Artificially induced pneumothorax for diagnosis of pleural nodules

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SUMMARY

Obtaining biopsies of pleural nodules in suspected malignancy is crucial for prognosis and treatment planning. Diagnosing cases of dry pleural dissemination (nodules without associated effusion) presents a significant challenge, as the absence of fluid impedes accurate biopsy acquisition due to reduced visual field and potential lung parenchyma injury. Our case highlights a unique instance of artificially introducing a pneumothorax in a patient with dry pleural dissemination, to obtain accurate biopsies of multiple pleural nodules by enhancing surgical visibility and reducing complications.

INTRODUCTION

Pleural nodules are generally associated with a pleural effusion and are diagnosed via local anaesthetic thoracoscopy (LAT), utilising the fluid to facilitate trocar insertion and obtain multiple accurate biopsies. However, rare cases of pleural nodules without any associated effusion, known as dry pleural dissemination (DPD), present challenges due to the inability to safely obtain biopsies in the absence of fluid. In the past, these patients were subjected to open surgeries under general anaesthesia for biopsy acquisition, posing risks especially to patients with comorbidities.[1,2] Ultrasound-guided pneumothorax induction offers a solution to this problem, facilitating real-time visualisation and safe trocar insertion for biopsy acquisition. This case report highlights a rare case of a patient with dry pleural dissemination requiring biopsy of multiple pleural nodules, obtained by inducing a pneumothorax under local anaesthesia.

CASE PRESENTATION

A 73-year-old male with a history of type 2 diabetes, hypertension and a 30-pack year smoking history, presented to the clinic with complaints of chest pain for the last 1 month. He described the pain as “sharp and shooting” and had associated loss of weight (5 kg) and appetite over the last 1 month. He had no complaints of breathlessness, fever or cough with haemoptysis. Chest X-ray was normal, prompting further investigations with a computed tomography (CT) scan which showed multiple irregularly dispersed pleural nodules of various sizes in the costal pleura with no lesion in the lungs (Figure 1).

The decision was made to biopsy the nodule with the help of pleuroscopy for definitive diagnosis. Vitals on admission were within normal limits, and chest examination revealed normal vesicular breath sound. He was premedicated with IV fluids, IV antibiotics (ceftriaxone) and other supportive medications. The risks and benefits of the procedure were explained to the patient, and after consent was given, he was posted for pleuroscopy with biopsy.

The patient was kept under moderate sedation in the right lateral decubitus position, premedicated with 1 mg midazolam and 25 mcg of fentanyl. A bedside ultrasound was done to localise the point of entry along the mid axillary line in the safe triangle. The fully expanded lung was demonstrated by the presence of the sliding sign at the site of entry. The ultrasound probe was covered with a sterile cover for real time induction of pneumothorax. A 20 cc syringe filled with 2 % lignocaine was used to infiltrate the skin, followed by subcutaneous tissue and the deeper muscles. We gradually pushed the 21-gauge into the pleural space till we touched the lung and saw no more sliding sign, thereby inducing a pneumothorax.

The syringe was changed to a 50 cc bigger syringe prefilled with air with the same 21-gauge needle. The needle followed the same tract of entry and once the pleural line (where the sliding sign is absent) was reached, air was slowly pushed into the pleural space (Figure 2-A, B, C, D). The procedure was repeated 5 to 6 times, allowing for sufficient air to push the lung down to avoid injury during the blunt dissection. We then made a 2 cm incision with a scalpel at the site of entry followed by gentle blunt dissection. An 8 mm disposable trocar was gradually advanced through the dissected tract so that it entered the pleural space safely. An Olympus LTF 160 pleuravideoscope was then advanced in through the trocar and the parietal pleura with many tiny nodules was visualised (Figure 3-A, B). Biopsy forceps was introduced through the working channel of the pleuravideoscope and six to eight biopsies were collected for GeneXpert for tuberculosis and histopathological examination.

Once the biopsies were collected, a 24 Fr size intercostal drainage (ICD) tube was placed in the pleural space which allowed gradual evacuation of the pneumothorax. The ICD drain was removed after 24 hours after making sure that there is no bubbling in the ICD drain and no evidence of continuing air leak or residual pneumothorax on the chest X-

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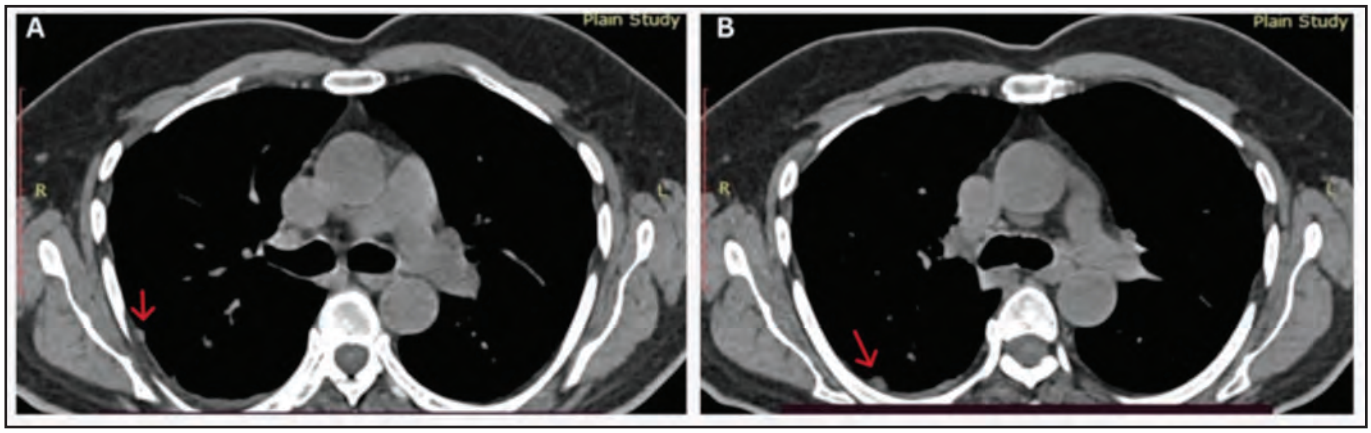


Fig. 1: Computed tomography showing multiple pleural nodules (arrow) without evidence of lesions in the lungs.

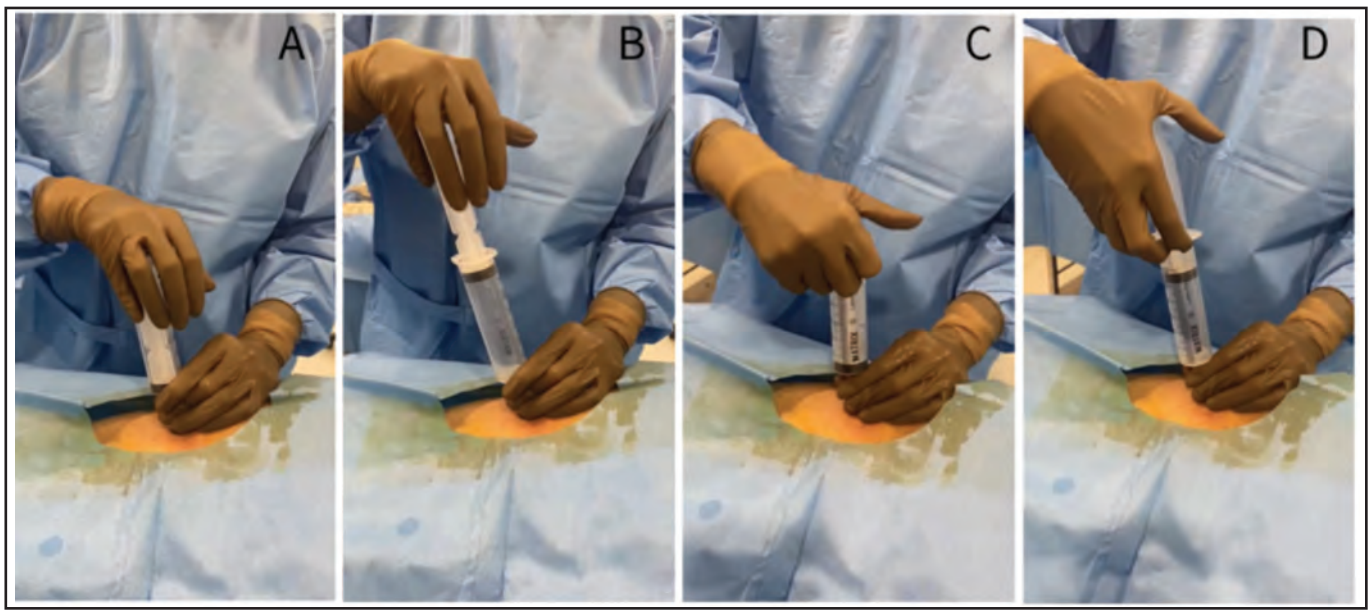


Fig. 2A-D : Demonstration of artificially inducing a pneumothorax by repeatedly pushing air into the pleural space using a 50 cc syringe and a 21-gauge needle.

ray. Histopathology showed fragments of pleural tissue lined by flattened mesothelial lining. The stroma showed infiltration by a malignant tumour composed of cells arranged in nests, sheets and focally in acinar pattern. Immunohistochemistry showed strong positive expression of CK7 (cytokeratin 7) and TTF-1 (thyroid transcription factor 1). The histology along with immunohistochemistry (IHC) markers favoured a diagnosis of moderately differentiated invasive adenocarcinoma of the lung. The patient was safely discharged the next day without any complications and was kept on regular follow-up. He was started on a chemotherapy regimen of cisplatin and vinorelbine and remained stable during treatment.

DISCUSSION

Pleural metastases are most commonly seen along with pleural effusions, a condition known as wet pleural dissemination (WPD) and are typically diagnosed using local anaesthetic thoracentesis (LAT), with the presence of pleural fluid facilitating safe access of the pleural space, enabling the collection of biopsies and cytological analysis of pleural fluid.[2,3]

However, in certain rare cases such as ours, pleural nodules may be seen in the absence of any effusion. This is known as dry pleural dissemination (DPD) and is characterised by CT findings revealing minimal (< 10 ml) or no effusion.[1,4] Obtaining an accurate biopsy via LAT in these patients is quite challenging, as without any fluid, there is a diminished field of vision and limited space to efficiently obtain biopsies, thereby increasing the risk of lung injuries during the procedure.[5] In the past, such cases were diagnosed by obtaining biopsies through open surgeries under general anaesthesia, however longer recovery times and comorbidities in patients have rendered these methods less effective.[3]

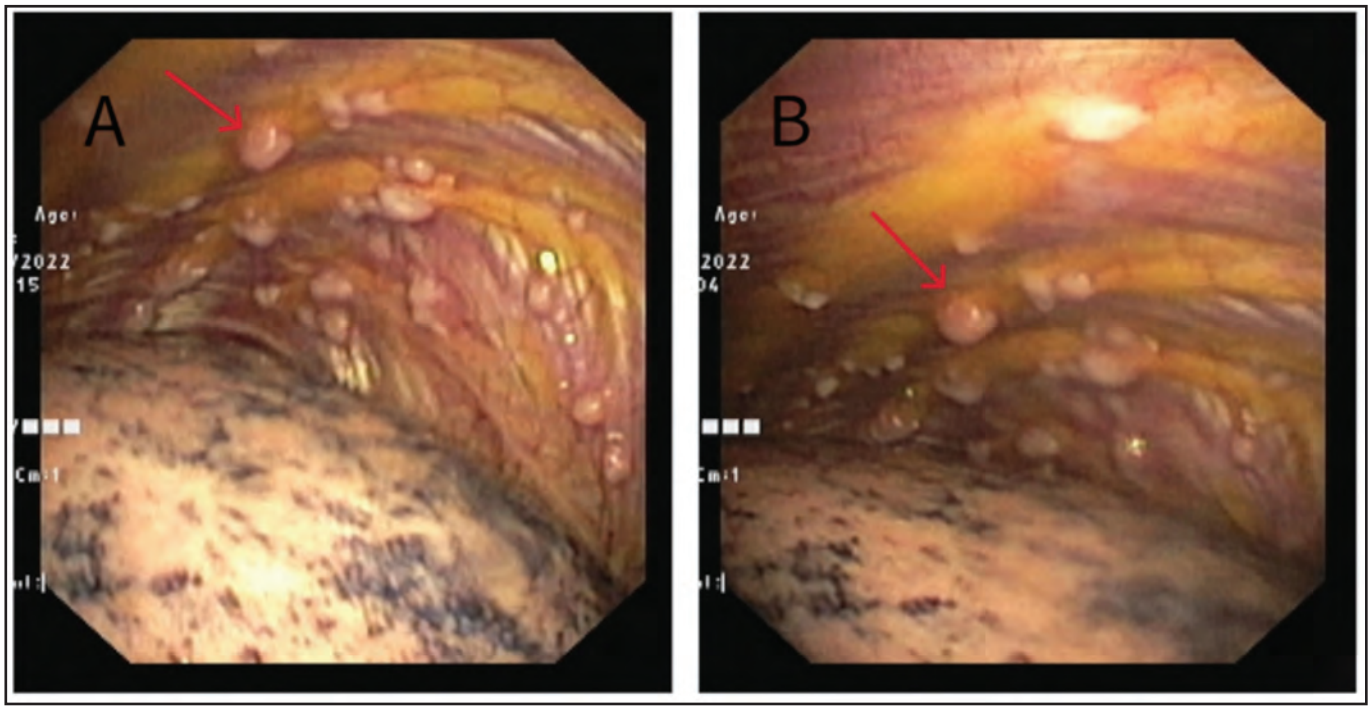


Fig. 3A-B : Pleurascopic view showing multiple irregular nodules on the surface of the parietal pleura (arrow) following pneumothorax induction.

We decided to proceed with LAT and overcame the above challenges by artificially inducing a pneumothorax, which improved visual field, provided adequate access to the pleural space, and created enough space for trocar insertion, thus enabling retrieval of multiple biopsies. A Boutin needle, used with the blunt end, or a Veress needle, with its spring-loaded blunt end and red-to-green visual cue, provides a safe and effective method for inducing pneumothorax in cases of dry pleural deposits. However, in our institute, lacking access to these instruments, we used a 21-gauge needle under ultrasound guidance to safely induce a pneumothorax. This method offers several advantages, including reduced anaesthetic requirements, smaller incision sites, the possibility of same-day discharge, and a higher safety profile when compared to open surgical methods.[4] Ultrasound plays a crucial role in identifying the safest entry point and avoiding potential adhesions (primary contraindication to pneumothorax induction).[2] By providing real-time visualisation, ultrasound confirms the successful introduction of pneumothorax, indicated by the absence of the lung sliding sign, thus obviating the need for confirmation through chest X-rays.[3]

Induction of a pneumothorax may be associated with certain complications such as desaturation, respiratory acidosis and hypercapnia, with partial aspiration remedying these complications. However, the procedure's benefits significantly outweigh potential complications, suggesting its potential application for similar cases in the future. More case reports on this topic are needed in the future to further establish the safety and validity of the procedure.

CONCLUSION

There have been very few studies highlighting the benefits of introducing a pneumothorax for diagnosis of pleural nodules and our case underscores its utility. It allows for a local anaesthetic thoracoscopy to be carried out without a pleural effusion and is particularly useful in elderly patients with several comorbidities. As a result, our case shows that introducing a pneumothorax proves highly effective in obtaining biopsies of pleural nodules with an increased safety profile and minimal complications.

DECLARATIONS

Theres is no conflict of interest between the authors. There was no funding received for this article. Patient consent was taken for publication.

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