A rare cause of thoracic neural foraminal widening, with diagnostic CT and MR appearances.

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Learning objectives

1) Revise the differential diagnosis of lesions causing neural foraminal widening.

2) Discussion of the importance of making the correct radiological diagnosis in order to ensure optimal management, e.g. pre-operative embolisation.

3) Review the literature regarding the diagnosis and management of angiolipoma.

Background

The majority of lesions causing neural foraminal widening are solitary benign peripheral nerve sheath tumours, such as neurofibromas or schwannomas \(^1\). However, the differential diagnosis for such lesions is potentially vast. We present a case of a rare cause of neural foraminal expansion and discuss the importance of making the correct radiological diagnosis in order to ensure optimal management, e.g. pre-operative embolisation prior to surgical excision.

A 71 year old woman presented with compressive symptoms from a large multinodular goitre. The patient was listed for thyroidectomy.

AP and lateral chest radiographs (Figure 1), performed as part of anaesthetic assessment, revealed an incidental right-sided posterior mediastinal soft tissue mass projected over the T5/6 neural foramen.

A routine pre-thyroidectomy unenhanced CT scan of the neck corroborated the conventional radiography findings, confirming a focal soft tissue mass in the right paravertebral pleural region (Figure 2).

The patient denied any neurological symptoms. No focal neurological signs could be elicited on examination. An enhanced CT (chest) (Figure 3) and MR (thoracic spine) with gadolinium (Figure 4 & 5) were performed to characterise the incidental lesion further.

Imaging findings OR Procedure details
Imaging findings

Both CT and MR demonstrate expansion, without destruction, of the right T5/6 neural foramen due to a dumbbell shaped lesion (Figures 3B & 4). The lack of associated bony invasion may favour a benign aetiology in this case, such as a neurofibroma or schwannoma. However, there are other features on the CT and MR images that suggest a different diagnosis.

The initial unenhanced CT (neck) reveals a soft tissue density lesion (40HU), in which there is a discrete peripheral hypoattenuating region (-100HU) (Figure 3a). On MR, the mass is generally isointense to muscle on T1-weighted sequences. However, there is a region of high signal within the mass which correlates anatomically to the hypoattenuating area demonstrated on CT (Figure 4). Both these appearances imply a focal fatty region within a soft tissue mass. The coronal post gadolinium T1-weighted MR image reveals a discrete black/white band at the boundary of the fatty component of the lesion (Figure 5C). This is chemical shift artefact at a fat/fluid interface, providing further indirect evidence of significant fatty component to the mass.

Post-contrast CT images through the lesion reveal a heterogeneously enhancing tumour (Figure 3B). The lesion enhances avidly on T1-weighted MR images following intravenous gadolinium administration (Figure 4B & 5C). These features suggest a copious vascular supply.

In summary, the CT and MR findings demonstrate a well-vascularised soft tissue mass with a fatty component, expanding but not destroying the neural foramen of T5/6. These features are in keeping with a posterior thoracic extradural angiolipoma.

The MR images also reveal a haemangioma in the vertebral body adjacent to the angiolipoma (Figure 5), which may simply represent an incidental finding. However, haemangiomas and lipomas are hypothesised to be at polar ends of a spectrum, with angiolipoma an intermediate entity\(^2\). As such, the angiolipoma in our patient might have been related aetiologically to the adjacent vertebral body haemangioma, serving as another diagnostic clue.

Histopathological examination of the tumour revealed adipose tissue within which were very numerous thin-walled blood vessels of varying calibre. The appearances were typical of an angiolipoma, corroborating the radiological diagnosis (Figure 6).

Discussion
The differential diagnosis of neural foraminal widening...

A dumbbell solitary benign peripheral nerve sheath tumour is the cause of neural foraminal widening in the vast majority of cases\(^1\). These tumours are divided into two major groups: neurofibroma and schwannoma, with the former being slightly more common.

Benign peripheral nerve sheath tumours are characteristically isointense to muscle on T1-weighted MR images. Heterogeneous signal return is frequently observed on T2-weighted sequences, where high signal corresponds to areas of cystic degeneration and low signal to collagen fibres which may enhance following administration of gadolinium. Where there is a central fibrous component and peripheral cystic degeneration, this constitutes the target sign, which is seen more frequently in neurofibromas than schwannomas\(^3\). Other methods of distinguishing between these two pathologies on MR include the fact that schwannomas are typically eccentric to the parent nerve but within the epineurium, whereas neurofibroma can obliterate the nerve\(^3\).

The differential of lesions causing neural foraminal widening includes many rarer causes, e.g. tumours such as a spinal metastasis, solitary bone plasmocytoma, chordoma, malignant fibrous histiocytoma, osteoblastoma, chondrosarcoma, superior sulcus tumour, as well as a malignant peripheral nerve sheath tumour\(^1,4\). In addition, a plethora of rare non-neoplastic lesions can widen the neural foramen, including tuberculous spondylitis, vertebral hydatid disease, aneurysmal bone cysts, infraforaminal synovial cysts, traumatic pseudomeningoceles, extradural arachnoid cysts and vertebral artery tortuosity\(^1,4\).

Angiolipomas...

Spinal angiolipomas are rare, benign neoplasms, accounting for 0.04-1.2% of all spinal axis tumours\(^5\). A recent review of all 123 published cases of spinal angiolipoma describes erosion of the walls of the adjacent vertebrae as the most frequent bony manifestation\(^2\). Even though neurofibromas and schwannomas are far more frequent causes of neural foraminal expansion, angiolipomas need to be at least considered in the differential of a dumbbell lesion expanding the neural foramen because of the peri-operative bleeding risk associated with these vascular tumours. Indeed, tumour embolisation is an extra precaution sometimes performed in cases of angiolipomas prior to surgical resection\(^2\), but not for neurofibromas or schwannomas.
However, making the diagnosis of angiolipoma may be no mean feat. Despite the high lipid content of angiolipomas, their T1-weighted MRI appearances can vary from hyperintense, through isointense, to hypointense, depending on their associated vascular density. We describe the presence of chemical shift artefact on post gadolinium T1-weighted imaging as indirect evidence of a fatty component (figure 5C). This is potentially an important diagnostic sign which may raise the suspicion of angiolipoma, especially in an isointense or hypointense dumbbell lesion on T1-weighted imaging. To the best of our knowledge, this diagnostic feature has not previously been reported amongst angiolipomas. Accurate radiological diagnosis of an angiolipoma should reduce unexpected haemorrhagic complications from biopsy or resection of the lesion.

Images for this section:

![Fig. 1: AP chest radiograph demonstrating a soft tissue prominence at the superior aspect of the right mediastinal border (white arrow). Lateral chest radiograph confirming a posterior mediastinal mass projected over the T5/6 neural foramen (black arrow).](image-url)
Fig. 2: Routine pre-thyroidectomy non-contrast CT(neck) revealing soft tissue thickening in the right paravertebral region with a discrete hypoattenuating component laterally.
**Fig. 3:** 3A: Post intravenous contrast CT(chest) revealing soft tissue thickening in the right paravertebral region with a discrete hypoattenuating component laterally (white arrow). 3B: Post intravenous contrast CT(chest) demonstrating a partially enhancing heterogeneous lesion, expanding the T5/6 neural foramen.

**Fig. 4:** 4A: T1-weighted axial image through the isointense dumbbell shaped tumour, which expands the neural foramen. 4B: Post intravenous gadolinium T1-weighted axial image through the tumour, revealing avid enhancement. 4C: T2-weighted axial image through the tumour, which is of intermediate intensity.
Fig. 5: 5A: T1-weighted axial image through the proximal aspect of the tumour demonstrating a focal fatty region of high signal. 5B: T1-weighted sagittal image through the tumour revealing a rim of hyperintensity around the isointense lesion, in keeping with a fatty capsule (open white arrow). 5C: Post intravenous gadolinium T1-weighted coronal image through the tumour, demonstrating avid enhancement and a region of chemical shift artefact (white arrow).
**Fig. 6:** Haematoxylin- and eosin-stained section through the tumour composed of adipose tissue interspersed with numerous thin-walled blood vessels of varying calibre, an appearance diagnostic of an angiolipoma. Scale bar = 200µm.
Conclusion

Angiolipomas are rare causes of neural foraminal widening. There have characteristic imaging features which should be recognised to ensure an accurate pre-operative radiological diagnosis to reduce unexpected haemorrhagic complications from biopsy or resection of the lesion.

Personal Information

References


