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Case Report

Computed tomography-guided percutaneous needle biopsy for middle mediastinal tumors with retroaortic paravertebral approach: A case report[☆]

Rakuhei Nakama, MD, PhD^{*}, Yasunori Arai, MD, Toshihiro Horii, MD, Tatsushi Kobayashi, MD

Department of Diagnostic Radiology, National Cancer Center Hospital East, 6-5-1 kashiwanoha, Kashiwa, Chiba 277-8577, Japan

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ABSTRACT

A 74-year-old man was referred to our hospital for a close examination of a mediastinal mass. Contrast-enhanced CT showed a middle mediastinal tumor. We planned to perform a CT-guided percutaneous needle biopsy of the tumor using a retroaortic paravertebral approach to avoid transpulmonary puncture. A coaxial blunt-tip needle with a side hole was used to create space in the mediastinum and avoid azygos vein injury. After injecting normal saline, a blunt-tip needle was advanced through the space between the aorta and the vertebral body to the anterior surface of the tumor, and tissue was obtained. The patient was discharged the following day with no complications. For percutaneous middle mediastinal tumor biopsy, the retroaortic paravertebral approach may be a safe, effective route.

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Introduction

Percutaneous needle biopsy of tumors is becoming increasingly important, not only for pathological diagnosis, but also because drug selection depends on the genotype expressed [1]. CT-guided percutaneous needle biopsy (CT-PNB) is used in many situations because it is unaffected by air and bone artifacts and can accurately locate at-risk vessels and organs [2].

However, depending on the tumor site, it may be difficult to avoid injuries/complications in vital organs when using

CT-PNB. For example, because a middle mediastinal tumor is surrounded by the heart, vertebrae, and lungs, securing a safe puncture tract is difficult. Transpulmonary puncture can lead to complications, such as pneumothorax and alveolar hemorrhage [3]. Furthermore, systemic air embolism is fatal [4]. There is room for ingenuity when safely performing biopsies.

A nontranspulmonary percutaneous biopsy approach for middle mediastinal tumors, that is, retroaortic paravertebral approach with hydrodissection, has been reported [5]. This technique does not cause complications, such as pneumothorax or systemic air embolism. However, there are few case

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^{*} Corresponding author.

E-mail address: r.n.emergency0611@gmail.com (R. Nakama).

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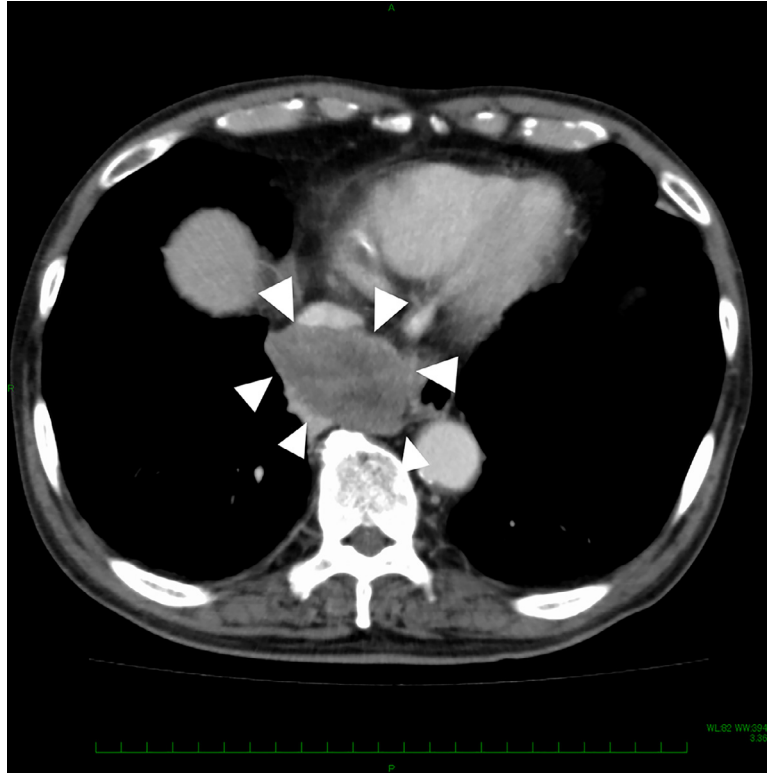


Fig. 1 – Contrast-enhanced CT showing a middle mediastinal tumor (arrow).



Fig. 2 – Prebiopsy CT. Dashed circle indicates target tumor. The ventral structure of the aorta pointed to by the arrow is the azygos vein.

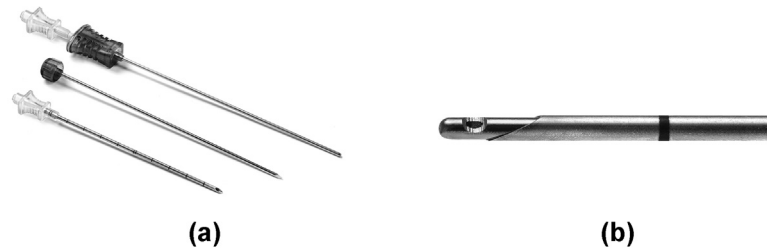


Fig. 3 – (A) This is a complete view of HydroGuard®. From top to bottom: blunt stylet with a luerlock connector (allows fluid/gas injection), beveled needle, coaxial trocar, and **(B)** this is the HydroGuard® tip after being combined with a blunt stylet and a coaxial trocar.

studies, and the safety and efficacy of the approach have not been established.

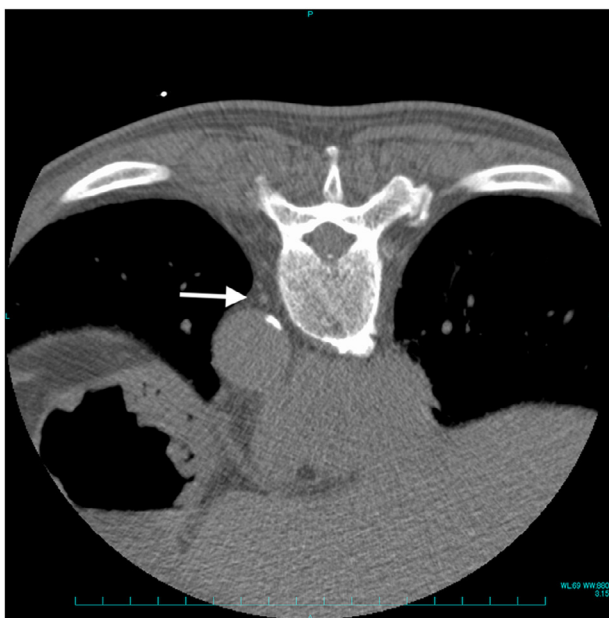
We present a case that allowed biopsy via the retroaortic paravertebral approach for middle mediastinal tumors by creating space using a coaxial blunt-tip needle.

Case report

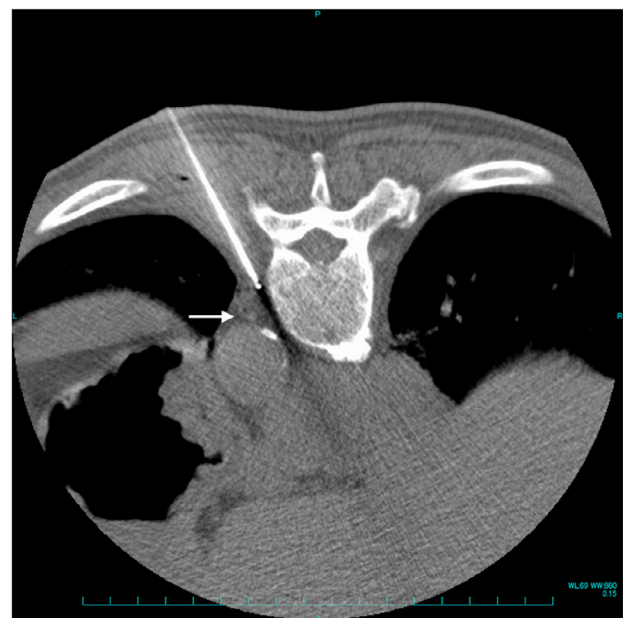
A 74-year-old man was referred to our hospital for ultrasound sonography when a mediastinal mass without any symptoms was incidentally detected during a medical checkup. His medical history included hypertension and pulmonary emphysema. Contrast-enhanced CT revealed a middle mediastinal tumor measuring approximately 60 mm (Fig. 1). Initially, a biopsy via upper gastrointestinal endoscopy was considered; however, there was concern that this tumor could be derived

from the lung, which may result in a fistula between the esophagus and the thoracic cavity. Alternatively, CT-PNB can be performed for a definitive diagnosis.

For CT-PNB, this tumor usually needs to be punctured through the right lung; however, there was concern about the high risk of severe pneumothorax or systemic air embolism due to the long puncture distance in the lung and the patient's history of pulmonary emphysema. A paravertebral approach from the right side was also considered; however, prebiopsy CT showed that the placement of the ribs and transverse processes would make it difficult to puncture the axial section (Fig. 2). We planned to perform CT-PNB of the tumor using a retroaortic paravertebral approach from the left side. Furthermore, to ensure safety, we decided to use a coaxial blunt-tip needle with a side hole (Gangi HydroGuard®[□], AprioMed AB, Uppsala, Sweden). This device consists of a coaxial trocar that can be used in combination with a spring-loaded blunt stylet with a Luer-lock connector and beveled needle (Fig. 3).



(a)



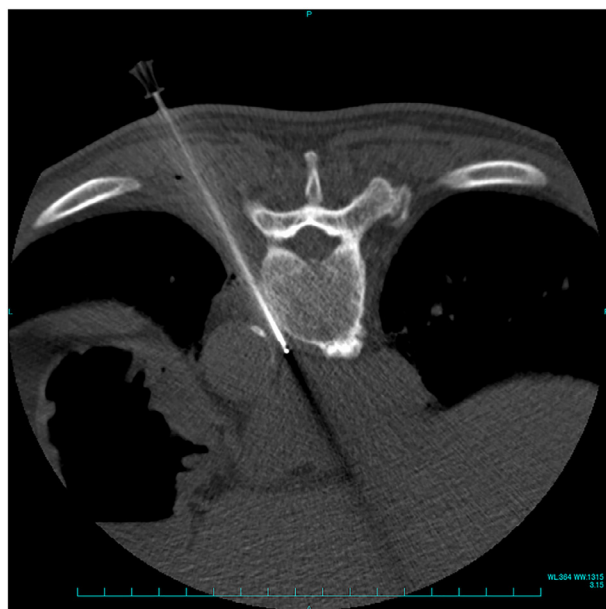
(b)

Fig. 4 – Comparison of CT before and after normal saline injection. (A) Prebiopsy CT showed the azygos vein (arrow). **(B)** Following the injection of normal saline through the side hole of the blunt-tip stylet, CT revealed an enlargement of the mediastinal space and lateral deviation of the azygos veins.

A blunt-tip needle can be advanced through the tissue without injuring the vital organs or vessels. Furthermore, it has a side hole that allows the injection of fluids such as saline, while having a blunt-tip stylet in place. With these characteristics, this device is already being used to access "hard-to-reach" lesions for biopsies, drainage, and ablation [6,7]. In this case, the creation of sufficient mediastinal space with this device was expected to allow for a better puncture route and avoid the azygos vein.

First, local anesthesia was administered subcutaneously, and a beveled needle was used to penetrate the muscle and

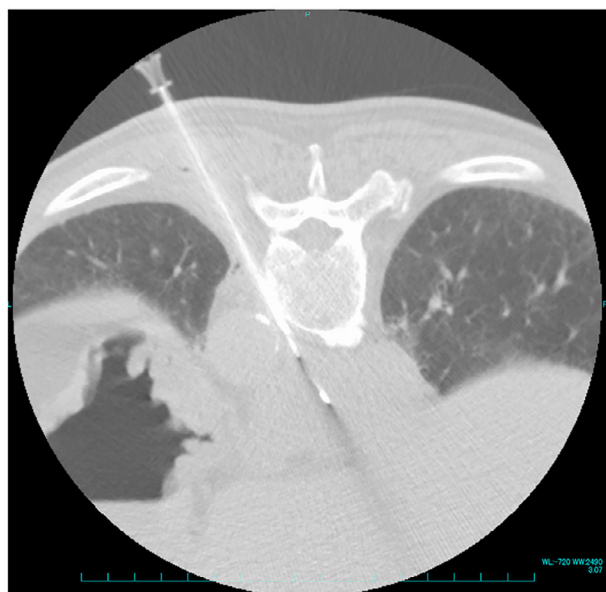
enter the mediastinum. Next, normal saline was injected from the side hole of the blunt-tip stylet into the mediastinum to create a space to avoid the azygos vein (Fig. 4). Subsequently, a blunt-tip needle was advanced through the space between the aorta and vertebral body to the anterior surface of the tumor (retroaortic paravertebral approach) (Fig. 5A). A blunt-tip stylet was removed and an 18G semi-automatic biopsy needle (TSK STARCUT Biopsy Needle Aspiration Type, TSK, Tochigi, Japan) was inserted, and the tumor tissue was obtained (Fig. 5B). CT of the pulmonary window setting proved the biopsy needle did not pass through the lung parenchyma and revealed no



(a)



(b)



(c)

Fig. 5 - (A) CT showed that blunt-tip needle was located on the anterior surface of the tumor through the space between the aorta and the vertebral body. **(B)** Blunt tip stylet was removed, and tumor tissue was obtained by an 18G semi-automatic biopsy needle. **(C)** CT at the pulmonary window setting revealed no signs of lung injury.

signs of lung injury (Fig. 5C). Postbiopsy CT showed no abnormalities. The patient was discharged the following day with no complications. The final pathological diagnosis was neuroendocrine carcinoma.

Discussion

We presented a successful case of middle mediastinal tumor biopsy using the retroaortic paravertebral approach with a blunt-tip needle and hydrodissection which resulted in a definitive diagnosis without complications. This approach for mediastinal tumors is not a transpulmonary approach and may be a safe route for CT-PNB.

In addition to percutaneous biopsy, surgical intervention, transbronchial needle biopsy, and endoscopic US-guided fine-needle aspiration biopsy have been applied to mediastinal tumors [5]. However, owing to the superiority of core needle biopsy over fine needle aspiration in terms of diagnostic accuracy and the ability of CT to accurately detect the location of the tumor, CT-PNB may continue to be the primary biopsy method for mediastinal tumors [8]. The retroaortic-paravertebral approach used in this case would expand the indications for middle mediastinal lesion biopsy.

However, there are 2 issues with this approach: 1) the space in the mediastinum is too narrow to allow a straight puncture route to the tumor and 2) osteophytes make puncture impossible. Regarding the mediastinal space, the use of a coaxial blunt-tip needle with a side hole, as demonstrated in this case, would create enough space to allow for a straight puncture route. With regard to osteophytes, it has been reported that the left side of the spine is less likely to produce these growths because the left-sided descending aorta inhibits new bone formation [9]. Therefore, the retroaortic paravertebral approach may be a reproducible biopsy route for middle mediastinal tumors.

However, the technique has several limitations. First, its safety is still unknown and more cases need to be accumulated to determine whether this approach route are truly safe. Furthermore, there are likely to be many challenging cases owing to the anatomy. The anatomical locations of the ribs, vertebrae, and aorta in the puncture tract can affect the success rate of the procedure. Further studies are required to determine which cases are suitable candidates for this approach.

Thus, the demand for CT-PNB is expected to increase in the near future. Various approaches should also be considered to prevent complications. The retroaortic paravertebral approach will have a role to play in this process.

Patient consent

Informed consent for the publication of this case report was obtained from the patient.

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