]	1 Duodenal ulcer rupture	1			PM,	immediate
					CA	
[11]	1 Traumatic delivery			1	PTx,	12 d
[12]	1 Tracheal trauma		1			6 d
[13]	1 Surgical	1			ACS	3 d
[14]	6 Surgical	1	2	3	RSE	2 : 12 h
						1 : 24 h
						3 : 48h
[15]	10 Barotrauma (MV*)	10			8 PTx	7.5 d
						(mean)
[16]	1 COPD	1			PM	8 h
[17]	1 COPD	1			PM	5 d
[18]	2 Trauma	2			PTx, PM	12 h
[19]	1 Surgical (dental)			1		6 h
[20]	2 Surgical	2			PTx	3 h

[21]	1 Surgical	1				PM	24 h
[22]	1 COPD	1					3 d
[23]	12 Surgical	12					1-3 d
[24]	1 Surgical (dental)	1					2 d
[25]	1 Surgical (cardiac)	1					

*Mechanical ventilation; Coex. Cond: Coexisting conditions; Imp. Period: Improvement period.

Surgical management includes a variety of methods and devices/materials used. The commonest two interventions reported is placement of subcutaneous drains (SBD) (uni~ or bilateral) or performance of infraclavicular incisions (ICI) (**Table 2**).

The size preferred for the drain tube is usual >24 Fr. Other methods, such as submandibular incisions [12-19] or liposuction [20] are more also mentioned. Application of continuous negative pressure is also a suggested method for

speeding up the recover process. The location of the incisions varies, even if in generally, the mid-clavicular line is preferred. Wide angiocatheters (14G) and central venous catheter (CVC) have also been used as drain materials [21].

Finally, scarce data are provided for possible complications of the interventions applied. Haemorrhage, insufficient drain positioning depth and problems with occlusion of incision are reported only in one paper [3].

Table 2: Intervention reported in the literature.

Reference	SBD	ICI	Comments/other methods
[4]	14 unilateral (>24 Fr)		
	7 bilateral		
[3]	22 unilateral	35 bilateral	
	13 bilateral		
[5]		1 bilateral	
[6]	1 unilateral		
[7]			Sutures revised
[8]	1 bilateral	1 bilateral	
[9]			Fenestrated 14G angiocatheter bilateral, 2 cm lateral to midclavicular line at the level of the third rib, with suction
[10]			bilateral horizontal slits ~3 cm long over the clavicle, into the fascia ("gills")
[11]			Surgical ENT procedure
[12]			2 submandibular incisions
[13]		4 "blowholes"	
[14]			Multifenestrated drainage silicone tube just under ports
[15]		10 +NP	
[16]			Scalpel-Fenestrated CVC subcutaneous at mid-clavicular line, 2nd intercostal spaces
[17]	1 right SBD		
[18]		2	
[19]			1 submandibular incision
[20]			2 Liposuction

[21]			14G angiocatheter with spiral fenestration, mid-clavicular, over 3rd rib at 45° 0.5-1 cm depth, compressive massage
[22]			2 14G fenestrated angiocatheter
[23]			12 14G fenestrated angiocatheter
[24]			Bilateral pectoral incisions
[25]			Bilateral Penrose drains and colostomy bags
*NP: Negative pressure.			

Conclusion

It seems that men suffer more often from a SE that may need surgical intervention. Whether this is related with the causing factor (e.g. trauma) of SE or gender can be considered per se as a risk factor is not clear [22-24]. The same is also valid or the severity of SE. Most interventions are performed when SE reached grade V. The latter may related to the clinical manifestation of such condition (e.g. respiratory distress). And even though the fatality reported is very low, one can't claim that not choosing surgical treatment earlier is not a more prudent management [25].

On the contrary, thing are more clear regarding the interventions that one can apply to "release" SE. It seems that all reported methods work. Unfortunately, there is no reliable comparison study, so as to identify the best method; neither we have any large series study published about possible complications of each method [26]. Larger studies are needed to definitely come to safe conclusions. Yet, till then, surgical management of SE, is something that clinician should have in mind early in the management of such conditions [27].

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