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Mediastinal neuroblastoma causing Horner's syndrome in a 7-year-old child: a case report

Alicija Šavareikaitė [a,*,1], Paulius Valatka [b]

[a] Vilnius University Faculty of Medicine, Vilnius, Lithuania
[b] Vilnius University Hospital Santaros Klinikos Pediatric Surgery, Orthopaedic, and Traumatology Center, Vilnius, Lithuania

A B S T R A C T

Introduction: Peripheral neuroblastic tumors comprise a spectrum of neoplasms (neuroblastoma, ganglioneuroblastoma, ganglioneuroma) that primarily arise from the sympathoadrenal lineage and can cause variety of symptoms.
Case presentation: A 7-year-old patient with no significant past medical history presented to the emergency room. On clinical examination, right-eye miosis and ptosis were observed, along with conjunctival hyperemia, redness, and neck muscle rigidity. Auscultation demonstrated pathological breath sounds consistent with an acute upper respiratory tract infection. An anterior chest X-ray revealed a clearly defined, oval mass with calcifications at the apex of the right lung and paravertebral regions. Subsequent imaging, including computed tomography (CT) and magnetic resonance imaging (MRI), identified a mass in the upper posterior mediastinum measuring approximately 39× 25 × 27 mm, suggestive of a neurogenic origin. Enlarged lymph nodes were also observed, while laboratory findings showed no significant abnormalities. A whole-body two-dimensional metaiodobenzylguanidine (MIBG) scintigraphy demonstrated scintigraphic evidence of an adrenergic-origin tumor in the right upper mediastinum. The solitary mass measured 40 × 27 × 26 mm and was partially calcified. No pathological findings were detected in the lungs, and there was no evidence of osseous metastasis. Based on the radiological findings, a preliminary diagnosis of paraspinal ganglioneuroma with associated Horner syndrome was made. Thoracoscopic surgery was performed, resulting in the complete excision of a tumor measuring approximately 5 cm in diameter, along with mediastinal lymph node dissection. The postoperative recovery was uneventful, with the wounds healing by primary intention and no complications occurring. Histopathological examination of the resected specimen, revealed a differentiated neuroblastoma with lymph node metastasis. Additional treatment, including adjuvant therapy was not selected for the patient. Horner syndrome resolved after the surgical treatment. At the one-year follow-up, routine chest MRI revealed new foci in the posterior superior mediastinum. Whole-body MIBG scintigraphy confirmed recurrence, and a subsequent surgical intervention was planned.
Conclusion: Children who develop Horner syndrome of unknown origin must undergo imaging studies to rule out a tumor in the posterior superior mediastinal region.

1. Introduction

Peripheral neuroblastic tumors represent a diverse range of neoplasms, from benign to malignant, emerging from the sympathoadrenal lineage of the neural crest. This category includes neuroblastoma, ganglioneuroblastoma, and ganglioneuroma [1]. When mediastinal tumors are present, their symptoms can vary widely. Some patients might be asymptomatic, while others could experience significant issues, such as chronic ataxia, which is exceedingly rare. It is important to recognize symptoms caused by the mass itself, including cough, stridor, hemoptysis, shortness of breath, and respiratory distress, as these can rapidly deteriorate [2].

In pediatric patients, treatment strategies for either benign or malignant mediastinal masses must be individualized, with total

* Corresponding author. Vilnius University Faculty of Medicine, M. K. Čiurlionis street. 21, LT-03101, Vilnius, Lithuania.
E-mail address: alicija.savareikaite@mf.stud.vu.lt (A. Šavareikaitė).
[1] **Present/permanent address:** Vilnius University Faculty of Medicine, M. K. Čiurlionis street. 21, LT-03101, Vilnius, Lithuania.

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surgical excision often being the treatment of choice. The treatment approach must be guided by tumor stage, biological characteristics, and risk orientation. While low-risk patients might only require surgical resection, those at higher risk necessitate a comprehensive multimodal treatment incorporating chemotherapy, surgery, stem cell rescue, biologic/immunologic therapy, and radiotherapy [3].

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2. Case report

A male pediatric patient, aged 7, presented with a drooping right eyelid and a reddened right eye to the emergency room. The patient was referred to a tertiary healthcare facility. Acute upper respiratory tract infection with conjunctivitis was suspected. Due to ophthalmological symptoms, a comprehensive examination and consultations with a neurologist, an otorhinolaryngologist, and an ophthalmologist were recommended. A comprehensive evaluation of the patient's condition revealed the following: respiratory rate was 24 breaths/min, oxygen saturation (SpO_2) was 98 %, and heart rate was 118 beats/min. Examination revealed miosis of the right eye, ptosis, redness, and conjunctival hyperemia, along with rigidity of neck muscles. Auscultation noted symmetrical, rough breathing sounds and transmitted wheezing. An anterior chest X-ray revealed a clearly defined, oval mass with calcifications, approximately 35 × 30 mm in size, at the apex of the right lung and paravertebral regions (see Fig. 1). A magnetic resonance imaging (MRI) scan of the head showed no pathological changes. A computerized tomography (CT) scan (both with and without intravenous contrast) indicated a clearly defined mass in the upper posterior mediastinum at the levels of vertebrae TH1 and TH2, measuring approximately 37 × 25 × 19.6 mm, closely adjoined to the inner surfaces of the dorsal ends of the first and second ribs (see Figs. 2, 3). Additionally, there was a group of lymph nodes measuring 13 × 11 × 16.3 mm in diameter near the right subclavian vein and the right superior intercostal vein, behind the clavicle. A few lymph nodes in the mediastinum measured 11 × 6 mm. A neurogenic origin of the mass was suspected based on radiological appearances, which resembled a neoplasm of the autonomic ganglia. Laboratory tests revealed no significant changes. The patient developed additional symptoms, including weakness, difficulty lying down, lethargy, and worsening pain in the head and shoulder. The patient also resisted any contact with the back and could not stand. Due to the deteriorating condition, the decision was made to hospitalize the patient in a university hospital.

The urinary concentrations of catecholamine metabolites were within normal limits. Abdominal ultrasound of the digestive system (liver, gallbladder, bile ducts, pancreas, stomach, intestines) as well as renal and adrenal examinations showed no sonographic changes. Ultrasound of the neck soft tissues and mediastinum concluded that a mass was present in the right upper chest, displaying a nodular structure with abundant calcifications, vascular in nature, measuring approximately 39 × 13 mm, covered by lung tissue and bone, and surrounded by large arteries and veins. The mass was not associated with the remaining thymus and did not affect lung permeability. A puncture was not performed due to the risk associated with large surrounding arteries. MRI of the mediastinum with intravenous contrast revealed a heterogeneous, lobulated mass in the upper posterior mediastinum on the right, contacting adjacent structures (including the right vertebral artery, right subclavian artery, and the bodies of the first and second vertebrae as well as the ribs paravertebrally), but with no clear signs of infiltration. The mass measured 39 × 25 × 27 mm, and contrast enhancement was observed to be mildly intense. The radiological diagnosis was suggestive of a paraspinal ganglioneuroma. Additionally, a whole-body

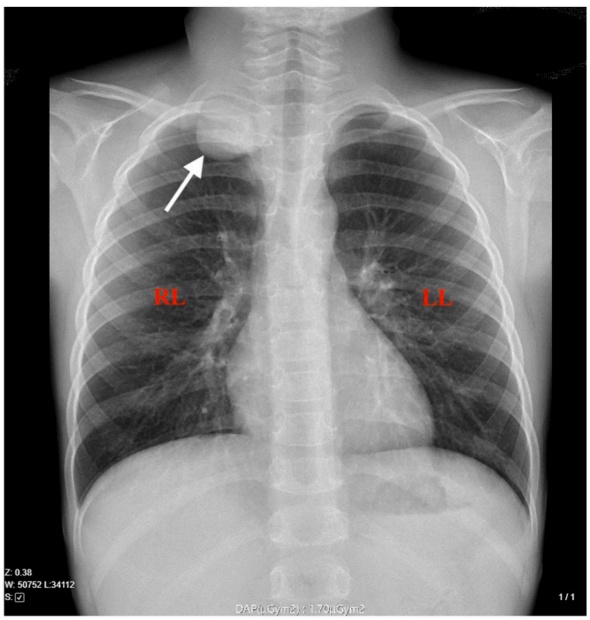

Fig. 1. *Anterior chest X-ray of the patient.* A well-defined oval mass with calcifications (35 × 30 mm) is visible at the apex of the right lung and in the paravertebral region. RL – right lung; LL – left lung; white arrow – oval mass in the superior part of the mediastinum.

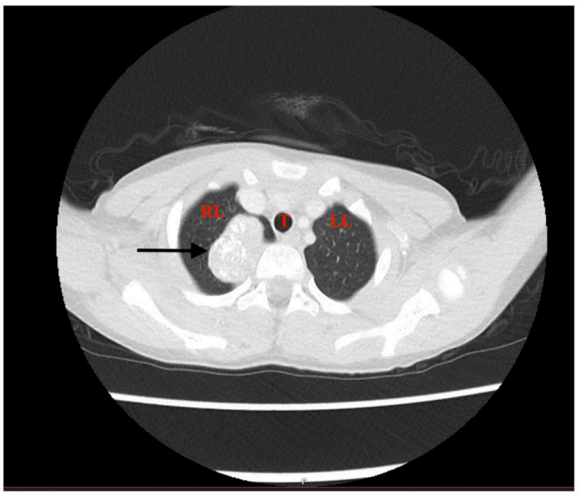

Fig. 2. *Axial computed tomography (CT) scan.* A well-defined mass (37 × 25 × 19.6 mm) is visible in the upper posterior mediastinum at the level of the TH1–TH2 vertebrae, closely adjoining the inner surfaces of the dorsal ends of the first and second ribs. RL – right lung; LL – left lung; T – trachea; black arrow – mass in the superior part of the mediastinum.

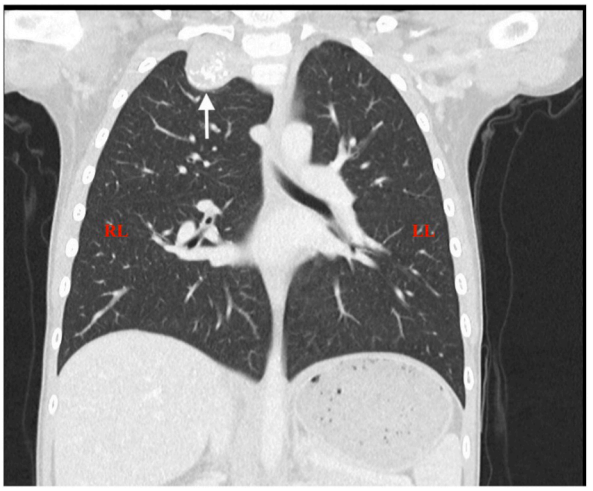

Fig. 3. *Coronal computed tomography (CT) scan.* The same mass (37 × 25 × 19.6 mm) is observed in the upper posterior mediastinum at the level of the TH1–TH2 vertebrae, adjacent to the dorsal ends of the first and second ribs. RL– right lung; LL – left lung; white arrow – mass in the superior part of the mediastinum.

two-dimensional metaiodobenzylguanidine (MIBG) scintigraphy was performed. Twenty-four hours after the injection of the radioactive tracer, MIBG and hybrid single-photon emission computed tomography (SPECT) images of the abdominal area indicated scintigraphic signs of an adrenergic-origin tumor in the right upper mediastinum, paravertebrally, at the level of the first and second intercostal spaces. The solitary mass size was measured as 40 × 27 × 26 mm, partially calcified, with intense accumulation of the radioactive tracer, prominently highlighted in the dorsal aspect of the mass. No pathological findings were noted in the lungs, and there were no signs of tumor spread to the bones (SIOPEN 0). Further MRI study provided additional identification of the mass as L1 IDRFs 0.

Based on the patient's history, objective examination findings, and diagnostic imaging and laboratory results, the pediatric oncology and hematology consultation concluded a diagnosis of Horner syndrome. Treatment was initiated, including antipyretics and analgesics as needed, and the decision was made to excise the mass. Thoracoscopic surgery was performed. After general anesthesia with endotracheal intubation, trocars were introduced, and a tumor measuring approximately 5 cm in diameter was observed in the upper region, adhered to the parietal pleura, medial to the *truncus brachiocephalicus* and right subclavian artery, inferiorly to the right brachiocephalic vein, and laterally to the azygos vein. The tumor was dissected bluntly and sharply, placed into a bag, and removed through the incision. The mediastinal lymph nodes were also excised. There was no observed bleeding. The removed tissue was sent for histological examination. The postoperative course was smooth, with the wounds healing by primary intention and no complications.

Histopathological examination revealed differentiated neuroblastoma with metastasis in the lymph nodes.

One year later, the patient returned for a routine chest MRI. The imaging revealed several new foci located in the posterior superior mediastinum. A whole-body two-dimensional MIBG scintigraphy was subsequently performed, which confirmed uptake in the new lesions. A multidisciplinary team meeting was convened to plan surgical treatment.

3. Discussion

The mediastinum is not the most common location for neuroblastoma, with research indicating that the adrenal gland is the primary site, followed by retroperitoneal ganglia. Most cases of neuroblastoma are diagnosed in pediatric patients before the age of 10. Regarding gender distribution, neuroblastomas occur with equal frequency in both males and females. Additionally, the survival rate improves with younger age at diagnosis, as children under one year old tend to have significantly better outcomes compared to older children. Even favorable or less aggressive neuroblastoma cases show poorer outcomes in older patients [4,5].

The Neuroblastoma Pathology Classification, commonly referred to as the Shimada system, categorizes neuroblastoma into four distinct types based on patient age at diagnosis, stroma abundance, and differentiation stage [6]. The benign tumor is the ganglioneuroma, which consists of gangliocytes and mature stroma. Ganglioneuroblastoma contains both mature gangliocytes and immature neuroblasts, exhibiting intermediate malignant potential. In contrast, neuroblastoma is the most immature, undifferentiated, and malignant tumor of the three. Immature tumors are typically aggressive and primarily affect younger patients, with a median age of just under 2 years, while mature tumors tend to occur in older children, with a median age of around 7 years, and generally exhibit benign behavior [7]. Postortem histopathological studies have shown that delta-like, an epidermal-growth-factor-like protein (regulates neuroblastoma cell differentiation), has higher expression in ganglioneuroma than in ganglioneuroblastoma, which affects their malignancy [8].

When assessing neuroblastoma, doctors commonly use imaging technologies like CT and MRI [9]. CT scans, with or without contrast, show a wide range of features for this type of tumor. These can appear as well-defined, oblong masses near the spine with consistent enhancement, or as irregular shapes with cystic and hemorrhagic characteristics. CT imaging is particularly effective for evaluating tumor size, as well as other details such as the tumor's origin, tissue invasion, and the presence of lymph node enlargement and calcifications [7]. Another article notes that ultrasonography is often the first choice for detecting these tumors, identifying them as masses with uneven echo patterns and areas of calcification and necrosis [10]. In the clinical case we examined, advanced diagnostics like MRI with intravenous contrast and whole-body scintigraphy were utilized. These sophisticated tests provided scintigraphic evidence of a tumor originating from adrenergic tissue, pinpointed the tumor's exact location, identified calcification sites, assessed the tumor's spread to other organs, and measured the tumor size more precisely than a CT by 1–2 mm. Additionally, we were able to rule out any tumor growth.

Neuroblastomas often produce catecholamines, especially vanillylmandelic acid and homovanillic aciD, which are important for diagnostic purposes and clinical follow up [11]. Currently, there are no specific markers available to differentiate between ganglioneuromas and ganglioneuroblastomas. Various screening programs have been created to detect neuroblastoma in infants by measuring catecholamines in urine, but have not led to any significant changes in mortality rates. Therefore, they are not generally recommended for routine use [4]. In this clinical case, there were no significant changes in laboratory results, including the levels of catecholamine metabolites in the urine.

The most effective treatment for mediastinal neuroblastoma is radical surgery, particularly when performed early in the disease process [12–14]. In this clinical case, thoracoscopic surgery was successfully performed to remove the tumor, and the patient experienced no complications after the procedure. During follow-up, there were no signs of tumor recurrence.

This clinical case underscores the diagnostic importance of a comprehensive evaluation in identifying Horner syndrome. The patient's symptoms, along with findings from the ophthalmological examination, facilitated the detection of a tumor located in the mediastinum. Although Horner syndrome is a relatively common manifestation of mediastinal tumors in the general population, it remains exceedingly rare among children.

Horner syndrome typically presents with a clinical triad that includes miosis (constricted pupil), mild upper eyelid ptosis (drooping), and facial anhidrosis (lack of sweating) and/or hyperemia (redness) [15]. However, in the case described, the patient did not exhibit signs of facial anhidrosis or hyperemia. This highlights the necessity for visualization tests of the mediastinum when pediatric patients present with incomplete symptoms of Horner syndrome. It is crucial to hospitalize the patient and conduct a thorough assessment of their symptoms to monitor for potential tumor growth. However, this presentation of the clinical case has its limitations due to the absence of representative follow-up data for the patient.

4. Conclusion

Children who develop Horner syndrome of unknown origin must undergo imaging studies to rule out a tumor in the posterior superior mediastinal region.

CRediT authorship contribution statement

Alicija Šavareikaitė: Writing – review & editing, Writing – original draft, Visualization, Methodology, Formal analysis, Data curation, Conceptualization. **Paulius Valatka:** Writing – review & editing, Writing – original draft, Visualization, Supervision, Project administration, Methodology, Data curation, Conceptualization.

Informed consent

Informed consent for publication of this case report and any associated images was obtained from the patient's mother.

Authorship

All authors attest that they meet the current ICMJE criteria for Authorship.

Conference presentation

This case report was presented at the European Paediatric Surgeons' Association (EUPSA) Conference, held in Dubrovnik, Croatia, on May 21–24, 2025.

Informed consent attestation

The authors attest that informed consent was obtained from the patient's parents or guardian.

Declaration of generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author used *OpenAI o1*(2024, December 5) in order to improve language and readability of manuscript. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the published article.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Legends

Abbreviations:

SpO_2	peripheral capillary oxygen saturation
MRI	magnetic resonance imaging
CT	computed tomography
SPECT	single-photon emission computed tomography
MIBG	metaiodobenzylguanidine

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