Paraganglioma of cauda equina - case report and literature review

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Abstract

Paragangliomas are tumors arising from neuroectodermally derived extra-adrenal paraganglion system which has a wide distribution throughout the body. The majority of paragangliomas are located in the head and neck region. Their occurrence in the spinal canal is infrequent. We report the first case of paraganglioma of cauda equina from Brunei Darussalam. The histological features and immunohistochemical findings are discussed.

Keywords: *cauda equina, immunohistochemistry, paraganglioma*

Introduction

Paragangliomas are uncommon tumours arising from neuroectodermally derived extra-adrenal paraganglion system which has wide distribution throughout the body. The majority of paragangliomas are located in the head and neck region and arise from paraganglia intimately associated with parasympathetic nervous system. Examples of such tumours are carotid body tumour, glomus jugulare tumour, vagal body tumour etc. Those extra-adrenal paragangliomas arising from aorticosympathetic paraganglia associated with sympathetic nervous system occur predominantly in the para-aortic region of retroperitoneum including anatomic sites of organs of Zuckerkandl, posterior thorax and neck [1, 2]. They may rarely occur in urinary bladder, prostate and gall bladder [3-5]. Primary paragangliomas occur infrequently in the spinal canal [6-12]. We report a case of paraganglioma of cauda equina.

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Clinical presentation

A 26 year-old policeman presented with a four-month history of pain in the lower lumbar region and right sciatica. He also complained of weakness and numbness of both legs which predominantly affected the left side. He also experienced gait difficulties. He denied any past history of spinal trauma. His bladder function was intact. No vasomotor symptoms including episodic hypertension were present. The blood pressure was 120/80 and pulse rate was 68/min throughout his stay in hospital. Neurologically, he was having 4/5 power in the right hip, knee and ankle. Deep tendon reflexes were absent in both legs. Straight leg raising test was negative. He also had L3, 4, 5 and S1 dermatomal hypoesthesia. Plain radiograph of lumbar spine showed no obvious abnormality. However, magnetic resonance imaging (MRI) of lumbar spine revealed a well-defined intradural extramedullary enhancing lesion in the D12-L1 region pushing the conus medullaris upwards and compressing the cauda equina (Fig. 1). The MRI diagnosis was possibly a schwannoma or ependymoma. D12 and L1 laminectomy was subsequently performed. The lesion was seen on opening the dura mata and it was found to be attached to one of the nerve roots with a vascular pedicle. The vascular pedicle with nerve root attachment was cut, cauterized and tumour was resected completely. The operation was uneventful without any complications. Postoperatively, the patient had a complete neurological recovery. No signs and symptoms of recurrence were noted at 20 months follow-up.

Pathological features

Grossly, the tumour was small, ovoid, dark brown and soft to relatively firm in consistency. It measured 2x1.5x1cm. Cut surface showed yellowish to dark tan appearance (Fig. 2). Routine histological examination showed a small tumour enclosed by fibrous capsule. It exhibited typical nesting (Zellballen pattern) of neoplastic chief cells surrounded by delicate fibrous septa richly endowed with congested dilated sinusoidal capillary network. The chief cells were generally uniform, medium-sized and polygonal in appearance. The nuclei were round and vesicular with finely dispersed chromatin. Mild degree of nuclear atypia was noted. The cytoplasm was pale pink granular to homogenous eosinophilic in nature. Only occasional scattered mitoses were present. The flattened to spindle sustentacular cells were seen at the periphery of nests of tumour cells. The chief cells were also found to be arranged into anastomosing strands and cords in areas. Microcystic change and presence of some siderophages were noted in a few areas. There was no evidence of vascular and capsular invasion (Fig 3). Immunohistochemical studies showed diffuse positive immunoperoxidase reactions of chief cells for neurone specific enolase (NSE), chromogranin A, synaptophysin and vimentin . The sustentacular cells were highlighted by positive reactions to S100 protein and glial fibrillary acidic protein (GFAP). The chief cells were found to be negative for GFAP and neurofilament protein (NF) (Figs. 4-6). These typical histomorphologic features and positive immunoreactions for neuroendocrine markers established the diagnosis of this tumour as paraganglioma.

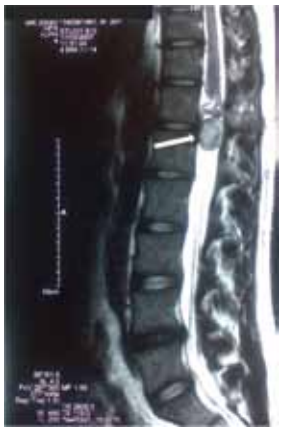

Figure 1. T2 weighted MRI of thoracolumbar spine showing an intradural lesion (white arrow) at T12/L1 level compressing and displacing the conus medullaris superiorly.

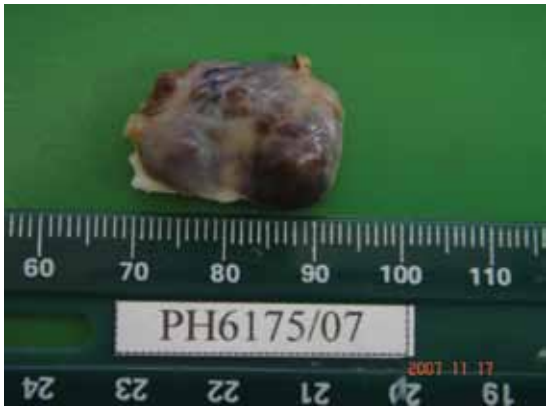

Figure 2. Gross appearance of the resected tumour. It was small, ovoid, dark brown and measured 2x1.5x1cm.

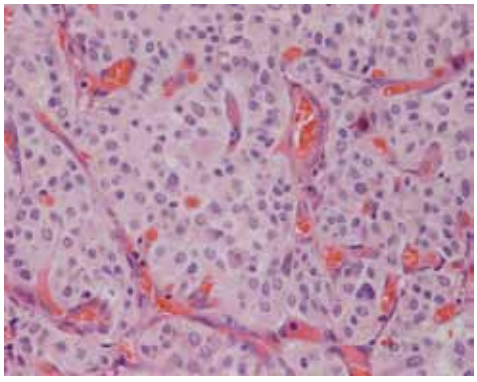

Figure 3. Histology of the tumour showing typical Zellballen pattern of chief cells surrounded by richly vascular stroma (H & E, original magnification x200).

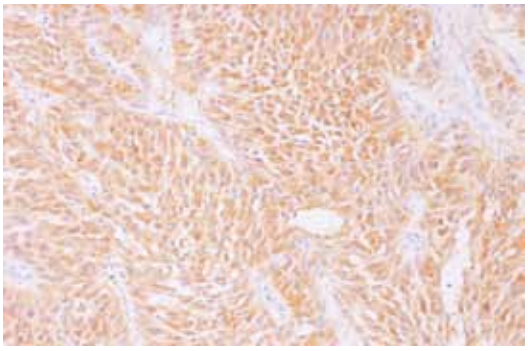

Figure 4. Immunoperoxidase stain for neurone specific enolase demonstrates diffuse dark brown cytoplasmic positivity of chief cells (original magnification x200).

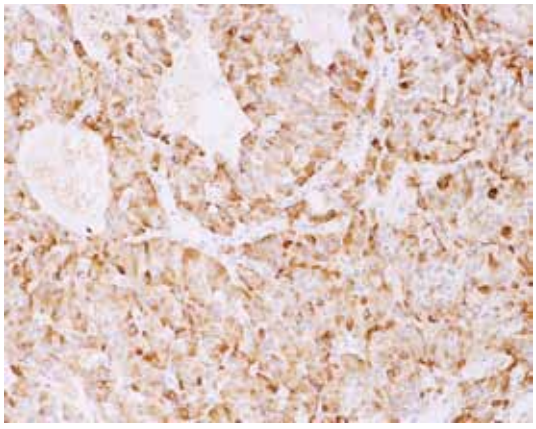

Figure 5. Immunoperoxidase stain for chromogranin A displays granular dark brown cytoplasmic positivity of chief cells (original magnification x200).

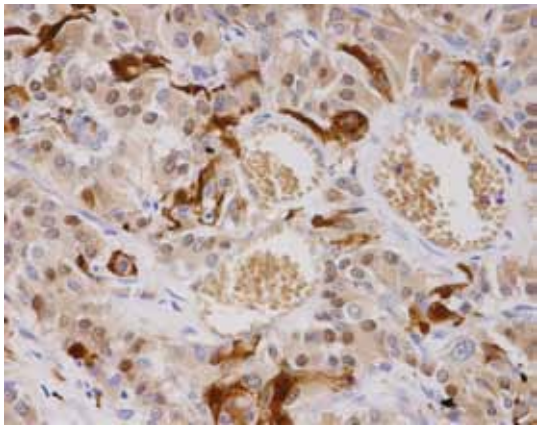

Figure 6. Immunoperoxidase stain for S100 protein highlights the spindle sustentacular cells (original magnification x400).

Discussion

Paragangliomas occur infrequently in the spinal canal. The majority are located in lumbar region, cauda equina and filum terminale [6-12]. The lumbar and cauda equina paragangliomas are presumed to arise from neural stem cells present in the ependymal layer of the spinal canal or from the residual peripheral neuroblasts residing in cauda equina [13-15].

The recognition of spinal paraganglioma as a distinct clinical and pathologic entity by its histological, histochemical and ultrastructural characteristics was reported first by Lerman et al in 1972 as a ganglioneuroma-paraganglioma of cauda equina in a 29 year-old black man [16]. In fact, a case of a "secretory ependymoma" of filum terminale reported by Miller and Torack in 1970 was in retrospect proven to be the first case of spinal paraganglioma [17]. Since then only limited numbers of single case reports and small case series were reported in literatures [6-12]. A total of 184 cases of lumbar paraganglioma had been reported until 2008 [18].

Most of these tumours clinically presented with low back pain with or without sciatica and other clinical signs and symptoms of spinal cord compression [7, 8, 10-12]. Uncommon signs and symptoms of increased intracranial pressure may also occur [19]. The patient's age ranges from 9 to 74 years (mean 45.9 ±13.1 years). Males are affected more than females[10]. However, no gender difference was noted in the study of 30 cases reported by Moran, Rush and Mena [8]. The clinical signs and symptoms are non-specific and usually these will initiate radiological investigations including magnetic resonance imaging (MRI). MRI findings are also found to be generally non-specific but according to Abe et al, the presence of serpiginous vasculature and a vascular pedicle is diagnostic if visible on MRI [20]. Correlation between MRI findings and pathologic features of cauda equina paragangliomas was also described by Yang et al in their study of clinicopathoradiologic finding in four cases [21].

The definitive diagnosis of paraganglioma depends on the recognition of typical histomorphologic appearance on routine haematoxylin and eosin (H and E) histology and positive immunohistochemical reactions of tumour cells for neuroendocrine markers. Clinicopathological, histomorphological and immunohistochemical studies of spinal paragangliomas were reported by Sonneland et al in 1986 and by Moran, Rush and Mena in 1997 [7, 8]. A comprehensive review of histology, ultrastructure, immunohistology and molecular biology of extra-adrenal paragangliomas was reported by Kliewer and Cochran in 1989 [22].

From these studies as well as from other reported cases of extra-adrenal paragangliomas, it is found out that the basic histomorphologic features of all paragangliomas are similar whether they are situated in spinal canal or other sites.

The typical features are dual-cell population and arrangement of chief cells into compact nests (Zellballen) surrounded by delicate fibrous septa richly endowed with sinusoidal capillary network. The nests of chief cells are wrapped by spindle sustantacular cells in the peripheral region. Immunohistochemical studies of paragangliomas displayed positive immunoreactivity of chief cells for neuroendocrine markers such as NSE, chromogranin A and synaptophysin. Sustentacular cells are immunoreactive for S100 protein and GFAP.

The spinal paragangliomas are usually non-functional although they are of neuroendocrine origin. Only three cases of functionally active cauda equina paragangliomas were found in the literature reviewed by Gelabert-Gonzalez in 2005 [10]. Most of spinal paragangliomas are slow growing, benign in nature and less than 1% may be locally aggressive [8].

The differential diagnosis of paragangliomas of cauda equina includes myxopapillary ependymoma, neural tumour, meningioma and metastatic carcinoma. Among them, the lesion most commonly confused with paraganglioma on routine H & E histology is myxopapillary epdendymoma. Misinterpretation of paragangiloma as ependymoma is contributed by the fact that paraganglioma may exhibit intimate cell-capillary relationship as well as formation of perivascular pseudo-rosettes and papillae. It is possible differentiate paraganglioma from ependymoma by immunohistochemical studies. The tumour cells of myxopapillary ependymomas are negative for neuroendocrine markers but are positive for GFAP and S100 protein. The differentiation of paraganglioma from ependymoma is important as paraganglioma is slow growing, benign in biologic behavior and complete excision of the tumour will be curative in contrast to ependymoma.

Our patient is a young man who presented with lower lumbar pain associated with right sciatica, bilateral numbness and weakness of the legs of four months duration. MRI of lumbar spine detected a well-defined enhancing intradural extramedullary tumour in D12-L1 region. Histomorphology and immunohistochemical studies showed typical features of paraganglioma. Following the total resection of the tumour, he recovered completely from neurological signs and symptoms and is back at work as a policeman. He is also found to be free from recurrent neurological signs and symptoms at 20-month follow-up.

Conclusion

Paragangliomas occur infrequently in spinal canal in contrast to their more common occurrence in the head and neck region. Spinal paraganglioma should be considered as one of the differential diagnoses of spinal intradural tumours such as ependymoma, neural tumour and metastatic carcinoma. We report this case to be aware of the occurrence of paraganglioma in spinal canal which can be cured surgically if completely excised.

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