

**Article type: Ultrasound Corner**

**Title: A patient with effusion undergoing pleural biopsy**

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## Case Description

A 59 year-old female patient presented with acute right sided chest pain, dry cough and dyspnea. Initial blood work-up revealed leukocytosis with neutrophil predominance. Her D-dimer levels were elevated. A computed tomography (CT) pulmonary angiography ruled out the presence of pulmonary embolism but revealed right-sided partially encysted pleural effusion associated with pleural thickening and bilateral multifocal lung consolidations (figure 1). A sample of the pleural fluid was aspirated and physically it was yellowish and slightly turbid. Biochemical analysis of the pleural aspirate showed it to be an exudate with glucose level of 43.2 mg/dl and LDH level of 1,286 IU/L. Bacterial culture and smear for acid fast bacilli returned negative.

Given the possibility of pleuro-pulmonary tuberculosis and the non-conclusive test results, an ultrasound (US) guided cutting-needle pleural biopsy was conducted. US confirmed the presence of effusion and lung consolidation (asterisk and arrowhead respectively in figure 2). In the routine pre-procedure scan, Doppler examination of the intercostal space where the biopsy was planned did not detect any unhidden intercostal vessels. Following the second needle biopsy, a plume of echogenicity was seen to arise from the site of pleural puncture (video1).

What does the video show and how to proceed?

At the centre of the image echogenic shadows are seen propagating from a point at the deepest part of the pleura which is very suggestive of bleeding from the parietal pleura. Doppler examination confirmed pleural bleeding (see panel B in figure 4). Finger external compression on the biopsy site was performed for two minutes and subsequent US examination confirmed that the bleeding had stopped. A globular echogenic thrombus was noted at the bleeding site (hollow arrow, figure 3). The authors' explanation for this image was that formed thrombus assumed such a conformation due to the presence of fine septations in the pleural fluid (solid arrow, panel B) which likely permitted tamponade of the bleeding site. In order to confirm

this, a few mls of agitated saline were injected into the thrombus via a tuohy needle. The echogenic air bubbles did not float into the adjacent fluid but rather remained confined inside the thrombus confirming the presence of fine septations, likely contributing to limitation of blood spillage into pleural cavity thus creating thrombus subsequently tamponading the site of bleeding(video 2).

## **Discussion**

US guided pleural biopsy is a sensitive test to diagnose pleural disease, particularly in tuberculosis where the pleura is diffusely affected.<sup>1</sup> In complex pleural spaces – a situation similar to the presented case- US guided pleural biopsy is preferred to medical thoracoscopy which is challenging in the presence of extensive adhesions and where the lung is expected to be tethered to the chest wall. It has been shown that US-guided cutting needle biopsy has good sensitivity in patients who were planned for thoracoscopic pleural biopsy but the lung failed to sufficiently collapse thus making thoracoscopy unsafe.<sup>2</sup> In this case, the presence of effusion encystment was highly suggestive of failure of thoracoscopy.

US guided cutting needle pleural biopsy is a generally safe technique with good yield. Besides pain and infection, intra-pleural bleeding is among the commonly reported complications.<sup>3</sup> Proper antiseptic techniques, generous anesthesia and careful pre-procedure planning are necessary to avoid such complications in most of the situations. In particular, meticulous inspection of the targeted intercostal space for the intercostal artery using Doppler technique is of utmost importance.<sup>4</sup> US aids in choosing the biopsy site when pleural involvement is focal. Where there is diffuse pleural involvement biopsies are usually taken at the mid-axillary or posterior axillary lines where the intercostal bundle coursing the space is typically hidden below the above rib. It has been shown, however, that the course of the intercostal artery is variable between individuals, particularly in older adults.<sup>5</sup> Many of the patients who require therapeutic pleural interventions are among this age

group which makes routine US inspection of the intercostal space before needle puncture a valuable practice.<sup>6</sup> Real-time US guidance during needle insertion and biopsy acquisition is very useful both for safe execution of the procedure and accurate sampling.

Studies have shown that chest physicians performing thoracic US are competent in delineating aberrant and vulnerable arteries when US examination is conducted before invasive pleural procedures<sup>7</sup> (panel A, figure 4). In the event of suspected bleeding, Doppler examination can easily prove or rule out such complication. A unidirectional Doppler flow is seen to arise from a distinct point in the pleura (panel B, figure 4). In the presented case, the bleeding was inconsequential, in part, due to the avoidance of large vessels. The injured vessel was probably a small branch.

Post-biopsy pleural bleeding is seen fairly commonly and can potentially lead to life-threatening hemorrhage due to the fact that the pleural space can accommodate more than four liters of fluid without effective tamponading which theoretically can lead to exsanguination.<sup>8</sup> Fortunately, this occurs very rarely. Direct compression on the bleeding site is sometimes sufficient for control of bleeding, and septated pleural spaces are probably less likely to result in large volume bleeds. More brisk bleeding occasionally is seen, and US can help pick up such bleeding and expedite management. Such bleeding requires either coiling of the bleeding intercostal artery by interventional radiology<sup>9</sup> or formal surgical repair via thoracotomy.

## **Reverberations**

- In experienced hands, US-guided cutting needle biopsy is a sensitive test to diagnose pleural diseases

- Ultrasound examination is indispensable for safe execution of invasive pleural procedures
- Routine Doppler examination of the targeted intercostal space improves the safety of pleural procedures and guards against inadvertent intercostal artery laceration
- Pleural bleeding can potentially be fatal. Timely identification by ultrasound is essential for proper and prompt management

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### **Figure captions**

Figure 1: CT pulmonary angiography, mediastinal window shows right side consolidation with effusion.

Figure 2: Thoracic ultrasound shows pleural effusion (asterisk) and consolidated lung (arrowhead)

Figure 3: Post bleeding ultrasound image shows echogenic thrombus (hollow arrow), fine septa (solid arrow) and consolidated lung (arrowhead)

Figure 4: A. Doppler shows course of the intercostal artery at the deepest layer of the chest wall B. Homogeneous plume of Doppler flow away from surface denoting blood spurting

### **Video description**

Video 1: Pleural bleeding is seen at the centre of the image as echogenic shadows propagating from a point at the deepest part of the pleura

Video 2: Tuohy needle is seen as a hyper-echoic line traversing the chest wall and ending inside the formed thrombus. Few air bubbles are seen to come out of the needle tip with little movement beyond the tip denoting probable incarceration with fibrous septation.