

# Diagnostic Evaluation of Spinal Cord Compression.

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## ABSTRACT

There are various modalities for the diagnosis of spinal cord compression. When it is suspected, the ideal investigation is magnetic resonance imaging if the facility is available. Through costly, MR provides all the necessary information. CT and contrast CT myelography also provide most of the relevant information. Plain X-rays and CSF studies provide many clues for diagnosis and these followed by water soluble contrast myelography are standard techniques used even now in many centers in many countries, hence these are discussed here.

**Keywords:** Diagnostic Evaluation, Spinal cord, X-rays.

## INTRODUCTION

When spinal cord Compression is suspected, the ideal investigation is magnetic resonance imaging if the facility is available. Through costly, MR provides all the necessary information. CT and contrast CT myelography also provide most of the relevant information. Plain X-rays and CSF studies provide many clues for diagnosis and these followed by water-soluble contrast myelography are standard techniques used even now in many centers in many countries, hence these are discussed here.

## METHODS

The various modalities for diagnosis were evaluated. A thorough literature search was done using Pub Med, Google Scholar and textbooks for various studies carried out during a period of one year. The results are discussed below.

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## RESULTS

### Plain X-ray Studies

The value of the plain roentgen logic study in the diagnosis and localization of spinal tumors was emphasized by Elsberg and Dyke.<sup>[1]</sup> Anteroposterior, lateral and suitable oblique views of the spine are taken from a systematic study of the following: 1) The size, shape and mineral content of the vertebral body and the pedicles 2) The interpedicular distance 3) The configuration of the posterior surface of the

vertebral body 4) The intervertebral foramen 5) The spines 6) Lamina and transverse processes 7) The existence of paravertebral soft tissue shadows and 8) The presence of Calcification in the tumor. Evidence of Spinal tumor on plain skiagrams of the spine is observed in 15-30 percent<sup>[2,3]</sup> in most series reported from India, Positive findings on Plain x-rays were reported in 42-50 per cent.<sup>[3-5]</sup> This is Probably a reflection of the late referral of cases in many centers. Extradural tumors, most of which are malignant and tumors of vertebrae show radiological changes in high percentages of cases. Nagi et al<sup>[6]</sup> found that 93 per cent of such tumors showed positive plain X-ray findings in the form of destruction of vertebrae or pressure erosions.

The earliest evidence of an intra spinal tumor is a straightening of the medical convex border of the pedicle. The pedicle of the third and fourth dorsal vertebrae often show an apparent flattening of their medial surface due to the obliquity caused by the dorsal Kyphosis and this should not be confused as pathological. With an increase in growth and pressure, the medial border of the pedicle becomes concave and ultimately the pedicle is destroyed. Enlargement of the intervertebral foramen, best seen in the lateral or oblique views, occurs in lesions with an extraspinal extension, e.g. in dumb-bell neurinomas growing along the nerve root a paraspinal sympatheticoblastoma may likewise cause this when it extends into the spinal canal.

Scalloping of the posterior surface of the vertebral body is found in intraspinal tumors producing pressure on the posterior surface, and is commonly seen in big neurinomas in the lumbar region. It must be remembered that such scalloping affecting a number of vertebral bodies may be seen in cases of Von Recklinghausen's disease in the absence of any tumor. This is also seen in some in some cases of congenital hydrocephalus.

Para vertebral soft tissue shadows are seen in the AP view in malignant tumors of the vertebral body and

occasionally in neurinomas with extraspinal extension. Calcification within the tumor, though rare, occurs in psammomatous meningioma. Intramedullary tumors may produce enlargement of the spinal canal.

Primary tumors of the vertebra, e.g. chondroma, haemangioma, plasmacytoma, eosinophilic granuloma, and aneurismal bone cyst present characteristic changes in plain X-rays. Secondary usually produce lytic lesions with collapse or occasionally osteosclerotic changes as in carcinoma of the prostate. A careful survey of the whole spine is necessary to reveal multiplicity of the lesions, if secondaries are suspected. While viewing the plain x-ray, the head, neck and the body of the ribs, wherever visible, are also carefully scrutinized as these may show changes earlier than the vertebra in extra spinal tumors.

### Myelography

Even when the clinical localization is clear, it is advisable to have a myelogram done to ensure exact localization before surgery. Myelography with water-soluble nonionic positive contrast material, and sometimes with CT myelography is useful to confirm the diagnosis, to localize the site and extent the tumor and possibly to get an idea about its nature. In case of complete block, if the neurological and myelographic localization do not coincide, a cisternal myelogram is necessary to determine the upper extent of the lesion. One must also be prepared for immediate surgery, as myelography may at times precipitate an acute neurological deficit.

The essential features to be studied in myelogram are: 1) the width of the spinal cord and its displacement, 2) The distance between the outer margin of the subarachnoid space and the bony margin of the spinal canal, 3) The width of the subarachnoid space on either side of the spinal cord and the degree of block, partial or complete.

### Extradural Tumors

The myelographic features of an extradural tumor are: 1) The displacement of the outer border of the subarachnoid space away from the bony margin on the side of the tumor, 2) Narrowing of the spinal cord and of the subarachnoid spaces on both sides, and their displacement to the opposite side. Lesions situated anteriorly or posteriorly tend to produce a picture of a transverse serrated block in the AP view due to compression and the approximation of the dura, subarachnoid fluid and spinal cord ("brush border" appearance).<sup>[7]</sup>

Benign, slowly growing, extradural tumors like neurinomas and meningiomas produce a lateral indentation in the contrast column in the early stages.

When the construction becomes complete, a smooth oblique defect will be produced at the head of the contrast column. In addition, stretching of the nerve roots may be visualized as described by Dinakar and Balaparneshwar Rao in case of extradural Lesions.<sup>[8]</sup>

### Intradural Tumors: Myelography shows:

1. The outer margin of the subarachnoid space remains close to the bony margin of the spinal canal on both sides.
2. Subarachnoid space on the side of the tumor is widened and is seen as a triangular shaped opacity.
3. The spinal cord and the opposite subarachnoid space are compressed and displaced away from the tumor.
4. As most intradural tumors are benign, they produce a lateral cap or a central cup deformity at the head of the contrast column depending on their position, is called meniscus sign.

### Intra and Extradural Tumors

Some neurinomas are located in both intradural and extradural spaces. The intradural portion generally produces the typical cup deformity with a displacement of the spinal cord. The presence of extradural part can be made out only if there is lateral portion on the side of tumors in addition to the cup shaped defect. This will be seen if extradural part is of sufficient size and located intraspinal.

### Magnetic Resonance Imaging (MRI)

MRI has largely supplemented CT myelography as a definitive diagnostic approach.<sup>[9-11]</sup> Lesion signal abnormalities, cerebrospinal fluid capping, and spinal cord or cauda equine displacement identify most extramedullary masses on a technically adequate, nonenhanced imaging study. The diagnosis of lipoma, neurenteric cysts dermoid or epidermoid, arachnoid cysts, or vascular pathology may be established on the basis of imaging characteristics alone. Gadolinium enhancement markedly increases the sensitivity of magnetic resonance imaging, particularly for small tumors.<sup>[12-14]</sup>

Most intradural tumors are isointense or slightly hypointense with respect to the spinal cord on T1-weighted images.<sup>[15]</sup> Nerve sheath tumors are more likely to be hyperintense to the spinal cord than meningiomas on T2-weighted images. Cauda equina tumors usually demonstrate increased single intensity with respect to cerebrospinal fluid on both T1 and T2 weighted images. Small cauda equine tumors are easily overlooked on nonenhanced images.

Almost all spinal cord tumors demonstrate some degree of contrast enhancement. Meningiomas typically exhibit intense, uniform enhancement,

although non enhanced calcification or intradural cysts may rarely seen.<sup>[16]</sup>

Enhancement of adjacent dura i.e., dural tail strongly supports the diagnosis of meningioma.

Although most nerve sheath tumors and filum ependymomas also demonstrate uniform contrast uptake, heterogeneous enhancement from intratumor cysts, hemorrhage or necrosis is frequently seen.

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