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Myelographic abnormalities of spinal cord and nerve roots lesions in conventional myelography

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Summary
The authors review the myelographic abnormalities of spinal lesions on 90 patients evaluated with conventional or fluoroscopy myelography between 1989 and 1995. The value of Conventional myelography in spinal lesions involving the spinal cord and nerve roots are assessed. The subjects include 49 (45.4%) males and 41 (45.6%) females with a mean age of 38.3 years. Majority of the cases 74(82.2%) had specific neurological symptoms while 16 (17.8%) presented with non-specific neurological symptoms.On the whole 78 (86.7%) cases were successfully analysed, in which 58 (74%) cases had abnormal myelograms and 20 (25.5%) had normal myelograms. Extradural lesions was seen in 47 (81%) cases, while 6 (10.3%) cases and 2 (3.5%) cases showed Intramedullary and Intradural-extramedullary lesions respectively. 3 (5.2%) cases showed combined lesions. The most common anatomical site or location of abnormal myelograms was the Thoracic region with 31 (53.4%) cases, 16 (27.6%) cases in the lumbar, 10 (17.2%) and 1 (1.8%) cases in the cervical and sacral regions respectively. Conventional myelography can be successfully used to demonstrate myelographic abnormalities, including identification and determination of the extent of the anatomical location of spinal lesions.

Keywords: *Conventional, myelography, extradural, intradural, intramedullary.*

Résumé
Les anomalies myélographiques de lésions épinières chez 90 patients étaient revues et évalués utilisant la fluoroscopie myélographiques entre 1989 et 1995. La valeur de la myélographie conventionnelle des liaisons de la moelle épinière et des racines nerveuses étaient aussi évaluées. Il y'avait 49(45.4%) des hommes et 41(45.6%) des femmes avec un age moyen de 38.3 ans. La majorité des cas 74(82.2%) avaient des symptômes neurologiques et 16(17.8%) avaient des symptômes neurologiques non spécifiques. Au total, 78(86.7%) des cas étaient bien analysée, 58(74%) des cas avaient des myélogrammes anormaux et 6(10.3%) des cas et 2(3.5%) avaient des lésions intra médullaires et intra dural extra médullaires respectivement 3(5.2%) des cas montraient des lésions combinées. Le site anatomique le plus commun où la location des myélogrammes anormaux était la région thoracique. Chez 31(53.4%) cas, 16(27.6%) des cas dans la région lombaire, 10(17.2%) et 1 (1.8%) des cas dans les régions cervicales et sacrales respectivement. La myélographie conventionnelle peut être utilisée avec succès pour démontrer les anomalies myélographiques incluant l'identification et la détermination du degré de la localisation anatomique des lésions épinières.

Introduction

The spinal cord and its various nerve roots are fundamental neurological organs that relay messages sent from various centres in the brain to initiate or effect specific neuromuscular action in a coordinated fashion. Patients with Spinal Cord injury usually have permanent and often devastated deficits and disability [1]. Conventional Myelography have proved to be an important Radiological tool in the identification and localisation of Spinal cord abnormalities and its related structures, thus aiding diagnosis and initiating treatment to neurological injuries.

Conventional myelography shows superiority over CT and MRI myelography in the assessment of nerve root compression, and remains a crucial supplemental study necessary to confirm degenerative root impingement in the lateral recess as the cause of radiculopathy. However, CT Myelography has been found to provide significant additional information, including better characterization of spinal abnormalities than Conventional myelography [2]. The introduction of new non-ionic, water soluble compounds such as Amipaque, Iopamidol and Iohexol have been found

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to be universally satisfactory for myelography [3,4]. The low osmolarity, miscibility with spinal fluid and low viscosity to the central nervous system have considerably improved the diagnostic accuracy of conventional myelography which has made this imaging modality a useful tool in evaluating spinal lesions in the developing parts of the world where CT is not readily available and affordable due to high cost of examination.

The purpose of this study is to highlight the different myelographic abnormalities of the theca, spinal cord and cauda equina in conventional myelography, resulting from common spinal lesions, and compare with those already existing in literature.

Materials and method

A retrospective review of records of Ninety (90) conventional myelograms done between 1989-1995, in the Radiology Department of the University College Hospital Ibadan, Nigeria. The subjects were patients referred from the Neurological and Neurosurgical units of the hospital with specific and non-specific neurological symptoms of spinal origin.

The information about sex and age were obtained from radiological request cards while clinical information was obtained from the case note. The myelographic appearances and description including the technique used were obtained from their corresponding radiographs, radiology reports and the available myelography record book in the radiology department.

Technique

Seventy cases had water soluble non-ionic metrizamide (Ampaque) myelography while twenty cases had oil Lipidol (MYODIL) myelography, which is relatively cheaper than metrizamide.The original techniques of Shapiro [5] were routinely employed in those that had oil-myelography while the technique described by Grainger [6,7] was employed for metrizamide myelography. The mode of injection in all the myelography cases was by lumbar puncture technique at the level of L3 and L4 vertebra interspace. Adults had 6.75 mg vials of amipaque with a solvent amount of 12 – 15 mls, while the 3.75 gm vials with a solvent of 7-10 mls were used for children. About 6mls of myodil are usually injected into the subarachnoid space in children and 9 mls in adult.

Myelography was performed with a fluoroscopic device tilting table with a maximum tilt of the table to about 30° (head-down) which is adequate to totally examine the cervical area in order to prevent dilution due to easy flow and miscibility of amipaque with cerebro-spinal fluid. It was routine that patients for myelography should have a plain film of the spine in the area of interest before examination, but this was not strictly adhered to in some cases. The examination is usually terminated after each region has been adequately examined and the area of interest or lesion well demonstrated on representative films.

Myelographic appearances

The following parameters were used in assessment of the myelographic images obtained:

1. Flow of contrast medium: This could either be free flow, total or partial obstruction to the flow of contrast medium.
2. The contour, shape and width of the lateral dense zones of contrast medium that represent the subarachnoid space(SAS) not occupied by the spinal cord.
3. The uniformity and shape of the relatively less dense central zone that represents the spinal cord.
4. The thickness and shape of the linear lucencies representing the nerve roots in the lumbar region.
5. The number of lesions- either single or multiple.
6. The sites of lesions- cervical, thoracic lumbar or sacral regions of the spine

Based on the parameters above, a radiologic diagnosis was made as follows:

a. Normal Appearance (Fig 1a&b): The dense lateral column of contrast medium in the subarachnoid space and the central less dense column of the spinal cord at the cervical and thoracic levels are seen clearly, while linear lucencies representing the nerve roots in the Cauda equina are seen at the Lumbar region within the SAS.

b. Extradural Lesion (Fig 2a&b): The lesion arises from outside the theca and is characterized by medial deviation and displacement of the dense lateral column of the SAS.

c. Intradural - extramedullary Lesion: The lesion is usually in contact with the dense lateral

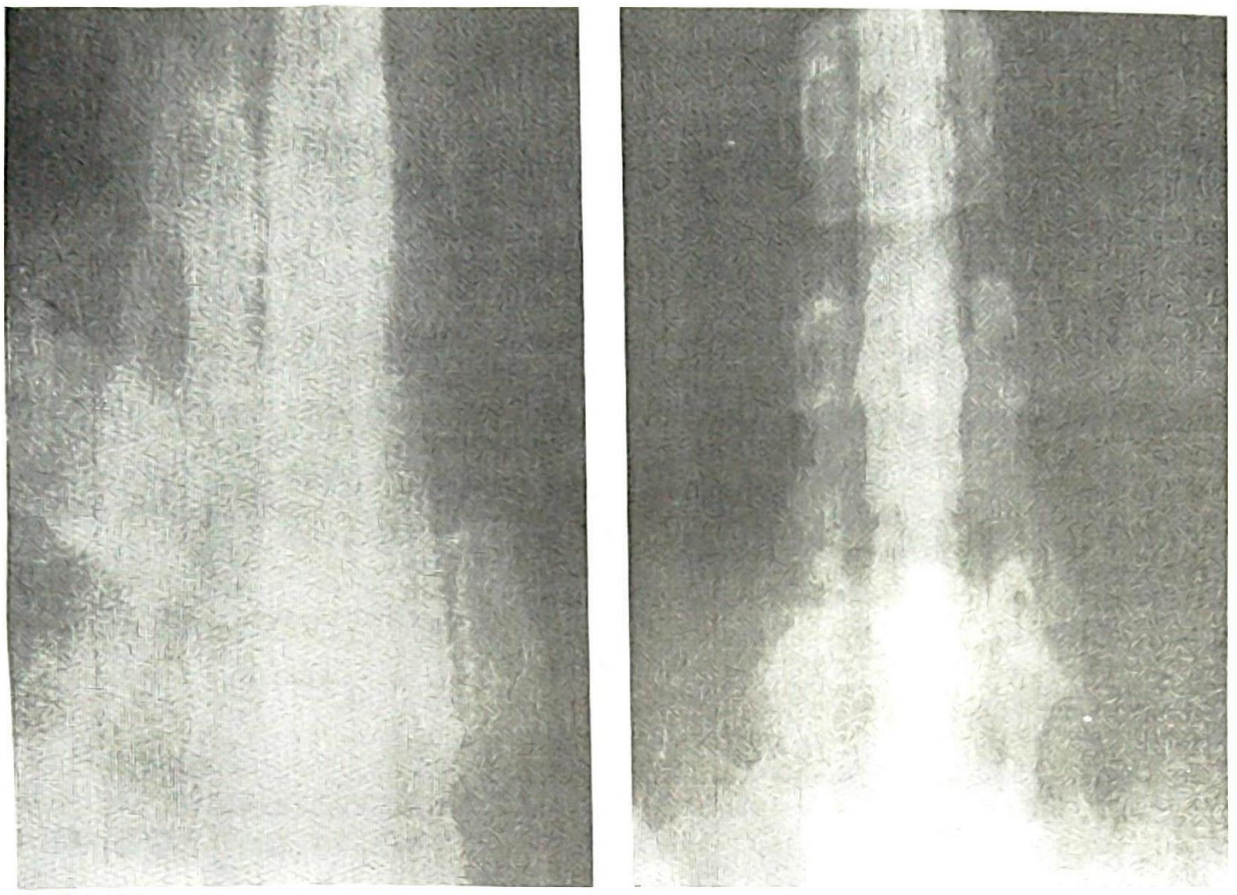

Fig. 1a & b: Normal thoracic and lumbar myelogram: (a) Showing myodil myelogram of the thoracic region with dense lateral columns of the theca and central less dense region of the spinal cord.(b)Showing normal amipaque myelogram of the lumbar region with vertical linear lucencies representing the nerve roots.

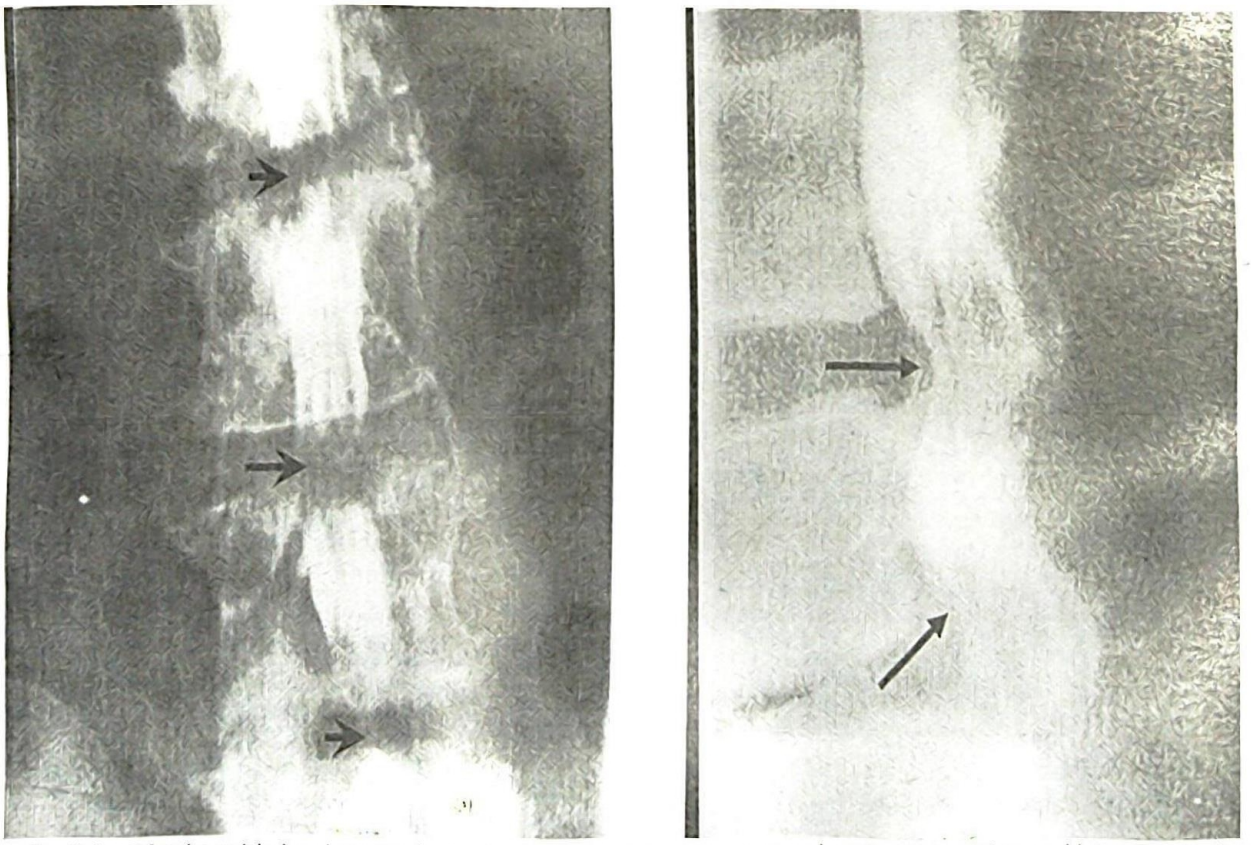

Fig. 2a & b: Metrizamide lumbar myelogram: (a) Antero-posterior view showing narrowing and lateral extradural indentations (arrow heads) of the cauda equina at the lumbar disc levels of L2-L5 and (b) Lateral views showing extradural anterior indentifications (arrows) of the theca at the same lumbar disc levels

Fig. 3: Expansile intramedullary lesion with effacement and thining of the lateral column of the theca in the cervical region

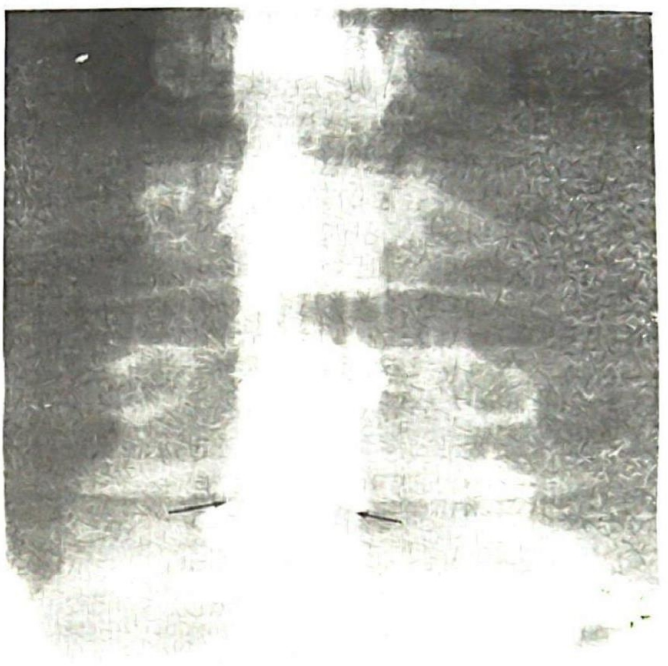

Fig. 5: Antipaque lumbar [illegible] of Theca width at L4/L5 disc level with effacement of the lucent nreve roots bilaterally (arrows)

Fig. 4: Myelogram, antero-posterior view showing complete extra and intradural (combined) block. Note the medial deviation of theca on the right and the 'cap defect' (arrows) typical of Intradural lesion on both sides at the terminal end of the opaque contrast column at D12/L1 level

column of the SAS, and is characterized by a filling defect in this area or an unusual concavity (cap defect) of the terminal head of the contrast medium in contact with the lesion. The less dense central zone may or may not be affected.

d. Intramedullary:(Fig 3): Can either manifest as (i) an unusual expansion of the less dense central zone representing the spinal cord , with narrowing and lateral deviation of the dense lateral column of the SAS or (ii) a filling defect in the central zone.

e. Mixed lesions (Fig 4): Combined features as described in b - c above.

f. Nerve root lesion (Fig 5) : manifest as effacement of the lateral lucency representing the nerve roots within the contrast in the cauda equine

Results

The Ninety (90) subjects whose myelograms were reviewed had their ages ranged from 3years to 77 years with a mean of 38.3 years. The sex and age distribution patterns are shown in Table I. 49 (45.4%) of the patients are males while 41 (45.6%) are females. When the subjects were grouped according

Table I: Age and sex distribution pattern of the subjects

Age In Years	Male (n = 49)	Female (n= 41)	Total (n = 90)
1 – 10	3 (6.1%)	4 (9.7%)	7(7.8%)
11 – 20	5 (10.2%)	7 (17.1%)	12 (13.3%)
21 – 30	9 (18.4%)	7 (17.1%)	16 (17.8%)
31 – 40	4 (8.1%)	6 (14.6%)	10 (11.1%)
41 – 50	12 (24.5%)	7 (17.1%)	19 (21.1%)
51 – 60	14 (28.6%)	6 (14.6%)	20 (22.2%)
61 – 70	2 (4.1%)	2 (4.9%)	4 (4.5%)
71	- (0%)	2 (4.9%)	2 (2.2%)
Total	49 (54.4%)	41 (45.6%)	90 (100%)

Table 2: Neurological indications for myelograms in the series

Neurological indications	No. of patients	Total
(1) Quadriplegia	4	4.4%
(2) Paraplegia	42	46.7%
(3)Quadriparesis	6	6.7%
(4) Paraparesis	22	24.4%
(5) Others	16	17.8%
	90	100%

to age, the 2nd to 4th decade (10-40 years) of life recorded 38 (42. 2%) cases in the series, while the 5th to 6th decade (41 – 60 years) recorded 39 (43.3%) cases. The low frequencies were found in the 1st decade of life with only 7 (7.8%) cases and also in the 7th to 8th decade with 6 (6.7%) cases.

On the whole 70 (77.8%) had metrizamide myelography while 20 (22.2%) had oil myelography. A total of 12 (13.3%) myelograms were found to be inconclusive in the series, while the remaining 78 (86.7%) were successfully analysed. 58 (74.4%) of the successful cases had abnormal myelograms and 20 (25.5%) had normal myelograms. Of the 59 amipaque myelographic cases, 43 (72.8%) showed abnormal findings and 16 (27.2%) normal myelograms, while of the 19 myodil investigations there were 15 (79.8%) abnormal and 4 (21.1%) normal myelograms.

Neurological symptoms

Table 2 shows the neurological clinical indication for the myelographic study. Paraplegia was the most common neurological deficit with 42 (46.7%) cases, followed by Paraparesis with 22 (24.4%), Quadriparesis 6 (6.7%) cases, and Quadriplegia with 4 (4.4%) cases. A group termed 'Others' (i.e non-specific neurologic symptoms) made up 16 (17.8%) remaining cases of the series.

Myelographic description and location/ sites distribution

The Descriptive Types of lesions and the locations/ sites of the abnormal myelogram are represented in Table 3. From the table it is evident that Extradural lesions was seen in 47(81%) cases of the 58 abnormal myelograms, while 6 (10.3%) cases and 2 (3.5%) cases showed Intramedullary and Intradural lesions respectively. 3(5.2%) cases showed combined lesions. The most common site of abnormal myelograms was the Thoracic region with 31 (53.4%) cases . 16(27.6%) cases in the lumbar. 10(17.2%) and 1(1.8%) cases in the cervical and sacral regions respectively.

Table 3: Myelographic description and locations/sites of lesions

Sites	Extradural (n = 47)	Intradural (n = 2)	Intramedullary (n = 6)	Combined (n= 3)	Total (n = 58)
Cervical	7(14.9%)	-	3(50%)	-	10(17.2%)
Thoracic	26(55.3%)	-	3(50%)	2(66.7%)	33(53.4%)
Lumbar	13(27.7%)	2(100%)	-	1(33.3%)	16(27.6%)
Sacral	1(2.1%)	-	-	-	1(1.8%)
Total	47(81%)	2(3.5%)	6(10.3%)	3(5.2%)	58(100%)

A high frequency of Thoracic involvement was present in 26 (55.3%) cases of the 47 Extradural lesions in the study, followed by 13 (27.7%) cases in the Lumbar region,7 (14.9%) cases in cervical region and 1 (2.1%) case in the sacral region. The only 2 (100%) cases of Intradural lesion in the series were found in the Lumbar region, while Cervical and Thoracic sites recorded 3 (50%) cases each of the Intramedullary lesions in the series. The combined lesions recorded 2(66.7%) cases in the Thoracic and 1 (33.3%) case in the Lumbar regions.

Discussion

Conventional Myelography [CM] has proved to be an essential tool in the evaluation of Spinal lesions such as disc pathology; radiological description into extradural, intradural and intramedulary lesions, and also to identify obstruction to flow of cerebro spinal fluid within the theca [2]. It has been widely reported to be a valuable method of assessment of the spinal cord and canal and found to be sufficient to allow preoperative planning of surgical management in the absence of complete block [8]. The introduction of non-ionic water soluble contrast medium (Metrizamide) in the 1970s has made the examination easier and improved the diagnostic accuracy, especially in those patients that require surgery [9]. The high sensitivity of CM in the accurate identification of spinal lesions in this study was reinforced by the high frequency of abnormal myelographic findings in this study. The success rate at which conclusive and diagnostic myelograms were obtained has also improved with water soluble contrast medium [10]. This study recorded a high success rate of 86.7%, and the few failures recorded were mainly due to both subdural or epidural injections of contrast medium and inappropriate positioning and manipulations of patients on the examination table. Multiple or recent lumbar punctures before myelography, with resultant accumulation of cerebro-spinal fluid in the subdural or epidural injections has also been reported in the literature as possible causes of failure of examination [2]

The most frequent spinal lesions, as reported by most workers in literature, occur within the 3rd-4th decade of live [11], which is in agreement with the age distribution pattern of the subjects in our series. Traumatic Spinal Cord injuries occur frequently between the ages of 18-25 years with predominance male sex ratio of 3:1 [1]. Degenerative Changes or Spondylosis occur commonly between 42-60 years of age while disc prolapse occur at a relative younger age between 30-50 years [11,12]. Majority of Spinal Tumours, either benign or malignant are found within the 3rd -5th decade of live, with the benign primary tumours occuring earlier in the 2nd decade, and these are predominantly metastatic lesions, most frequently from carcinomas of the Prostate, Breast, Lung and Gastric, which occur frequently within 40-60 years of age. A high female preponderance has been documented in the meningiomas and metastatic carcinomas of the thyroid and breast [13].

Majority of the cases examined in this study falls within the age 40-60 years and show a male preponderance. This is expected as the usual causes of compressive myelophathies such as Tumours, Metastasis and Disc prolapse are mostly extradural myelographic abnormal lesions, which are the most frequent lesions in our series, and they constitute the largest myelographic lesions found in this age group [11,12,13].

The most common clinical presentation of benign or malignant spinal lesions is back pain. Spinal or radicular pains, usually from Spinal Cord or radicular compression are reported to be the initial symptoms in spinal metastases, followed by appearance of neurological symptoms [11,14]. The neurological symptoms range from sensory deficits to paresis and later lead to complete paraplegia. Loss of bladder or bowel continence can also occur in the later part of the disease depending on the severity and extent of the spinal compression. The high incidence of paraplegia and Paraparesis in our series is not unexpected as most patients in our environment are seen in the latter part of their illness, and myelography in this study has been limited to cases in which surgery was being contemplated. The overwhelming preponderance of the lower limbs over that upper limbs involvement in the cases of weakness and paralysis, is because majority of the spinal cord lesions demonstrated by myelography in our series occurs in the thoracic region, below the level of the cervical spine. This is in agreement with the cases of intranspinal tumours reported by Andrew *et al* [13].

The high frequency of extradural myelographic abnormalities encountered in the series is not unexpected, as the largest group of lesions seen are made up of extradural components or restricted to the extradural space. This is in

agreement with the high frequency of Extradural lesions recorded by RF Carmody *et al* [15]. Their study also reported a high sensitivity and specificity of conventional myelography to extradural masses causing cord compression.

The low frequency of cases of intrameduallary myelographic abnormalities reported in our series were all found both in the cervical and thoracic regions. This low incidence is expected because the intramedullary region is the seat of the developmental spinal cord lesions and of a group of adult gliomas, which are rare and occur predominantly in children between 1-10 years of age. These include Syringo myela, Spinal dysraphism, Lipoma and tumours of embryological origin such as teratomas, dermoid cyst and neuroblastoma [11,12]. Further more, the low incidence may be related to the fact that most of the developmental spinal cord lesions in this environment carries a high mortality rate and are usually lost before presentation.

Only two cases of intradural myelographic abnormalities were found in our series. Both were found in the lumbar region. The low frequency of Intradural-extramedullary abnormalities encountered in our series is due to the relatively low frequency occurring intraspinal tumours that are found generally in this group [16]. The combined variety of myelographic abnormalities shows both extradural and intradural features. Our series recorded three (3) of such cases. Two were located in the thoracic region while the third was in the lumbar region.

The Thoracic and Lumbar regions are reported to be predominantly the common sites of involvement of spinal lesions, since the frequently occurring spinal lesions, such as Degenerative, disc prolapse, tumours and metastasis are found predominantly at these sites [13,15]. This is in agreement with the findings in this study in which majority of the lesions are in the Thoracic (57.4%) region followed by the Lumbar (27.6%) region.

In conclusion, conventional myelography was found to have high accuracy in identification and determination of the extent of the anatomical location of spinal lesions, including appropriate demonstration of their corresponding myelographic abnormalities, and thus plays an important role in the preliminary radiological evaluation of spinal lesions, especially in those cases in which surgery is planned or contemplated. The use of the recently introduced non-ionic contrast medium is a contributory factor to the improved efficacy of this imaging modality. The combination of Conventional myelography with CT-myelography has also been widely reported to have increased its diagnostic value in the accurate detection of spinal lesions.

References

1. Donald Schreiber. Spinal Cord Injuries 2004; 27: 1-17[emedicine].
2. Bartynski WS and Lin L. Lumbar Root Compression in the Lateral Recess: MR Imaging, Conventional Myelography, and CT Myelography comparison with Surgical confirmation. Am J Neuroradiol 2003; 24(3): 348-360.
3. Cobby MJ, Leslie IJ and Watt I. Cervical myelo graphy of nerve root avulsion injuries using water soluble contrast media. British Journal of Radiology, 1988;61(728): 673-678.
4. Grainger, R. Intravenous contrast medium – The Past, the Present, The future. British Journal of Radiology, 1983; 55:1-20.
5. Shapiro, R. Myelography. 4th edition Chicago, III: Year Book. Medical Publishers 1984.
6. Grainger, R.; Kendall, E and Wylie, G. Lumbar Myeology with metrizamde a new non-ionic contrast medium. British Journal of Radiology, 1976; 49: 996-1003.
7. Grainger R, Allison DJ and Adam A. Text book of medical imaging. The Spine: Methods of examination. 4th edition,(3), Churchil Livingstone, 2002; 2411-2421.
8. Lorigan JG, O'Keeffe FN and Toland JA. current status of myelography in the evaluation of thoracic spinal cord. Ir. J. Med Sci. Sci. 1989; 158(7):185-188.
9. Ahn HS and Rosenbaun AE. Lumbar myelography with metrizamide: supplementary Technique. Am. J. Roentgenol 1981; 136:547-551.
10. Katayama H. Heneine N. Van Gessel R. Taroni P. and Spinazzi A. Clinical experience with Iomeprol in myelography and myelo-CT: clinical pharmacology and double-blind comparisons with Iopamidol, Iohexol and Iotrolan. Am J Neuroradiol, 2003; 24(3): 348-360.

11. Allan Garber and Harold Sox. Diagnostic evaluation of low back pain with emphasis on imaging. Annals of Internal Medicine, 2002; 137(7): 586-597.
12. Koyanagi I, Iso T, Iwasaki Y, Akino M, Abe H, Tashiro K, Mivaska K, Abe S and Kaneda K. Radiological diagnosis of chronic spinal cord compressive lesions at thoraco-lumba junction, NO SHINKEI GEKA, 1988, 16(11): 1227-1233.
13. Andrew A Sama. Spinal Tumours. eMedicine. 2004.
14. Stark RJ, Henson RA and Evans SJ. Spinal Metastases. A retrospective survey from a general hospital. Brain 1982; 105(1):189-213.
15. RF Carmody, PJ Yang, GW Seeley, JF Seeger, EC Unger and JE Johnson. Spinal cord compression due to metastatic disease: Diagnosis with MRI versus myelography. Radiology 1989; 173:225-229.
16. Sen CN and Sekhar LN. An extreme lateral approach to Intradural lesions of the Cervical Spine and foramen magnum. Neurosurgery, 1990; 27(2):197-204.

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