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Brief Communication or Correspondence

Necrotizing Chest Wall Fasciitis Complicating Closed Tube Thoracostomy: Can It Be Avoided?

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Necrotizing fasciitis (NF) remains a life-threatening surgical condition. In its classical form, NF usually involves the extremities. The underlying causes are usually related to trauma or minor injuries. The infectious process usually affects the deep fascial plane, with secondary necrosis of subcutaneous tissue and skin caused by the thrombosis of the subcutaneous and perforator vessels. The muscles are involved in the infectious process; however, myonecrosis typically rarely occurs.

We read with great interest the recent article by Chun et al. [1], who presented their experience with the management of a patient with massive chest wall fasciitis complicating empyema after the insertion of a chest tube. We congratulate the authors for their superb work and excellent results. However, we have some comments and would like to share our insights on the management of this case.

A MEDLINE search retrieved 7 reported cases of chest wall NF complicating tube thoracostomy [1-5] (Table 1). Pleural empyema was a common denominator in almost all reported cases. One patient had pulmonary tuberculosis, and according to the authors, tube thoracostomy was inserted for spontaneously developed pneumothorax; however, chest radiography showed obliteration of the costophrenic angle with air-fluid level [4]. When available, the bacteriological studies showed that the microorganisms isolated from the pleural fluid were also present in the chest wall purulent materials. These data support our concept that the source of infection is the empyema, rather than an external source introduced from thoracostomy tube insertion. Moreover, some cases of chest wall NF complicating empyema were reported before the insertion of the drainage tube; some sort of empyema necessitans must therefore have initially developed and then progressed to NF.

A possible mechanism for the development of pneumonia, lung abscess, and subsequent pleural empyema is the aspiration of infected debris from the mouth or secretions from the upper gastrointestinal tract. Abundant aerobic and anaerobic organisms are present in the normal flora of the mouth, gingival crevices, upper respiratory tract, and gastrointestinal tract. These mixed aerobic and anaerobic organisms have strong proteolytic activity and act in synergy to produce liquefactive necrosis of the affected tissue, whether in the lung or the chest wall tissue. These organisms are aggressive and are capable of producing pneumonia (if not primary lung abscess) with a high incidence of pleural involvement. The resulting pleural inflammatory process is usually severe and has a rapidly progressive course.

In our experience, during decortication in many cases of empyema thoracis, we observed the presence of ruptured small superficial abscesses (pustules) with resultant pyo-pneumothorax and bronchopleural fistula (Fig. 1). The isolation of *Streptococcus constellatus* (which is a normal component of the mouth flora) and anaerobic organisms from the pleural fluid of the reported case of Chun et al. [1] supports this pathogenesis theory.

The technique of closed tube thoracostomy insertion en-

Table 1. Reported cases of chest wall necrotizing fasciitis secondary to tube thoracostomy

Author	Patient sex	Age (yr)	Pathology	Comorbidities	Time of diagnosis	Organisms in pleura	Organisms in chest wall	Surgical management	Outcome
Pingleton et al. [2] (1983)	Female	36	Empyema	Smoking and ethanol consumption	Suspected on the 4th day	*Bacteroides, S. viridans, Streptococcus* group C	None	Incision and drainage (delayed)	Died on the 10th day (sepsis)
Chen et al. [3] (1992)	Male	63	Empyema	Lung cancer and obstructive pneumonia	3rd day	*Enterococcus* group D	*Enterococcus* group D and *Bacteroides*	None	Died on the 5th day (sepsis)
Chen et al. [3] (1992)	Male	77	Empyema	Not mentioned	3rd day	*E. coli; Bacteroides buccae*	*E. coli, Bacteroides, Staphylococci, Enterococcus* group D	Debridement (twice)	Died on the 24th day (ventricular tachycardia)
Chen et al. [3] (1992)	Male	68	Empyema	COPD	3rd day	*Pseudomonus aerogenosa, Serratia marcescens, Bacteroides*	Notavailable	None	Died on the 22nd day (sepsis)
Hsu et al. [4] (2006)	Male	46	TB; pneumothorax[a]	DM	5th day	*S. viridans, Klebsiella pneumoniae*		Debridement (twice)	Recovery
Sokouti et al. [5] (2016)	Female		Empyema; perforated esophagus	None	NR	NR	NR	Debridement (twice)	Recovery
Chun et al. [1] (2020)	Male	69	Empyema[b]	DM; distant history of stroke		*S. constellatus*, an anaerobe	*Acinetobacter baumannii* complex	Debridement, and negative-pressure dressings	Recovery

S. viridans, Streptococcus viridans; *E. coli, Escherichia coli*; COPD, chronic obstructive pulmonary disease; TB, tuberculosis; DM, diabetes mellitus; NR, not reported.
[a]The chest X-ray presented in the paper showed obliteration of the costophrenic angle with air-fluid level. [b]The chest X-ray presented in the paper showed pyo-pneumothorax with air-fluid level.

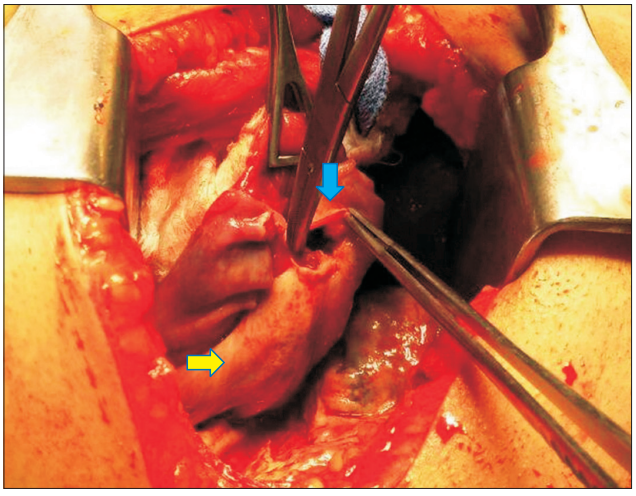

Fig. 1. Operative view showing a ruptured superficial small abscess (blue arrow) and fibro-purulent membrane covering the lung (yellow arrow).

tails blunt dissection of the intercostal muscles deep to the pleural space. In addition to opening the fascial planes during dissection, the opening in the intercostal space may be wider than the diameter of the catheter, with subsequent leakage of pleural fluid around the catheter. This leakage provides access for organisms to reach the chest wall with subsequent formation of a submuscular abscess or NF depending on the virulence of the pathogenic organisms. Clamping the intercostal tube for any reason increases the likelihood of this outcome. Therefore, we do not advise clamping the thoracostomy tube in cases of empyema thoracis, as the lung collapse is usually of short duration and the possibility of pulmonary edema upon re-expansion is relatively low.

The insertion of a small-bore catheter is a good alternative to ordinary tube thoracostomy; using the Seldinger technique during insertion makes the opening in the inter-

costal space just sufficient to accommodate the desired catheter and may eliminate the risk of purulent fluid leakage into the inter-muscular and the subcutaneous planes. The drawbacks of the catheter's small lumen and liability to obstruction by thick pus can be overcome by using a catheter larger than 12F, in addition to frequent flushing of the catheter with normal saline.

Rib resection drainage is seldom performed nowadays for the management of empyema, but it was used frequently during the early era of thoracic surgery. It has the advantages of making it possible to break the loculation, clean the empyema cavity, and adjust the drainage tube in the most dependent position. In this procedure, it is advised to keep the skin opened or just approximated with wide sutures to allow drainage of leaking purulent materials to the outside and to prevent submuscular or subcutaneous collection.

In summary, in cases of chest wall NF complicating thoracostomy tube placement, unlike NF of the extremities, the source of infection is usually from the pleural space. The use of a small-bore catheter or minimal dissection during ordinary closed tube thoracostomy and the avoidance of tube clamping are important tools to avoid chest wall NF related to pleural drainage. Needless to say, aggressive control of general predisposing factors, together with early recognition and prompt management of infection, is also of paramount importance.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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