MYELOGRAPHIC FINDINGS PRIOR TO THE ERA OF 3-D IMAGING IN ENUGU. A REVIEW WITH REAPPRAISAL OF CURRENT MYELOGRAPHIC INDICATIONS

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ABSTRACT

To conduct a retrospective review of the indications, clinical data and myelographic appearances. Also to reappraise the current indications of myelography in clinical practice.

The request forms, case materials, plain films, myelographic, surgical and histological findings on 227 patients who underwent non-fluoroscopic water soluble myelography for various forms of spinal disease were collected, analysed and reviewed.

Of the 227 myelograms done, 55 (24.2%) were normal while 172(74.8%) were abnormal. The pathological states which were demonstrated by myelography include disk prolapse 76(34.2%); spondylosis 50(22.5%), spinal tumours 41(22.5%), spinal stenosis 19(8.6%), spinal traumatic sequelae 14(6.3%) spondylolisthesis 8(3.6%), congenital malformations (spinal dysraphisms) 4(1.8%).

The indications for myelography have continued to shrink both in number and value especially in the developed world following the debut of the 3-Dimensional modalities like computer Tomography (CT), Magnetic Resonance Imaging (MRI) and Radionucleide Studies (RN).

This fact, notwithstanding, water-soluble myelography still has an important place in the investigative strategy of spinal pathology in certain circumstances and climes.

INTRODUCTION

It is not uncommon for laboratory findings and biopsy specimens to be unhelpful in the investigation of diseases of the spine and spinal cord.

When this occurs, clinical and imaging findings no matter how subtle assume paramount importance in establishing diagnosis and determining the course of management of these conditions.[1]

Investigative imaging of the spine (IIS) and its contents have undergone a slow but intensive evolution since the discovery of x-rays. Starting from the use of only plain film radiography which permitted sub-optimal indiscriminate appraisal of the bony spinal elements and surrounding soft tissue, IIS advanced to the stage of fluid-enhanced myelography where the various contrast media like gas, oily media, water soluble media (ionic and nonionic) were strenuously tried out over time to discover the most ideal non-toxic intrathecal medium. This era of research attained a gratifying water-mark with the discovery of non-ionic low osmolar contrast media eg. Metrizamide, iohexol and iotralan.[2]

IIS appears to be enjoying its zenith of development with the coming of CT myelography and now fluidless MRI myelography, the new gold standard.

Faced with the daunting task of arriving at a timely but definitive radiologic diagnosis of spinal disease in the absence of basic fluoroscopy, CT and MRI, we took advantage of the inherent properties of the miscibility and relative safety of the

various new water-soluble nonionic media to carry out consecutive myelographic investigation over a 5 year period in a radiodiagnostic center following a simple protocol.

This report is a review of the diagnostic yield after successfully carrying out myelography on 227 patients during this period. Its aim is to highlight for future comparative studies the spectral pattern of the myelographic appearances encountered and to evaluate the continued relevance and reliability of conventional myelography in communities where the unarguably better but more costly 3 dimensional modalities are unavailable.

MATERIALS AND METHODS

Between January 1998 and January 2003, conventional myelography with different water soluble media (metrizamide, iopamidol, iohexol) was performed on 227 patients (adults and children) at the Radiology Department of Hansa Clinics, a private Specialist Hospital for Radiodiagnosis and ENT Surgery in Enugu. Their ages ranged from 3 to 84 years. The patients were referred from various surgical and medical units of major hospitals in Enugu metropolis and environs whose fluoroscopic equipment had broken down or had no radiological cover during the given period.

The main indications for the myelograms were to confirm or exclude cord or nerve root compression by abscess, tumor, bone osteophytes, post traumatic bone fragments, and prolapsed disk. Others include detecting congenital spinal abnormalities and other operable spinal lesions. Information on the age, sex, clinical data, diagnosis, histological data and indications for request of myelography were retrieved and analysed.

As regards methodology, all examinations were done without fluoroscopy after introducing water soluble nonionic positive contrast medium following a lumbar puncture using a spinal needle of size 18 to 20 to 22 SWG. Lumbar punctures were done under local anaesthesia at either L3/L4 or L4/L5 or L5/S1 interspace levels in aseptic technique. The merits and demerits of this non-fluoroscopic method of myelography will form the subject of another study.

Five myelograms were performed via a cisternal puncture for lesions clinically believed to have originated in the cervical cord segment. Preliminary scout films were obtained before the introduction of positive water soluble contrast medium. The contrast medium used consisted of metrizamide (amipaque) in the first 33 patients, iohexol (omnipaque) in the next 30 patients and iopamidol in the remaining 164 cases. An average of 3 to 5ml in children and about 10 to 13ml of contrast in adults were instilled into the intrathecal space to achieve a complete myelogram irrespective of the requested area of interest.

Coned views: oblique views, swimmer's views; lateral view after Levine/olmstead manourve designed to overcome obstructions were added when necessary[3]. The total number of films used ranged from 12 to 18 depending on how quickly a lesion is localized. 25 patients were done on out patient basis while the rest were done as inpatients. The latter groups were admitted for 24 to 48hrs for medical surveillance depending on patient's response to the effects of intrathecal contrast instillation.

Post-Examination instruction for patients included sitting up with the head end of bed raised, keeping the head upright to prevent entry of excessive amount of contrast into ventricular space. Copious oral fluid intake with a view to effecting quick excretion of contrast from the body was encouraged. All myelograms were evaluated by one of 2 Consultant Radiologists.

RESULTS

Table 1 shows the age and sex distribution of patients who had myelograms done within the period of study Jan. 1998 to Jan 2003. The highest number of patients examined fell

into the 30 60 years age bracket.

Table 2 categorises the findings in the 227 myelograms into 2 groups, 24.2% were normal and 75.8% pathological.

Table 3 gives a breakdown of the various pathological findings in 172 abnormal myelograms.

Table 4 classifies four distinct disease entities namely spondylosis, spinal trauma, disk herniations, and Tb spine according to the anatomical site of involvement.

Table 5 shows the distribution of spinal tumors according to compartment and type. The histological diagnosis was retrievable in only 21 instances. These consisted of Ca Breast (5) Ca prostate (6) Hypernephroma (4) Aneurysmal Bone cyst (1) Osteoblastoma (1) Neurofibroma (4). These tumors were mostly metastatic and involved predominantly the extradural compartment destroying the vertebral bodies or pedicles in the process.

Table 6 highlights the myelographic features of the Tb spine. It fortuitously revealed a possible new sign demonstrating an incomplete obstruction of contrast column within the zone of infection. This phenomenon consists essentially of a total break in the continuity of the intrathecal column of contrast over the entire infected segment. The break covers the entire length of the affected 1 to 4 vertebrae and their intervening disks. The intact contrast column disappears at the lower end of the infected segment only to reform and manifest again at its upper end as an intact column. Within the infected zone, the contrast column appears to break up into hardly perceptible small tracts which made us give this phenomenon, the eponym "delta" sign. It was visualized in at least 6 out of 8 patients when we became aware of it and specifically searched for it.
(See fig. 1).

DISCUSSION

It has been shown that delays in diagnosis of spinal disease can lead to increased morbidity and mortality. It is also known that while most diseases involving the spine may not have specific clinical and laboratory findings, they may instead present with a plethora of similar but misleading symptoms and signs.[4,5] In such situations, the application of imaging techniques to detect subtle key radiologic features that favour a specific etiology could be of great clinical benefit. Conventional myelography (CM) is virtually extinct in the developed world following the advent of the 3 dimensional modalities like CT and MRI. Inspite of such disadvantages as its relative invasiveness and possible post-examination-related complications like infection and contrast allergy, conventional myelography continues to be relevant because of its easy applicability and cost-effectiveness. As a diagnostic method, it is suitable for prompt and accurate identification of the location and extent of many a spinal space-occupying lesion. It is inferior to MRI and CT in respect of lesional characterization. In the final analysis, histology and biopsy remains the mainstay of definitive diagnosis even after the application of these more sophisticated imaging procedures. Though sensitive in localizing lesions in the entire spine, CM is relatively non-specific. It is useful in the occasional claustrophobic patient who may not be able to undergo an MRI. Again where the clinical data and CT findings are at great variance as regards the site of lesion, myelography could play a decisive role in clinching the diagnosis. Above all, CM could effectively be put to use intraoperatively while assessing and repairing post traumatic dural tears.[6,7,8,9,10]

In this study more males 154 (67.84%) than females 73 (32.16%) underwant myelography. The commonest lesions encountered were disk herniations accounting for 34.2% of lesions. These occurred predominantly in males and in the lower lumbar segment involving

L3/L4; L4/L5; L5/S1 interspaces. Not a single case of disk herniation affecting the cervical or thoracic segment of the spine was seen. Double disk herniations were infrequently detected, occurring only in 8 patients out of 76 (10%). Noteworthy however is the observed lower incidence of double disk lesions in this series as compared to a Ghanaina series, a finding for which no plausible explanation can be offered as both communities have many social, environmental and racial similarities.
The second most common lesion seen was spondylosis comprising 22.4% of lesions was also detected predominantly in the hypermobile segments of the lumbar and the cervical regions. The disease was not confined exclusively to any age group being as often present in the young adults of (20 30) as in older adults (40 60) years at almost the same frequency. The observation conforms to the finding of previous authors in the subregion who hold the view that early prolonged load-carrying on the head, a common occupational practice in these climes may be contributory to the unusually premature manifestation of spondylosis in our younger population.[11]

Spinal tumors accounted for 18.4% of lesions detected by myelography in this series. In consonance with earlier reports, the myelogram enabled one triage spinal tumors into compartments of origin. Such distinction is not always feasible as some tumors especially the malignant ones can permeate and extend into all three compartments and beyond. Metastases constituted the predominant extradural tumors in this study. Secondaries originating from such primary sites as the breast, prostate and kidneys accounted for 60% of all spinal tumors. They were frequently located in the vertebral bodies and the neural arches where they caused considerable bony lysis as well as cord or nerve root impingement. The primary bone tumors consisting mainly of aneurysmal bone cyst and osteoblastoma contributed only 10% of cases in the pool of extradural tumors. Lesions of the intradural extramedullary compartment were the next most prevalent of all spinal tumors accounting for 20.4% of all spinal masses. This figure is in agreement with the observation of previous workers. These tumors are described as relatively rare and consist frequently of meningiomas, nerve sheath tumors or drop metastases. The rarity of intramedullary tumors as compared to tumors in the other two compartments is underscored by the finding of only (8.2%) such spinal tumors in this material. Although the histology of these were not available it is known that Ependymoma and astrocytoma constitute the majority of intramedullary spinal tumors.[12]

Detection of spinal injury with its acute and chronic sequelae was the indication for conducting myelography in 14 cases (6.3%). Most injuries resulted from road traffic accidents, falls from trees and missiles and occurred preponderantly in the cervical and lumbar regions. About 10% of fracture/dislocations are known to be associated with spinal cord injuries. In our study, the preliminary plain films readily reveal these bone injuries while the myelogramm detected the acute and chronic sequelae of the spinal injury depending on the timing of the procedure. Myelography is of immense utility value in the early post-traumatic period in the detection of dural tears, nerve root entrapment and committant disk herniation. Findings such as these could have serious implications in the choice of the approach and extent of surgery.[13]

At a later period, myelography could be deployed to assess the degree of spinal atrophy, the presence of foreign bodies, or syrinx formation. These pathological changes though better depicted by MRI and CT were also to a lesser extent detectable by myelography in our study. MRI is without doubt the gold standard as it can clearly and non-invasively unearth both the acute and chronic effects of spinal trauma thereby ensuring good management.
Spinal infections constituted 4.5% of abnormal myelogram in our material. All myelographic study was carried out inadvertently because clinical differentiation of spinal infections from degenerative diseases, non-inflammatory lesion, spinal neoplasm is

not always easy.[1]

The clinical features of these entities are subtle, but similar and early isolation of the offending organism by fine needle biopsy as well as the imaging features are therefore critical in the diagnosis of spinal infections.

Mycotuberculosis was the only etiological agent implicated in this series. They were proven by surgery or therapeutic trial or bacteriological isolation of the offending organism. The thoracic segment bore the brunt of infections. The study revealed not only the typical but also the rarer forms of the disease with such atypical features as skip or multiple site lesions, florid sclerosis and posterior segment involvement which have been exhaustively described by previous authors.[15,16]

The myelographic delta sign which was elicited in at least 6 out of 8 cases has not to our knowledge been described. It could serve as a good differential diagnostic tool except that the presence of any infection is a known contraindication to all myelography. Moreover, further exhaustive studies involving a large series would be needed to confirm its reliability.

Myelography is relatively insensitive for the diagnosis of spondylitis when compared to either combined nuclear studies or CT or MRI. CT has been described as sensitive but lacking in specificity. MRI on the other hand is most sensitive, specific and accurate (96%, 94%, 92%). Its improved diagnostic capacity is rooted in its ability in recognizing increased extracellular content of infection and reactive bone marrow stimulation.[1]

Spinal stenosis was detected in 8.6% of the abnormal myelograms involving mainly the lumbar segment and sometimes few vertebrae of the cervical segment. The critical adult sagittal diameters of the spinal canal are 15mm and 14mm in lumbar and cervical segments respectively. Symptoms are precipitated by such minor aggravating factors as small disk protrusion, spondylotic bars, bone fragments and facetal osteophytes.[11] Congenital spinal dysraphisms constituted a small group of spinal disorders revealed in abnormal myelogram. They accounted for 1.8% of all spinal lesions in our series. The lesions were as follows: Lipomyelocystocele (1), tethered cord syndrome (2), filum terminale lipoma (1).

The adverse effects of the intrathecal nonionic media encountered in this study were infrequent, consisting mostly of vomiting, nausea and headache. These subsided within 24 to 48 hours of hospitalization after intravenous administration of fluids, hydrocortisone and antihistamines. These results were not surprising as non-ionic contrast media are known to be less complication-prone than ionic media or the obsolete, oily medium iophendylate which was notorious for causing severe reactions like arachnoiditis.[11]

In conclusion, nonionic contrast conventional myelography may continue to dominate the diagnostic scene of spinal pathology in regions where lack of resources precludes use of modern 3 dimensional modalities like MRI and CT because it is still relatively safe, cost effective and yields reliable therapy-enhancing diagnostic inform

Table 1: Age and Sex Distribution of 227 patients who had myelography

Age (yrs)	Male (%)	Female (%)	Total (%)
0 9	2 (0.88)	2 (0.88)	4(1.76)
10 19	6 (2.64)	5 (2.20)	11 (4.85)
20 29	12 (5.28)	8 (3.52)	20 (8.81)
30 39	29 (12.78)	14 (6.18)	43 (18.94)
40 49	45 (19.82)	17 (7.59)	62 (27.31)
50 59	29 (12.78)	13 (5.73)	42 (18.50)
60 69	22 (9.69)	9 (3.96)	31 (13.66)
70 79	6 (2.64)	5 (2.20)	11 (4.85)
80 89	3 (1.32)	0 (0.00)	3 (1.32)
Total	154 (67.84)	73 (32.16)	227 (100)

M : F = 2.1 : 1

Table 2: Myelographic Findings

Category	No (%)
Normal	55 (24.2)
Abnormal	172 (75.8)
Total	227 (100)

Table 3: **Pathological findings in 172 abnormal myelogramms**

Lesion	No (%)
Spondylosis	50 (22.5%)
Trauma	14 (6.3%)
Infections (Pott's disease)	10 (4.5%)
Disc Prolapse	76 (34.2%)
Spinal stenosis	19 (8.6%)
Extradural tumors	35 (15.8%)
Intradural Extramedullary tumors	10 (4.5%)
Intramedullary Tumors	4 (1.8%)
Congenital Spinal malformation (Dysraphism)	4 (1.8%)
Total	**222 (100%)**

Table 4: Disease entities classified according to anatomical site

SITE	**SPONDYLOSIS**	**SPINAL TRAUMA NO. (%)**	**DISK HERNIATIONS NO. (%)**	**TB SPINE (POTT'S DISEASE)NO.(%)**
Cervical	13 (26)	6 (42.9)	0 (0%)	1 (7.2%)
Thoracic	5 (10)	2. (14.2)	0 (0%)	8 (57.1%)
Lumbar	32 (64%)	6 (42.9)	76 (100%)	5 (35.7)
Total	50 (100%)	14 (100%)	76 (100%)	14 (100%)

* Note: Some patients had more than one site of affectation.

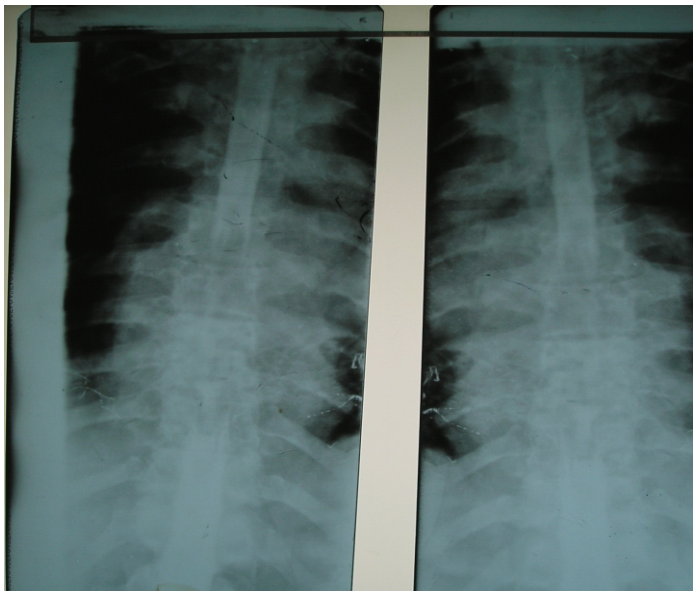
Table 5: **Spinal tumours, according to site**

Extradural	**No**	**%**
Bone tumors	5	10.2
Metastases	30	61
Intradural extramedullary	10	20.4
Intramedullary	4	8.2
Total	**49**	**100**

Table 6: **Tb features seen on myelogramms with anatomical site and number.**

Nos.	**Features**	**Site**			**No (%)**
		Cervical	Thoracic	Lumbar	
1.	Delta sign/partial interruption of contrast flow	-	4	2	6 (42.9)
2.	Fusiform paravertebral shadow	1	3	-	4 (28.7)
3.	Anterior Wedging	-	-	1	1 (7.1)
4.	Compression fracture with intact disc	-	1	-	1 (7.1)
5.	Abrupt cut-off of contrast column	-	-	1	1 (7.1)
6.	Multiple lesions (skip lesions)	-	1	-	1 (7.1)
	Total	**1 (7.1)**	**9 (9 (64.2)**	**4 (28.7)**	**14 (100)**

Fig. 1: Myelogram in Tb spine showing long break in continuity of the contrast column encompassing the length of three partly destroyed vertebrae i.e. from T10 to T7. Note also marked associated paravertebral masses (delta sign).



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