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# Thoracic ganglioneuroma found incidentally on a flight physical: an atypical magnetic resonance imaging presentation

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## Abstract

Ganglioneuromas are rare, benign neuroblastic tumors from neural crest cells, commonly found in the posterior mediastinum or retroperitoneum. They grow slowly and are often incidental findings. This report details a 28-year-old airman with a left apical pleural-based mass detected on a chest radiograph during a routine physical. A Computed Tomography (CT) revealed a posterior mediastinal mass with punctate calcifications, and Magnetic Resonance Imaging (MRI) showed varying signal intensities but no enhancement. A CT-guided biopsy confirmed ganglioneuroma. This case emphasizes the value of routine screenings and highlights the diagnostic challenges of ganglioneuromas due to their nonspecific and variable imaging findings.

**Key words:** neurogenic tumors, ganglioneuromas, flight physical, MRI, contrast enhancement.

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## Introduction

Ganglioneuromas are rare benign peripheral neuroblastic tumors derived from neural crest cells, specifically peripheral sympathetic ganglionic cells.[1,2] These tumors consist of gangliocytes and mature stroma composed of various materials such as spindled-shaped cells, large ganglion cells, and myxoid components.[3,4] They are more commonly found in women and tend to occur in younger adults. Ganglioneuromas are slow-growing tumors in the posterior mediastinum and retroperitoneum, accounting for nearly 35 percent of intrathoracic neurogenic tumors.[4,5] Due to their indolent growth, these tumors are often discovered incidentally. Sometimes, they can be symptomatic, usually from compressive symptoms on adjacent neurovasculature. Depending on its location and growth, associated symptoms can include brachial plexopathy, scoliosis, syringomyelia, conus medullaris, and opsoclonus-myoclonus syndrome.[1,6-9] Computed Tomography (CT) often reveals internal calcifications in 20% of cases of ganglioneuromas. They will also show slight to moderate enhancement on contrast-enhanced CT, especially when ganglionic cells are predominant. Ganglioneuromas exhibit a nonspecific appearance on Magnetic Resonance Imaging (MRI), usually of an enhancing intermediate on T1-weighted images and bright on T2-weighted images mass, making diagnosis based solely on imaging difficult.[2,10,11] This case underscores the potential importance of routine chest radiographs during military physicals in identifying pathologies and highlights the diagnostic difficulties of ganglioneuromas on CT and MRI.

## Case Report

A 28-year-old male airman presented for a standard flight physical to attend further special operations training in the Air Force. He reported no symptoms and had an unremarkable physical examination in the clinic. The patient also had no significant past medical, surgical, or family history. The patient was tentatively cleared for training pending ancillary studies, including a lipid panel, urinalysis, complete metabolic panel, complete blood count, immunization titers, and a chest radiograph. All tests were normal except for the chest radiograph. The chest radiograph revealed a medial left apical pleural-based mass with internal calcifications, suggesting a lesion in the posterior mediastinum (Figure 1). A differential diagnosis for a pleural-based mass seen on a chest radiograph is broad, including but not limited to the fibrous tumor of the pleura, mesothelioma, metastases, lymphoma, invasive thymoma, lipoma chest wall tumors (e.g., Askin tumors), or a mass of the intercostal nerve. Due to the limitations of the two-view chest radiograph and lack of prior imaging, further evaluation with a chest CT was recommended.

Two weeks later, the patient underwent a chest CT (Figure 2), which showed an oval pleural-based mass that was greatest in the craniocaudal dimension abutting the posterior mediastinum or paraspinal region, extending from T1 to T3. The mass exhibited a large area of calcification and smaller satellite calcifications. There were no signs of extrapleural extension or osseous involvement. Differential diagnoses included neurogenic tumors (e.g., gan-

glioneuromas vs. neuroblastomas), fibrous tumors of the pleura, or teratoma. The patient was referred to a pulmonologist and received additional imaging with a contrast-enhanced MRI and a CT-guided tissue sampling.

MRI revealed an elongated oval mass in the left posterior mediastinal or paraspinal region, with extension into and mild widening of the left T2-T3 neural foramen. The mass showed an intermediate signal on T1-weighted images and the hyperintense signal on T2-weighted images without restricted diffusion (Figure 3). Internal calcifications were noted as dark foci on both T1 and T2 images corresponding to those seen on prior radiograph and CT. The mass also abutted the left subclavian artery and descending aorta without evidence of invasion. Finally, the mass demonstrated vertical growth along the paraspinal region, which is typical of neurogenic tumors and ganglioneuromas. After administration of gadolinium-based contrast, the mass did not show enhancement, which was confirmed by subtraction imaging (Figure 4). This is a very atypical finding in neurogenic tumors. Based on the MRI findings, the differential diagnosis is still narrowed to a neurogenic tumor, but delineating between the types would require tissue sampling and a histologic diagnosis.

A CT-guided posterior mediastinal biopsy under moderate sedation revealed spindle cells in loose myxoid stroma, mature ganglion cells intermixed with spindle cells, and rare mast cells. Diff-Kwik slides showed spindle cells with rare large cells containing prominent nucleoli. Thus, the diagnosis of ganglioneuroma was confirmed. Although benign, this condition disqualifies the patient from continued military service. Surgical resection is planned, and the patient will continue follow-up with a cardiothoracic surgeon.

## Discussion

Ganglioneuromas are typically asymptomatic, slow-growing tumors consisting of benign Schwann cells and ganglionic components. With the exception of calcifications, ganglioneuromas appear relatively uniform on CT scans, similar to other neurogenic tumors. Schwannomas, another neurogenic tumor in this patient's differential diagnosis, usually present as round masses.[12] The distinct vertical growth pattern aligned with sympathetic ganglionic cell origin, and thus, the differential diagnoses included ganglioneuromas, ganglioneuroblastomas, and neuroblastomas.[10] Coarse calcifications were a prominent finding in our case, although nonspecific calcifications can be seen in all three diagnoses. Imaging findings that might have suggested ganglioneuroblastoma or neuroblastoma over ganglioneuroma are internal hemorrhage and/or necrosis; however, neither was seen in our case.[7]

On MRI, ganglioneuromas tend to have a variable appearance due to their mixture of myxoid tissue, collagen fibers, spindle cells, and other cell lines.[7] Many cases and case series have established that ganglioneuromas tend to have an intermediate signal on T1-weighted images while demonstrating a hyperintense signal on T2-weighted images, which we saw, in this case, reflecting the myxoid or mucous component. Additionally, the DWI and ADC findings are unreliable, displaying inconsistent results, including a lack of restricted diffusion in some malignant tumors.[13-18] These signal characteristics are not specific to ganglioneuromas as more malignant tumors such as ganglioneuroblastomas and neuroblastomas have similar signal characteristics unless complicated by hemorrhage.[2] The unique feature in this patient was the lack of enhancement after administration of a gadolinium-based contrast agent as opposed to the nearly uniform enhancement of neurogenic tumors.[18,19]

Surgical resection is the recommended treatment to achieve a complete cure. Compared to ganglioneuroblastomas and neuroblastomas, surgical resection of ganglioneuromas has favorable outcomes and low reoccurrence rates.[13-15]

Cancers and tumors frequently form abnormal blood vessels making the lesion enhance on contrast-enhanced imaging.[16] Nearly all neurogenic tumors follow this pattern, displaying either homogeneous enhancement seen in smaller or benign tumors versus peripheral enhancement seen in larger tumors with either malignant or aggressive pathologies.[17,18] Ganglioneuromas have been reported to show slight to moderate homogeneous enhancement on contrast-enhanced imaging due to their hypercellularity and abnormal blood vessel formation.[10] In our case, even with more sensitive subtraction techniques, the tumor failed to show any enhancement after contrast administration.

This finding is a unique imaging feature of ganglioneuromas that, to our knowledge, has not been previously reported with MRI. Prior studies have documented poorly or equivocally enhancing ganglioneuromas on CT imaging, likely due to the increased mucous (myxoid) matrix of the tumor.[19] However, MRI is more sensitive for subtle enhancement, and the absence of enhancement on MRI has not been noted in the literature.[7] In our case, the ganglioneuroma contained a high amount of loose myxoid stroma, which we surmise was the cause of the tumor's absent enhancement. This lack of enhancement introduces another presentation that ganglioneuromas can present on MRI, further complicating the diagnosis solely on imaging and necessitating the use of tissue sampling to aid in diagnosis.

This case report also highlights the potential benefit of routine pre-training physicals and their associated ancillary testing, including chest radiographs, in identifying rare but significant pathologies like ganglioneuromas. A previous retrospective study on the clinical utility of screening chest radiographs for airmen entering flight duty identified 45 nodules and 14 hilar or mediastinal masses out of 3,500 studies, with only two cases leading to medical disqualification after extensive workups.[20] Although previous studies

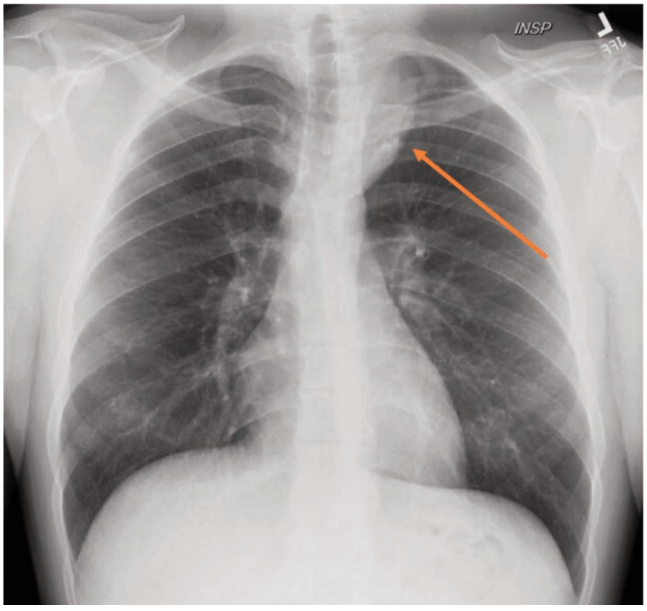


**Figure 1.** Posteroanterior (PA) chest radiograph demonstrates left medial apical pleural-based mass with internal calcifications (arrow).

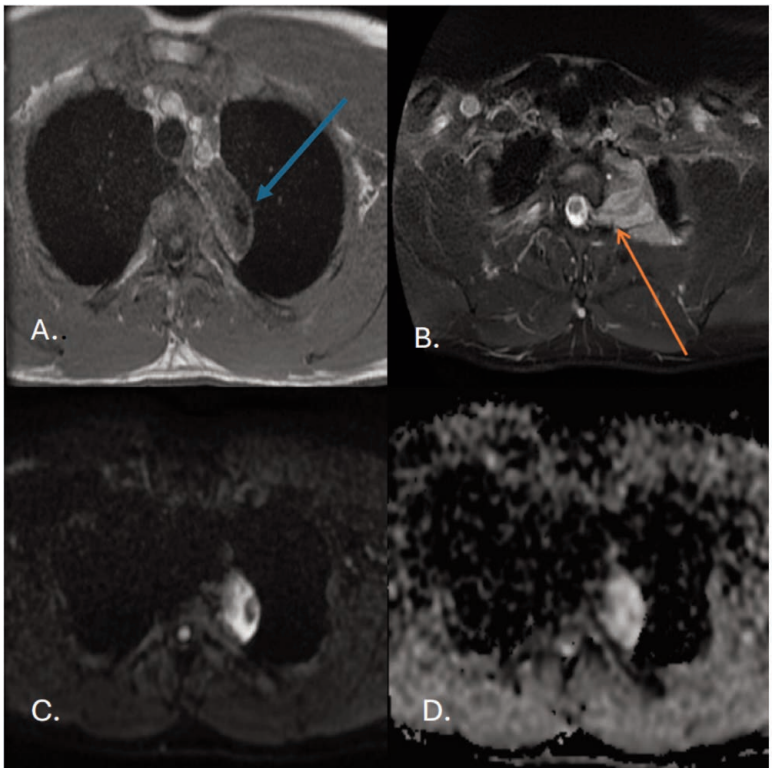


**Figure 2.** T1-weighted image shows intermediate signal with area of dark signal that corresponds with the calcification seen on Computed Tomography (CT) (**A**, blue arrow) and fat-saturated T2-weighted image located superiorly demonstrating the extension into the neuroforamen shown by arrow (**B**, orange arrow). Magnetic Resonance Image (MRI), Diffusion-Weighted Image (DWI) (**C**) and an Apparent Diffusion Coefficient (ADC) image (**D**). Lack of diffusion restriction demonstrated.

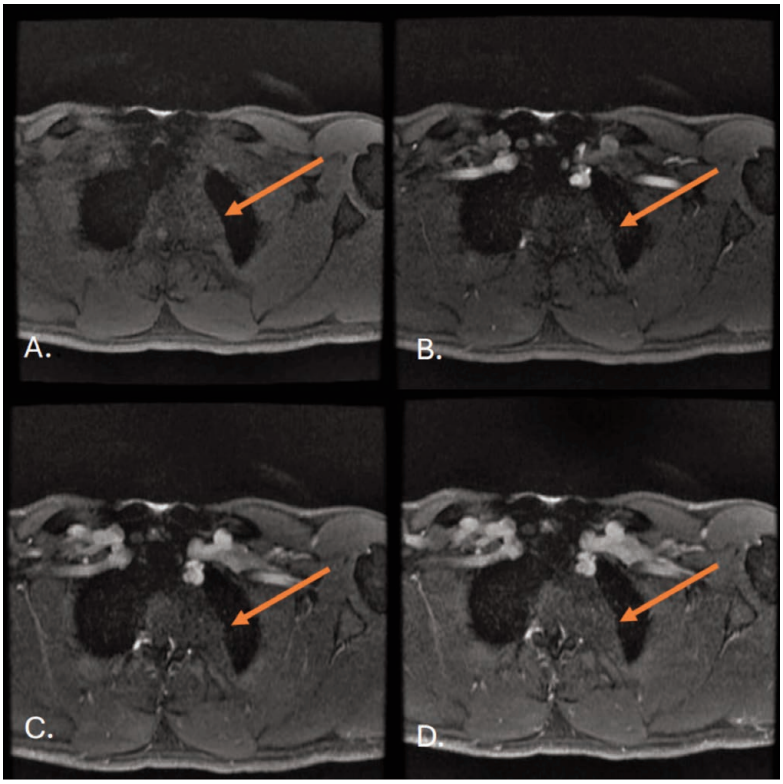


**Figure 3.** Unenhanced (**A**) and dynamic post-gadolinium axial T1-weighted images at 20 seconds (**B**), 1 minute (**C**), and 3 minutes (**D**) demonstrate no enhancement of the mass.

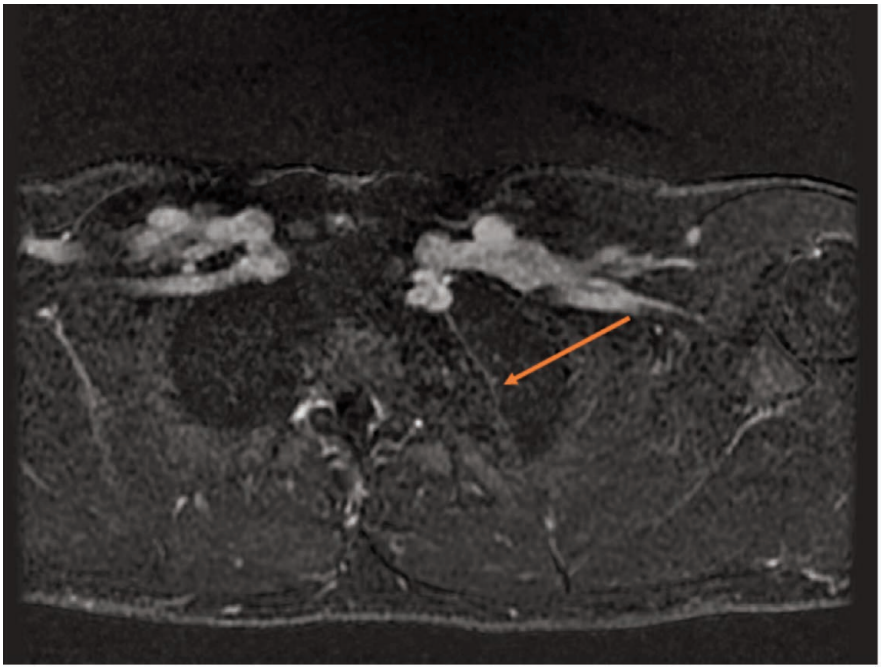

**Figure 4.** Axial T1-weighted subtraction image at 3 minutes post-gadolinium demonstrating a lack of enhancement.

have indicated that screening chest radiographs have limited utility due to their low detection rate for significant pathologies and high false positive rate, this case demonstrates their continued value. The incidental discovery of a mediastinal mass during a routine pre-training physical led to a comprehensive diagnostic process that ultimately identified a benign ganglioneuroma, allowing for timely treatment and prevention of complications. The case also highlights the challenges in imaging and diagnosing such tumors due to their non-specific findings on radiographs and CT, as well as varied presentations on MRI. Additionally, the report emphasizes the importance of screening in military settings where undiagnosed conditions might impact service readiness and safety. These findings reinforce the need for vigilance in routine health assessments and the potential for these evaluations to identify conditions that, while rare, can have substantial implications for a service member's health and future service.

## Disclaimer

The views expressed herein are those of the author(s) and do not reflect the official policy or position of Brooke Army Medical Center, the Department of Defense, or any agencies under the U.S. Government.

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