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Review Article

Septated Pleural Effusion and the Thin Line between Medical and Surgical Management

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Received: August 02, 2021; **Published:** October 27, 2021

Abstract

Septated or loculated pleural effusion can develop due to multiple pleuro- pulmonary etiologies. With increased use of bed side ultrasound early identification of septated effusion is increasing. Septated pleural fluid collections may be treated by thoracentesis, closed thoracostomy tube drainage, pleuroscopy or Video assisted thoracoscopic drainage, or surgical thoracotomy and decortication. If identified early a combination of drainage with fibrinolysis can be used to avoid surgical referrals..

Keywords: *Pleural Effusion; Septation; Fibrinolysis*

Introduction

Pleural effusions have long been classified as exudate and transudate on the basis of pleural fluid analysis, as defined by famous Lights criteria proposed by Dr. Richard W light [1]. Lately ultrasound of chest is emerging as an important and efficient modality in identifying various pleural pathologies. It is becoming evident that sonography of the chest not only has diagnostic and therapeutic significance, it can also provide important insights regarding prognosis of the effusion [2]. Sonographically pleural effusions can be anechoic, homogenously echogenic, complex septated and complex non septated [3]. Septated pleural effusion can develop due to a number of common pulmonary etiologies. A septated effusion is characterized by presence of thin deposits of fibrin in the pleural fluid that divides it into multiple compartments it represents the fibrinopurulent stage of a developing empyema [4]. Here we review the common causes, diagnostic options and management of septated pleural effusion.

Etiology

Septations are thin fibrin deposits that divide the pleural cavity into a number of compartments. These septations are a product of activation of coagulation cascade, this was demonstrated by Chung., *et al*. when they found an elevated level of Plasminogen activity inhibitor type 1 in patient who showed sonographic evidence of septations on repeated thoracocentesis [5]. These septations can later on develop into fibrinous adhesions through activation of fibroblasts.

Conditions that lead to inflammation in the pleural cavity and activation of the coagulation cascade are commonly considered as causes of septated pleural effusion. Most common causes of septated effusion are bacterial infection and tuberculosis (TB) pleurisy especially in

TB endemic countries [6]. Moreover, with improved survival and diagnosis, malignant pleural effusion is emerging to be a very important cause of septated pleural effusion. Needless to say all septated pleural effusion are found to be exudative in nature [7].

Diagnosis

Ultrasound is the diagnostic modality of choice for identification of septations in pleural cavity. 4A study compared Ultrasound vs CT scan vs chest roentgenogram in the identification of complicated para pneumonic effusion and found that pleural ultrasound had a sensitivity of 69.2% (95% CI 48.2% to 85.7and specificity of 90.0% as compared to Chest CT with a sensitivity of 76.9% and specificity of 65.0% and CXR had a sensitivity of 61.5% and specificity of 60.0%. Hence indicating ultrasound to be superior modality [8].

Septations appear as hyper echoic bands in the pleural cavity in an ultrasound but can be missed by a CT scan as demonstrated in figure 1 and 2.

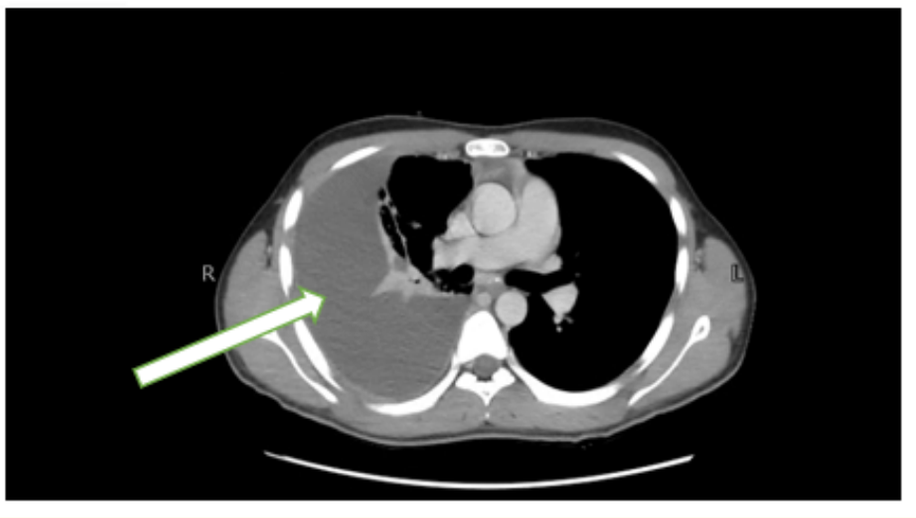

Figure 1: *CT scan chest with contrast mediastinal window showing right sided effusion in form of as single cavity (Arrow).*

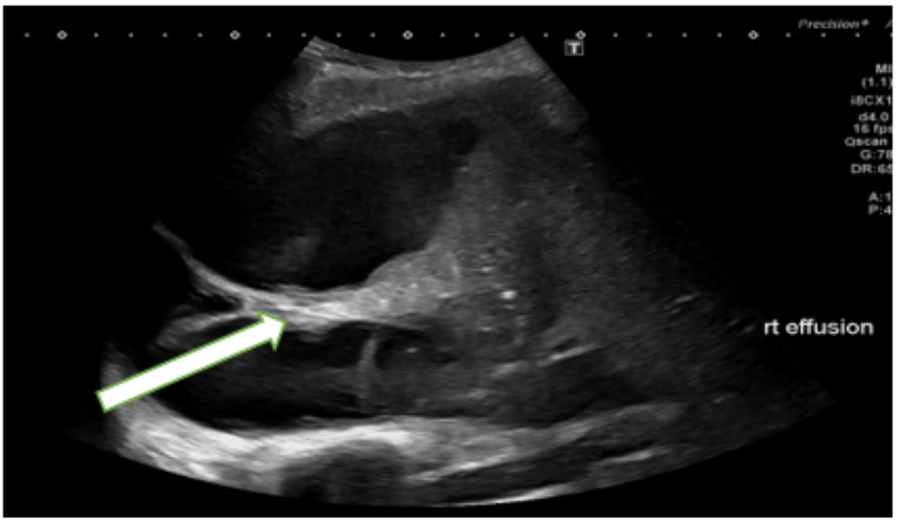

Figure 2: *Ultrasound chest of the same patient showing multiple thick septations (Arrow).*

Treatment

The rule of treatment of underlying cause does not suffice for complicated effusion, and the effusion itself requires additional interventions. Surgical intervention with open or video assisted thoracoscopy is considered as the gold standard of treatment. The quest for identifying non-surgical modalities has led to a number of off label interventions worthy of mention. The need of non-surgical interventions is especially important in terminally ill patients not fit for surgery and also to avoid the morbidity associated with invasive surgical procedures.

Tube thoracotomy and indwelling pleural catheters

Drainage is the key to the management of complicated pleural effusions. Tube thoracotomy and indwelling pleural catheters remain the mainstay of treatment for free flowing effusions however data suggests that these techniques when used as sole therapy fail to drain septated effusions and need to be coupled with other modalities like fibrinolysis or surgery for management [9,10].

Fibrinolysis

Considering the underlying mechanism of activation of coagulation cascade, number of fibrinolytic agents have been studied in treatment of septated effusions. These include streptokinase, urokinase, Tissue plasminogen activator and DNase. Most of the studies are done in setting of para pneumonsic effusion and empyema.

Streptokinase and urokinase

Streptokinase is a protein produced by beta hemolytic streptococci that directly binds to plasminogen and forms a complex that activates fibrinolysis [11]. Urokinase on the other hand is physiologic thrombolytic agent produced by renal parenchymal cells and, it cleaves plasminogen and causes activation of thrombolysis [12].

In 2019 a Cochrane review on fibrinolytic therapy in pleural empyema reported a decrease in requirement of surgical intervention and treatment failure but failed to demonstrate any mortality benefit [13].

n a trail comparing streptokinase with urokinase it was found that both could be effective adjunct therapies however urokinase was agent of choice as streptokinase was associated with allergic reactions and higher cost [14].

Three major trails have been found in literature regarding use of thrombolysis in septated malignant effusions using either streptokinase or urokinase with placebo. All of the studies demonstrated a decrease in amount of effusion with use of fibrinolysis however none of them reported improvement in dyspnea [15-17].

Tissue plasminogen activator (TPA) and DNase

TPA is a naturally occurring protein produced by endothelial cells. It activates plasminogen and lead to fibrinolysis. DNase is a human recombinant enzyme that breaks DNA in tissue and, it has been used as a mucolytic agent. The ground breaking MIST 2 trial demonstrated that only the combination of DNA and TPA lead to significant benefit in as compared to either on used alone. Similar results have been reported in a multicenter observational study using a combination of TPA and DNase [18,19].

Various doses of TPA and DNase have been used in literature but the consensus dose is considered to be 10 mg of TPA and 5 mg of DNase twice daily. A dose of TPA greater than this is associated with increased risk of bleeding [20].

In a study with 97 patients with malignant pleural effusion and a non draining pleural catheter it was found that use of TPA lead to restoration of flow in 86% of cases after first dose [21].

Medical thoracoscopy and fibrinolysis

There is limited data on the use of medical thoracoscopy in treatment of septated effusion. One study compared Early medical thoracoscopy with fibrinolytic therapy and found the former to be non-inferior to fibrinolytic therapy [22].

Surgical management

Surgery is considered to be gold standard for treatment of septated effusions. When compared with simple tube thoracotomy as first procedure in 104 patients by Wozniak., *et al*. it was found that surgery was superior in terms of resolution of empyema and sepsis and need of subsequent procedure. Similar results have been shown in a number of studies [23]. However, in a recent meta-analysis comparing surgical versus nonsurgical management of pleural empyema showed no mortality benefit of surgery over non-surgical methods. Video assisted thoracoscopy however did decrease the length of hospital stay [24].

When comparing various modes of surgical intervention, minimally invasive surgery through Video assisted thoracoscopy is preferred as it is associated with less morbidity and time of recovery [25].

Conclusion

Septated pleural effusions present a transition state between medically manageable simple effusion and loculated effusions. Both infective and non-infective etiologies can lead to development of septations in pleural fluids. Early identification with the help of an ultrasound can provide a chance at medical management with fibrinolytic agents and prevent surgery.

Disclosure Statement

The authors report no conflict of interest.

Funding Source

None.

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Volume 10 Issue 11 November 2021