Radiology Case Reports 17 (2022) 80–85

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: www.elsevier.com/locate/radcr

Case Report

A Rare Case of Giant Mediastinal Ganglioneuroma in A 3-year-old ☆

*Harry Galuh Nugraha, MD, Riza Putri Aulia Hernowo, MD**

Department of Radiology, Faculty of Medicine Universitas Padjadjaran, Jl. Pasteur No. 38, Pasteur, Kec. Sukajadi, Kota Bandung, Bandung, Indonesia, 40161

ARTICLE INFO

Article history:
Received 27 September 2021
Revised 30 September 2021
Accepted 2 October 2021

Keywords:
Child
Computed tomography scan
Ganglioneuroma
Neurogenic tumor
Posterior mediastinum

ABSTRACT

Ganglioneuroma is a rare, differentiated, and benign neurogenic tumor that could grow into a huge size with minimal or no symptoms at all. Ganglioneuroma is typically found in older children or adults and is commonly detected within the posterior mediastinum (other than retroperitoneal). Here, we present a case of a 3-year-old patient with shortness of breath, and radiological examination showed a giant mediastinal tumor which proved to be a ganglioneuroma after histopathological examination. This study highlights the possibility of ganglioneuroma occurring in younger children and the role of imaging in assessing ganglioneuroma as a posterior mediastinal tumor.

Introduction

Ganglioneuroma is a rare tumor and belongs to the neurogenic tumors, which are the most common tumors occupying posterior mediastinal masses in children [1]. Ganglioneuroma commonly arises from sympathetic ganglion cells and it is a differentiated and slow-growing type [2]. It is usually discovered incidentally in older pediatric patients or adults as it is typically asymptomatic; however, it can grow into a massive size and cause compression symptoms [3]. Radiological examination is essential to localize and characterize the tumor and the surrounding structures. In this report, we present a young child with a giant posterior mediastinal ganglioneuroma who presented with dyspnea; together with the radiological and pathological findings.

Case presentation

A 3-year-old girl presented to our emergency room with shortness of breath. The patient had been relatively well before and only developed dyspnea within the last few months. The patient had no fever, night sweats, loss of appetite, weight loss, vomiting, flushing, hypertension, nor abdominal pain. The clinical examinations showed no abnormality except for low oxygen saturation. Routine laboratory examinations were

☆ Competing Interests: None.

* *Corresponding author.*
E-mail address: rizahernowo2@yahoo.com (R.P.A. Hernowo).

https://doi.org/10.1016/j.radcr.2021.10.010

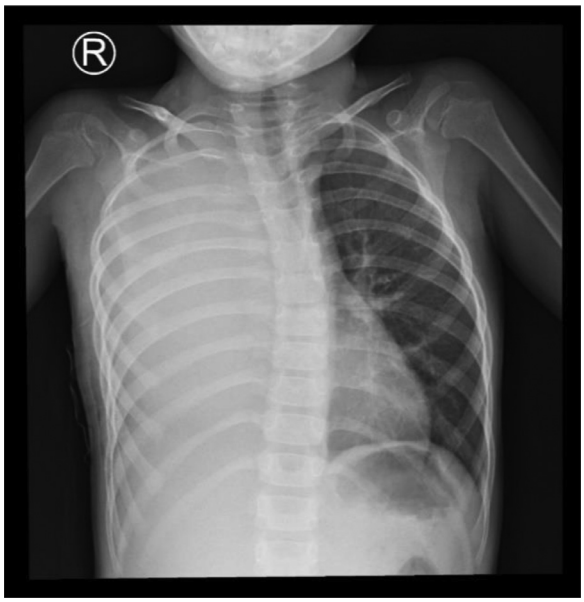

Fig. 1 – Chest radiograph reveals an opacity of the whole right hemithorax and scoliosis

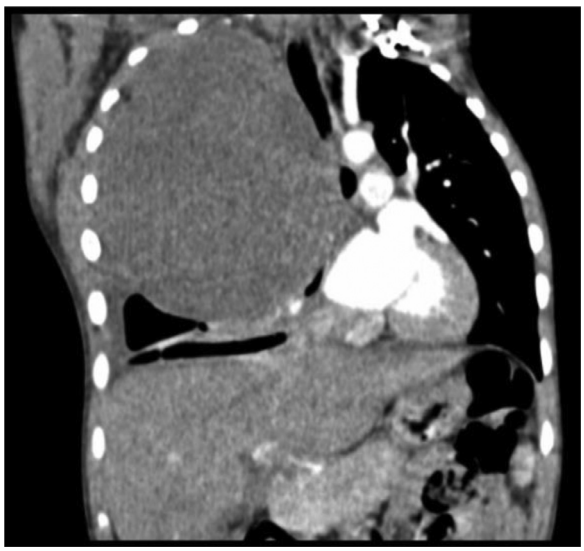

Fig. 2 – Coronal section of enhanced CT scanning revealed a heterogeneous hypodense mass in the right posterior mediastinum with no connection with trachea and bronchus

performed and the results were within normal limits. Frontal chest x-ray revealed an opaque right hemithorax and scoliosis (Fig. 1), which prompted further investigation with Computed Tomography (CT) scan. CT scanning with intravenous contrast revealed a well-circumscribed solid mass occupying the right posterior mediastinum, with measurement of 10.21 (W) x 9.19 (L) x 11.75 (H) cm, extending from first thoracal vertebrae until low cardiac level (Fig. 2). The mass appeared hypodense and mildly heterogeneous with punctate calcifications. The mass had no connection with the trachea and bronchi. The mass

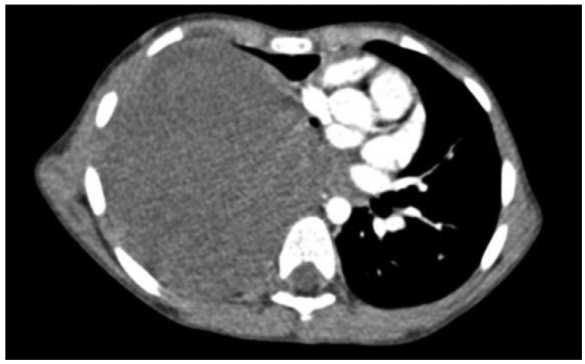

Fig. 3 – Axial section of enhanced CT scanning showed the mass pushing mediastinal organs to the contralateral side, with no evidence of bone destruction or other organs invasion

appeared to be pushing mediastinal organs and trachea to the left side, with no evidence of invasion into lung parenchyma, mediastinal organs, or chest wall. (Fig. 3) With contrast material, the mass demonstrated mild heterogeneous contrast enhancement and showed no vascular involvement. CT scanning showed no spinal destruction; however, nerve involvement could not be assessed as Magnetic Resonance Imaging (MRI) examination was not performed.

Given the size of the mass and the symptoms due to the mass compression, surgical resection was recommended. The patient was placed in the left lateral decubitus position and a right-sided posterolateral thoracotomy was performed under general anesthesia (Fig. 4). A huge mass was found to be occupying almost the whole right hemithorax, pushing the lungs to the inferior, and was capsulated by the pleura with no invasion to the adjacent structures. Gross examination revealed a solid capsulated mass with whitish color on the cut surface (Fig. 5) weighing 499 cm. microscopic evaluation showed mature, well-differentiated ganglion cells; uniform spindle cells, and Schwannian stroma (Fig. 6). There was no feature of malignancy and no mitotic nor apoptotic activity was observed. After the operation, the patient showed stable condition and chest radiograph revealed expansion of most of the right lung (Fig. 7). The patient was then discharged home with no complications.

Discussion

Ganglioneuroma belongs to the family of neurogenic tumors and it arises from neural crest cells, specifically the sympathetic ganglion cells [2]. Ganglioneuroma shares a common histogenic lineage with neuroblastoma and ganglioneuroblastoma; and these tumors represent a continuum of maturation and differentiation, with ganglioneuroma at the most benign and differentiated end of the spectrum [1,2,4]. Because neuroblastoma and ganglioneuroblastoma can mature into ganglioneuroma, ganglioneuroma may arise de novo or from differentiating neuroblastoma or ganglioneuroblastoma [3,5,6].

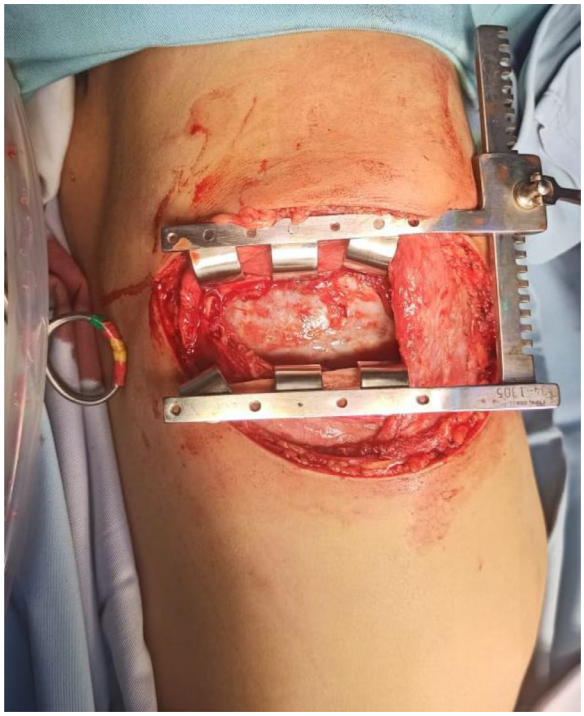

Fig. 4 – A right-sided posterolateral thoracotomy was performed on the patient under general anesthesia

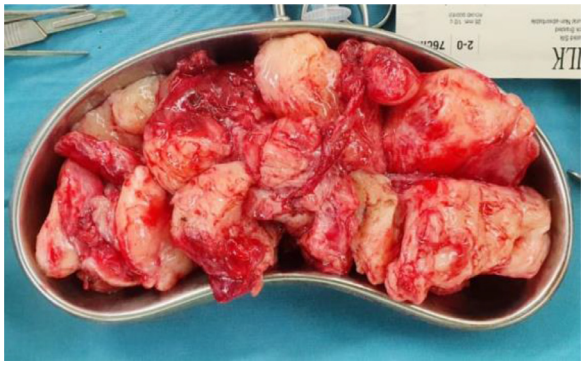

Fig. 5 – A cut section of the tumor revealed a whitish solid and capsulated tumor

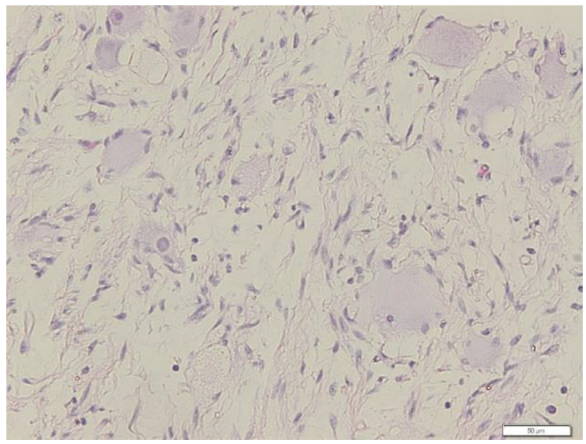

Fig. 6 – High power (200x) microscopic image revealing mature ganglion cell and Schwannian stroma

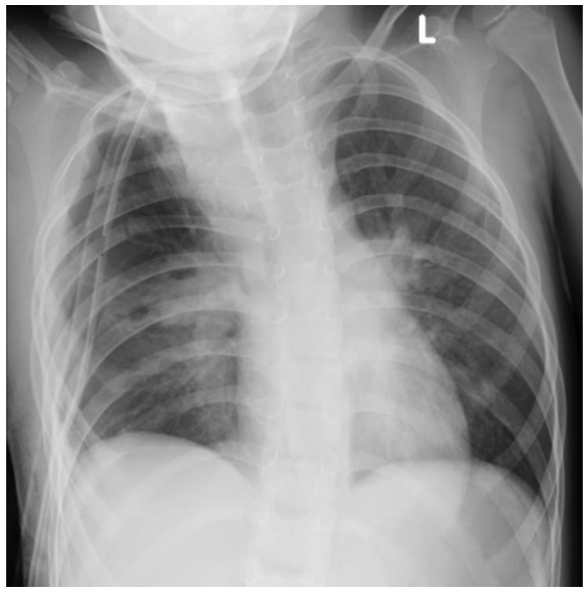

Fig. 7 – Chest radiograph on 1 day after surgical excision showed expansion of most of the right lung

Ganglioneuroma consists of mature ganglion cells, Schwann cells, nerve fibers, and mucous matrix [7]. The microscopic feature of ganglioneuroma is the presence of mature ganglion cells, which can be detected by the abundant and granular eosinophilic cytoplasm, large nuclei, and prominent nucleoli [2,7,8]. The Schwannian stroma is identified by its elongated uniform nuclei and ill-defined cytoplasm [8]. Ganglioneuroma has no immature elements (neuroblasts), atypia, mitotic figures, intermediate cells, or necrosis; and the presence of these features precludes ganglioneuroma[6,7,9,11].

Ganglioneuroma can arise anywhere in the place of peripheral autonomic ganglion cells. However, it most commonly occurs within the posterior mediastinum and retroperitoneum, arising from the sympathetic ganglia running parallel to the vertebral column [2,10]. Other less common locations include visceral ganglia, parapharyngeal region, cranial nerve ganglia, retropharyngeal region, or adrenal medulla [2,4,5]. Involvement of the central nervous system has been reported but it is rare [9,11]. Ganglioneuroma is often seen in older children or adults, however, it can occur in all age groups with no difference in distribution between males and females [3,7,9]. The median age of patients with ganglioneuroma varies between studies, ranges from seven to ten years old [5,6,12]. This age predilection may help to differentiate ganglioneuroma from neuroblastoma, which is more often seen during the first few years of life [13].

Ganglioneuroma typically extends to three to five vertebrae but due to its slow growth and benign nature, ganglioneuroma may develop into a massive size [3,14,15,16]. Ganglioneu-

roma is usually asymptomatic until it grows bigger and causes pressure effects on the adjacent structures; resulting in shortness of breath, cough, globus sensation, and Horner syndrome [3,5,8]. Some cases of mediastinal ganglioneuroma can extend into the spinal canal resulting in neurologic symptoms and painless spinal deformity [17]. Ganglioneuroma may also expand to the nerve root thus destructing the lateral and anterior vertebral elements, which results in scoliosis, as well displacing the adjacent skeletal structures [15,17].

Ganglioneuroma may also secrete a sufficient amount of catecholamines that manifests with several symptoms of catecholamine excess, such as labile hypertension and flushing [3,4]. Supposedly, ganglioneuroma has very little or no metabolic activity as it was hypothesized that more mature tumors have more mature biologic behavior, and should any catecholamine be secreted, it will be metabolized in the tumor [3,5,6]. However, studies show that some patients with ganglioneuroma have elevated catecholamine levels, such as VMA (vanillylmandelic acid) or HVA (homovanillic acid), which is presumed to be associated with the increased size of the tumor [3]. The use of Scintigraphy-Iodine-tagged medaiodobenzylguanidine (MIBG), a catecholamine analog, may not be useful in diagnosing ganglioneuroma. Even though MIBG has high sensitivity and specificity for tumors containing sympathetic tissue, it has no capability in differentiating the type of tumor in which the uptake occurs [6].

Radiological examinations help to determine the tumor location and characteristics; however, most neurogenic tumors have similar imaging features thus histological examination is still the only way to confirm the diagnosis. Radiographically, intrathoracic ganglioneuroma will be identified as a well-defined mass located in the posterior mediastinum, and as it follows the direction of the sympathetic chain, it will be located anterior and lateral to the vertebral column, revealing a craniocaudal length to major axis (CC/M) ratio greater than 1 [2,10,12,18]. Complications such as rib spreading and foraminal erosion may be seen on plain radiographs [5]. By ultrasonography, ganglioneuroma is identified as a homogeneous, hypoechoic, well-circumscribed mass [6].

More advanced examinations including CT and MRI are usually performed to assist in evaluating the extent of disease, establishing a differential diagnosis list, and judging the treatment response [1]. On unenhanced CT, ganglioneuroma may be homogeneous or heterogeneous and has low internal attenuation relative to muscle due to the abundant myoid matrix, but may also appear slightly hyperattenuating if it is dominated by ganglion cells [12,19]. Approximately 20% of ganglioneuromas have calcifications; and to distinguish it with neuroblastoma or ganglioneuroblastoma which has coarse calcifications, fine punctate calcifications are more often seen in ganglioneuromas [7,12,15,20,21].

In MRI, the appearance of ganglioneuroma may be less specific than CT [20]; however, MRI is more superior in evaluating chest wall involvement and identifying intraspinal extension, which is quite rare [1,10,15]. This makes MRI more helpful in assessing treatment response and for surgical considerations [1]. In MRI, ganglioneuroma shows as a homogenous mass with intermediate signal intensity on mostly all sequences. However, in T2-weighted images, ganglioneuroma occasionally shows heterogeneous intermediate to high signal intensity, depending on the proportion of myxoid stroma, cellular components, and collagen fibers within the tumor [2,12,15,22]. Intermediate to high signal intensity represents areas with high cellularity and more collagen, while markedly high intensity indicates higher myxoid stroma components and low cellularity and collagen amount [23]. Ganglioneuroma may also show a “whorled appearance”, which is due to curvilinear bands of low signal intensity representing the interlacing bundles of Schwan cells and collagen fibers within the mass [15,24,25].

Following contrast administration, ganglioneuroma shows mild to moderate enhancement on CT scanning; and this is different with neuroblastoma which demonstrates strong uptake of contrast [7,20,21]. In MRI, there is a poor early enhancement on dynamic MRI and higher accumulated contrast medium in non-dynamic MRI due to a high proportion of myxoid matric and enlarged extracellular space [20]. Delay enhancement may occur due to blocked perfusion of contrast agents by mucus [19].

The presence of fat inside the tumors has been reported in earlier studies. One mechanism postulated is that the tumor had presented before and some of it is replaced by fat after being degenerated, and another mechanism is that the tumor involves the surrounding fat component, especially in the paravertebral region [25]. Ganglioneuroma with fat will appear as an area with high signal intensity on both TI-T2 and low signal intensity on the fat-suppressed post-contrast images [2,7]. This presence of fat helps differentiate ganglioneuroma from other tumors in posterior mediastinum, especially if the mass clearly enters the spinal canal [2].

Ganglioneuroma requires complete surgical resection when possible due to the possibility of this tumor growing aggressively and invades the adjacent structures [4]. Despite being benign, surgery is suggested in patients who have symptoms, encroachment on the vertebral foramina, and increased catecholamine release, as well as in patients with significant size of tumor. Laminectomy is indicated if there is intraspinal involvement [26]. No medical treatment is indicated in ganglioneuroma. Prognosis is usually good as ganglioneuroma rarely becomes malignant or metastasize. Local recurrence is rare but radiologic surveillance after resection is still recommended [4]. Complications may only occur as a result of the surgery; however neurogenic symptoms, such as due to spinal cord compression, may not be reversed after the removal of the tumor [6].

In this report, the patient came to the emergency room with shortness of breath. The result of the chest radiograph and CT scanning suggested that there was a large mass occupying the posterior mediastinal region that it compressed the adjacent structures. In pediatric patients, neurogenic tumors are the most common and other possible diagnoses include bronchogenic cyst, enteric cyst, or meningocele [27]. Among other neurogenic tumors, ganglioneuroma is more often seen in older children but is not limited to any age group, thus the patient’s demographic data has little value in narrowing down the differential diagnoses.

Plain radiograph in this patient shows a huge opacity in the left hemithorax with the heart pushed to the right and scoliosis, indicating a massive mediastinal mass. Further examination using CT scanning revealed the presence of a true

posterior mediastinal mass which is heterogeneous and low-attenuating with a speck of calcifications and mild contrast enhancement. These characteristics support the diagnosis of neurogenic tumors, especially ganglioneuroma by judging the size of calcifications. MRI should be done to further assess the nerve involvement and the true etiology of scoliosis; however, it was not done due to the urgency of the symptoms and the patient's condition.

Despite the imaging examinations, the true diagnosis of ganglioneuroma is made by histopathological examination that revealed mature well-differentiated ganglion cells. The finding of mature ganglion cells directly precludes other neurogenic tumors. This diagnosis is in accordance with the lack of symptoms, that the patient only complained of shortness of breath as the mass had grown into a massive size and compressed the adjacent structures.

Conclusion

Ganglioneuroma is one of the rare neurogenic tumors occurring in the posterior mediastinum, which may be a diagnostic challenge both clinically and imaging. This report demonstrated a mediastinal ganglioneuroma in a patient presenting with shortness of breath. The tumor in our patient was unusual as it occurred in a young pediatric patient and the size was massive. Even though the confirmed diagnosis was made by histopathological examination, preoperative imaging examinations help to determine the location, assess the mass characteristics, and choose the appropriate treatment options.

Patient Consent Statement

Patient consent received for this case report.

REFERENCES

[1] Franco A, Mody NS, Meza MP. Imaging evaluation of pediatric mediastinal masses. Radiol Clin North Am 2005;43(2):325–53 MarPMID:15737372 . doi:10.1016/j.rcl.2005.01.002.

[2] Duffy S, Jhaveri M, Scudierre J, Cochran E, Huckman M. MR imaging of a posterior mediastinal ganglioneuroma: fat as a useful diagnostic sign. AJNR Am J Neuroradiol 2005;26(10):2658–62 Nov-DecPMID:16286419PMCID: PMC7976182.

[3] Geoerger B, Hero B, Harms D, Grebe J, Scheidhauer K, Berthold F. Metabolic activity and clinical features of primary ganglioneuromas. Cancer 2001;91(10):1905–13 May 15PMID:11346873 . doi:10.1002/1097-0142(20010515)91:10<1905::aid-cncr1213>3.0.co;2-4.

[4] Forsythe A, Volpe J, Muller R. Posterior mediastinal ganglioneuroma. Radiographics 2004;24(2):594–7 Mar-AprPMID:15026603 . doi:10.1148/rg.242035077.

[5] Lonergan GJ, Schwab CM, Suarez ES, Carlson CL. Neuroblastoma, ganglioneuroblastoma, and ganglioneuroma: radiologic-pathologic correlation. Radiographics 2002;22(4):911–34 Jul-AugPMID:12110723 . doi:10.1148/radiographics.22.4.g02jl15911.

[6] Adam O, Bola ES, Rodica Ilie, Mandrusca R. Ganglioneuroma. Jurnalul Pediatrului 2007;10(39-40):48–51 Jul-Dec.

[7] Guan YB, Zhang WD, Zeng QS, Chen GQ, He JX. CT and MRI findings of thoracic ganglioneuroma. Br J Radiol 2012;85(1016):e365–72 AugEpub 2012 May 9PMID:22573298PMCID: PMC3587058. doi:10.1259/bjr/53395088.

[8] Rodriguez EF, Jones R, Miller D, Rodriguez FJ. Neurogenic tumors of the mediastinum. Semin Diagn Pathol 2020;37(4):179–86 JulEpub 2020 May 21. PMID:32448592 . doi:10.1053/j.semdp.2020.04.004.

[9] Yam B, Walczyk K, Mohanty SK, Coren CV, Katz DS. Radiology-pathology conference: incidental posterior mediastinal ganglioneuroma. Clin Imaging 2009;33(5):390–4 Sep-OctPMID:19712821 . doi:10.1016/j.clinimag.2009.03.009.

[10] Ronson RS, Duarte I, Miller JI. Embryology and surgical anatomy of the mediastinum with clinical implications. Surg Clin North Am 2000;80(1):157–69 Febx-xiPMID:10685147 . doi:10.1016/s0039-6109(05)70400-x.

[11] Shin JH, Lee HK, Khang SK, Kim DW, Jeong AK, Ahn KJ, et al. Neuronal tumors of the central nervous system: radiologic findings and pathologic correlation. Radiographics 2002;22(5):1177–89 Sep-OctPMID:12235346 . doi:10.1148/radiographics.22.5.g02se051177.

[12] Pavlus JD, Carter BW, Tolley MD, Keung ES, Khorashadi L, Lichtenberger JP 3rd. Imaging of Thoracic Neurogenic Tumors. AJR Am J Roentgenol 2016;207(3):552–61 SepEpub 2016 Jun 24PMID:27340927 . doi:10.2214/AJR.16.16018.

[13] Ranganath SH, Lee EY, Restrepo R, Eisenberg RL. Mediastinal masses in children. AJR Am J Roentgenol 2012;198(3):W197–216 MarPMID:22358017 . doi:10.2214/AJR.11.7027.

[14] Schulman H, Laufer L, Barki Y, Philip M, Mares AJ, Maor E, Hertzanu Y. Ganglioneuroma: an 'incidentaloma' of childhood. Eur Radiol 1998;8(4):582–4 PMID:9569326 . doi:10.1007/s003300050438.

[15] Strollo DC, Rosado-de-Christenson ML, Jett JR. Primary mediastinal tumors: part II. Tumors of the middle and posterior mediastinum. Chest 1997;112(5):1344–57 PMID:9367479 . doi:10.1378/chest.112.5.1344.

[16] Lin PC, Lin SH, Chou SH, Chen YW, Chang TT, Wu JR, et al. Ganglioneuroma of posterior mediastinum in a 6-year-old girl: imaging for pediatric intrathoracic incidentaloma. Kaohsiung J Med Sci 2010;26(9):496–501 SepPMID:20837347 . doi:10.1016/S1607-551X(10)70078-4.

[17] Qiu Y, Wang S, Wang B, Zhu F. Adolescent thoracolumbar scoliosis secondary to ganglioneuroma: a two case report. Spine (Phila Pa 1976) 2007;32(10):E326–9 May 1PMID:17471082 . doi:10.1097/01.brs.0000261628.77342.ba.

[18] Woo OH, Yong HS, Shin BK, Oh YW, Kim HK, Kang EY. Wide spectrum of thoracic neurogenic tumours: a pictorial review of CT and pathological findings. Br J Radiol 2008;81(968):668–76 AugPMID:18628335 . doi:10.1259/bjr/28902167.

[19] Cai J, Zeng Y, Zheng H, Qin Y, T K, Zhao J. Retroperitoneal ganglioneuroma in children: CT and MRI features with histologic correlation. Eur J Radiol 2010;75(3):315–20 SepEpub 2010 Jul 1. PMID:20580177 . doi:10.1016/j.ejrad.2010.05.040.

[20] Scherer A, Niehues T, Engelbrecht V, Mödder U. Imaging diagnosis of retroperitoneal ganglioneuroma in childhood. Pediatr Radiol 2001;31(2):106–10 FebPMID:11214677 . doi:10.1007/s002470000381.

[21] Ichikawa T, Ohtomo K, Araki T, Fujimoto H, Nemoto K, Nanbu A, et al. Ganglioneuroma: computed tomography and magnetic resonance features. Br J Radiol 1996;69(818):114–21 FebPMID:8785637 . doi:10.1259/0007-1285-69-818-114.

[22] Zhang Y, Nishimura H, Kato S, Fujimoto K, Ohkuma K, Kojima K, et al. MRI of ganglioneuroma: histologic correlation study. J Comput Assist Tomogr 2001;25(4):617–23 Jul-AugPMID:11473195 . doi:10.1097/00004728-200107000-00018.
[23] Rha SE, Byun JY, Jung SE, Chun HJ, Lee HG, Lee JM. Neurogenic tumors in the abdomen: tumor types and imaging characteristics. Radiographics 2003;23(1):29–43 Jan-FebPMID:12533638 . doi:10.1148/rg.231025050.
[24] Juanpere S, Cañete N, Ortuño P, Martínez S, Sanchez G, Bernado L. A diagnostic approach to the mediastinal masses. Insights Imaging. 2013 Feb;4(1):29-52. doi: 10.1007/s13244-012-0201-0. Epub 2012 Dec 6. PMID: 23225215; PMCID: PMC3579993.
[25] Kato M, Hara M, Ozawa Y, Shimizu S, Shibamoto Y. Computed tomography and magnetic resonance imaging features of posterior mediastinal ganglioneuroma. J Thorac Imaging 2012;27(2):100–6 MarErratum in: J Thorac Imaging. 2013 Jul;28(4):262. Shibamato, Yuta [corrected to Shibamoto, Yuta]. PMID:21263353 . doi:10.1097/RTI.0b013e3181ff6404.
[26] Chang CY, Hsieh YL, Hung GY, Pan CC, Hwang B. Ganglioneuroma presenting as an asymptomatic huge posterior mediastinal and retroperitoneal tumor. J Chin Med Assoc 2003;66(6):370–4 JunPMID:12889507 .
[27] Duwe BV, Sterman DH, Musani AI. Tumors of the mediastinum. Chest 2005;128(4):2893–909 OctPMID:16236967 . doi:10.1378/chest.128.4.2893.