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Contribution of the MRI in the Diagnostics of Spinal Pathologies in Tropical Setting

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Abstract

Background: Magnetic Resonance Imaging (MRI) is the gold standard and an urgent first-line imaging test for the diagnosis of the spinal pathologies. The objective was to determine the contribution of MRI in the diagnostics of vertebromedullary diseases.

Methods: The study was done in a clinic with surgery, medicine and radiology units. The radiology department has medical imaging materials including MRI unit of 0.3 Tesla opened field. It was a retrospective study from January 2015 to December 2017. The study had concerned patients who came to perform MRI of the spine in the context of medullary pathology. The operator gathers the relevant information on the analysis report sheet and prepares the patient for the examination.

Results: MRI examinations accounted for 1,200 cases or 5.17% per year, and vertebro-medullary disease accounted for 440 MRI activities, or 38.83%. We recorded 256 men. The average age was 48.83 ± 13.01 years with extremes of 10 and 79 years, and 59.31% had between 40 and 49 years. Radiculalgia was the most functional sign in 37.70%. Lesions leading to narrowing of the spinal canal were dominated by diffuse disc protrusions. The herniated discs were paramedian (66.99%), migrated descending (59.26%) and led to radicular compressions in 34.72%. Of the 27 trauma patients, 20 (74.08%) had vertebral fractures and 7 (25.92%) had post traumatic spinal sequels.

Conclusion: Spinal cord compression remains in African countries a frequent daily challenge. It is a diagnostic and therapeutic emergency condition. The etiologies are dominated by degenerative pathologies, arachnoid cysts and intramedullary sequel traumas.

Keywords: Auditory brainstem response; Attention deficit hyperactivity disorder; Autism spectrum disorder; Cerebral palsy; Electroencephalogram; Visual evoked potential

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Introduction

The marrow is enclosed in an inextensible osteo-ligamentary canal and surrounded by its protective meningeal sheaths. It can be squeezed by various formations developed within the spinal canal or peri-vertebral regions. Medullary compression is a diagnostic and therapeutic emergency condition to avoid irreversible complications [1,2]. Vertebro-medullary magnetic resonance imaging (MRI) is the gold standard and first-line examination for exploring spinal compression. MRI allows a good visualization of the seat, and the extension and the nature of the compressive lesion [3,4]. The objective of this study was to determine the contribution of MRI in the positive and etiological diagnosis of spinal pathologies.

Materials and Methods

Setting and material

The study was carried out at the private "Autel d'Elie" clinic created on May 8, 2000. The clinic is structured in several services. Care services are provided general medicine, obstetrics and gynecology, pediatrics, visceral surgery and traumatology. The radiology and medical imaging department includes standard radiography and special examination units, mammography, ultrasound, multi-band CT scan and a 0.3 Tesla MRI unit. The radiology department has a staff specialized in radiology and medical imaging. The clinic receives nearly 12,500 consultants a year. The radiology department offers between 20,000 and 22,000 radiology examinations, 5,000 ultrasounds and 1,200 MRI per year. The clinic contributes to the research activities and training of students in radiology and medical imaging.

Methods and ethics

This was a retrospective study from January 2015 to December 2017. The study is intended to collect the records of patients admitted to the MRI unit. Patients of all ages and sex, referred to the clinic for spinal exploration, were included in the study. Patients not included came for other MRIs than spinal indication. Patients who have undergone the exam are either scheduled by appointment or directly admitted to the exam and have given their inform consent.

Description of the technique

The operator gathers the useful information on the analysis report sheet before the examination. He had carried out the civilian status (name, age, sex and profession), the requesting service, the prescriber, the clinical context and the indication, and the concerned spinal segment. In case of absence of one of the data, the operator speaks directly to the patients or to his companions. The patient undresses and removes any metallic material he may have on him. He is then put on a clean gown and explained to him the progress of the examination to be done, the noise of the machine and reassured him. The patient is warned that he must remain still during the examination. The patient is placed supine on the bed which slides in the opening of the machine. The antenna is adapted to the anatomical region of interested spine segment. After centering, the cuts are performed in T1 weighting; spin echo (SE), T2 weighting, fast spi-echo (FSE) with fat saturation suppression or STIR, 3D BASG mode or T2, coronal 3D myelo with MIP reconstruction on the cervical spine and T1 weighted sequences with gadolinium injection.

To check the centering and proper alignment of the spine, ultra-short registration sequences are made in the frontal plane to better position the sagittal sections. The sagittal plane is the quasi-obligatory as "reference" plane in MRI allowing the exploration of a whole segment.

Transverse axial sequences are performed on the pathological or clinically incriminated stage. Frontal sequences may be useful for assessing tumor or invasive infectious of the perimedullary soft tissues and scoliosis. The oblique frontal cuts are made in the plane of the foramina. The selected images are those that carry the lesions. The images are then stored on CD or printed on X-ray film. The interpretation was performed by a radiologist and a neurologist.

Statistics

The data was collected using the survey forms that were fulfilled by patient information. They were entered and processed with Epi Info software version 3.5.3 and completed with manual operations whenever necessary. All calculated frequencies were reported to the total number of patients. Means and other statistical indices were calculated by the normal law of Chi square test. The p value <5% with CI of 95% was considered statistically significant. The computer analysis was done by Microsoft Word and Excel 2013 software.

Results

Of the 23,200 imaging examinations carried out, MRI examinations accounted for 1,200 or 5.2% and vertebra-medullary pathologies accounted for 440 activities or 36.7%. We recorded 256 men with 58.2%. The sex ratio H/F was 1.4. The age of the patients was between 10 and 79 years with a peak frequency between 40 and 49 years of 59.3%. The mean age was 48.8 years (SD=13.01). The distribution of patients by age group is shown in **Table 1**. Neurosurgeons were the most demanding of MRI exam followed by neurologist in case of spinal cord compression (**Table 2**). Radiculalgia was the most represented functional sign in 37.7% followed by paraparesis. The principle reasons of admission were put in **Figure 1**.

Of the 440 MRI examinations performed, 436 were pathologic and 4 were normal, representing 99% of pathological MRI, with a predominance of extradural lesions in 88.30% as shown in

Table 1: Distribution of patient according to age groups

CI	Number (n)	Percentage (%)
[10-19]	9	2.05
[20-29]	23	5.23
[30-39]	60	13.64
[40-49]	140	31.82
[50-59]	121	27.50
[60-69]	62	14.09
[70-79]	23	5.22
[80-89]	2	0.45
Total	440	100.00

Table 2: Distribution of prescribers according to their speciality

	Number (n)	Percentage (%)
Neurosurgeons	202	45.90
Neurologists	114	25.91
Generalists	68	15.46
Rheumatologists	32	7.27
Traumatologists	16	3.64
Others*	8	1.82
Total	440	100.00

***Others:** Pediatric surgeons; Pediatrics; Internists; Pneumologists

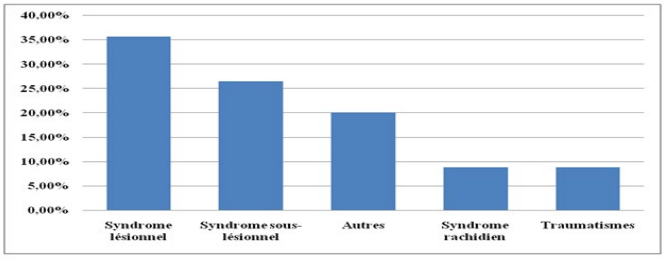

Figure 1 Reasons to explore spine.

Table 3. The lumbar spine was the most affected by degenerative lesions of the narrowed canal with 78 cases (50.25%) located on the metamere L1-L2 followed by the cervical spine (34.85%) and the dorsal spine (14.85%), noted in **Figure 2**.

The herniated discs had a frequency of 58.50% at the cervical segment. The herniated discs were paramedian (66.99%), migrated descending (59.26%), sub-ligamentous (71.92%) and within root compressions in 34.72%.

Of the 27 trauma patients, 20 (74.08%) had vertebral fractures, of which sixteen were cervical on C5, eight dorsal and four in lumbar level. Seventeen fractures were unstable and three were stable. Of the 48 traumatic injuries, 25% had spinal cord contusion, 12.50% had hematoma and 10.83% had spinal cord sections. Regarding the trauma sequels, the syringomyelic cyst was observed in 35.42% with 10 cases on the cervical and 7 cases on the dorsal spine. The metamere C3-C4 was affected in 3 patients and the metamere C2-C3/C4-C5/C5-C6/C6-C7 were damaged in two patients. Myelomalacia was present on the cervical spine with 11 cases (78.57%) and 3 cases (21.42%) on the dorsal spine. Medullary atrophy was observed on the C3-C4 and T4-T5 metamers. Different MRI traumatic lesions were established in **Figures 3-6**.

The infectious lesions were present in nineteen patients, of whom ten had spondylodiscitis, two epiduritis and seven cases of myelitis. The cervical, dorsal and lumbar stages were affected with the same frequency of 33.33%.

Regarding tumor lesions, vertebral tumors were all malignant with 5 cases (1.17%). Four secondary malignant tumors and one primitive malignancy were noted. There were 7 medullary tumors (5 astrocytomas and 2 neurinomas) located on the T5-T6 (66.67%) and T3-T4 (33.33%) metamers.

Discussion

The main and unique interest of the study is related to difficult access to MRI performing in limited resources income countries despite its importance for the diagnosis of medullary pathology. The present work may have some limits. These insufficiencies concern in one hand the study protocol as a retrospective regarding data collected which may not include all patient admitted for medullary MRI and in other hand those patients with spine pathology who died or many of those without financial support who did not reach care facilities were missed and reduce the sample size. The study did not cover all country radiological units. However, the consistence of the finding need his sharing with scientific community.

This study has identified some conditions that standard radiography and computed tomography cannot diagnose. It was a retrospective study that covered a 24-month period of activity

Table 3 : Extradural lesions frequency

	Number (n)	Percentage (%)
Herniated disc	137	32.23
Degenerative lesions	242	56.94
Trauma	27	6.35
Infectious	12	2.83
Tumor	5	1.17
Narrow canal	2	0.48
Total	425	100.00

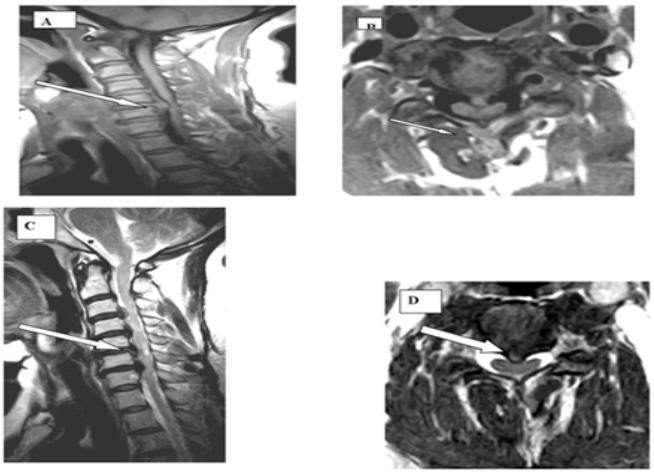

Figure 2 RMRI of the cervical pine in sagittal (A) T1 weighted and axial (B) 3D BASG T2 sequences weighted, sagittal (C) and axial (D) T2 weighted showed rosary aspect of cervical cord with medullary pain from C3 to C7 by disc herniation.

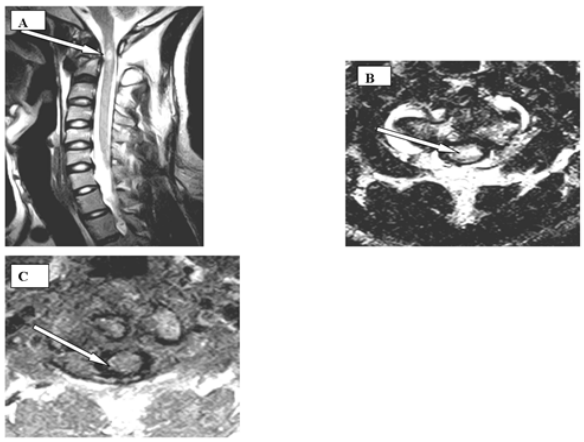

Figure 3 MRI of cervical spine in sagittal (A) and axial (B) T2 weighted sequences and axial T1 weighted showed intra medullary hematomas at C2 level in a 32-years-old patient with tetraparesis.

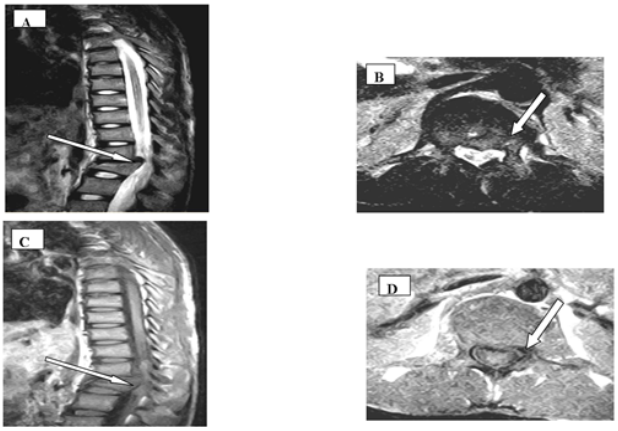

Figure 4 53-years-old woman admitted with post traumatic tetraplegia. Dorsal spine MRI T2 weighted sagittal (A) and (B) axial sequences; T1 weighted with sagittal (C) and axial (D) showed a wedge-shaped settlement of T12-L1 to posterior wall recoil with compression of the terminal cone that evocated a post trauma sequels.

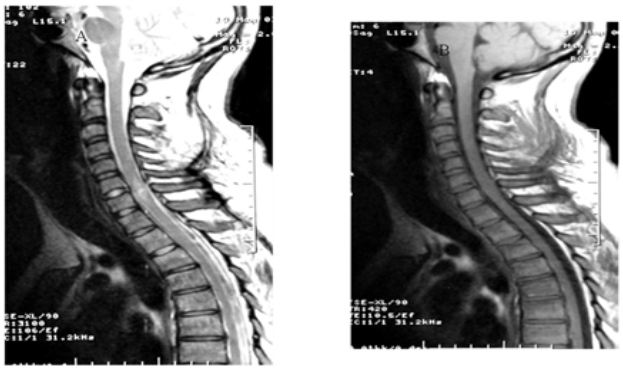

Figure 5 MRI of cervical spine T1 (A) and T2 (B) weighted sagittal sequences showed oedematous contusion of the spinal cord at the level of C6-C7.

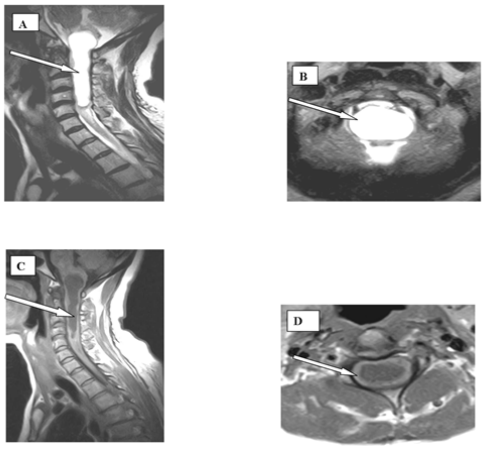

Figure 6 MRI of the cervical spine on T2 weighted sagittal (A) and axial (B), T1 weighted sagittal (C) and axial (D) sequences, showed a syringomyelic cyst from C1 to C5.

of the MRI unit. The results were obtained from the analysis of completed survey forms through MRI review reports. As all retrospective studies, there was lacked information related to unfulfilled examination request forms. It concerned profession, general condition and patient's medical history because the MRI unit is not a clinical department. However, our results have raised the additional need to make MRI more accessible to the population whose average income remains under the MRI cost. In view of the foregoing, the results of this study would not have been generalized to the entire population; nevertheless, the validity of the data obtained is enough to be shared with the scientific community.

The study reveals a male predominance of 58% with a sex ratio of 1.38. The male sex is dominant in the literature because of the predominance of degenerative lesions, most observed in men people due to their dialing activities [5-7].

The mean age was 48.83 years (standard deviation=13.01) and the most represented age group was 41 to 49-years-old. An average of 37.5 years and 53 years old were reported in the literature [8,9]. These age-related data are due to the fact that the first study focused on patients with spinal trauma, a common situation in the young population. The average age above observed in the second study is due to the predominant of degenerative lesions that appear as the age progresses. In addition, the CT scan with contrast (myeloscan) used has less sensitivity and specificity for the study of the spinal cord and its compartments than the MRI. This raises the interest of MRI which is the first-line imaging than myeloscan in the diagnosis of spinal cord compression [10,11]. The relatively young average age of our patients is explained by the fact that our country, like other developing countries, has a young population and is in the midst of demographic transition.

Radiculalgia and paraparesis were the most frequent reason for consultation, followed by paraplegia as reported in 90% of cases [1,4]. The high rate of radiculalgia found in our study is, on the one hand, related to the high rate of degenerative lesions and, on the other hand, to the pathophysiological mechanism of the medullary compressions, which at the beginning are manifested by rooting pain [12]. It is crucial that the population understands the severity of the spinal pathology to consult early in the care facilities.

In order of frequency, the reasons to explore the spine were the lesional syndrome in 35.72% of cases, the sub-lesional syndrome in 26.48% of cases, the spinal syndrome and spinal trauma in 8.82%. Some authors have reported a predominance of the spinal syndrome with 96%, followed by lesional syndrome and the sub-lesional syndrome in 2% of cases each, because of the report of tumor lesions [2,5].

The cervical spine was the most explored with 45.84% followed by 39.44% for the lumbar spine and 14.72% for the back spine. Previous studies have found a clear predominance of the lumbar spine with 78%, the dorsal, 29% and 2.9% for the cervical spine [13]. This high frequency of the cervical spine in our study could be due to heavy load ports, stressful positions of the cervical segment, recreational physical activities and sports. In addition, the cervical spine is more exposed to violent trauma and the

most affected in the cranio-encephalic traumas. The reported above study was limited to spondylodiscitis infectious, which is confined to the thoracolumbar spine.

Of the 436 pathological MRI, extradural lesions accounted for 88.30%, 10.60% for intramedullary lesions and 1.10% for extramedullary intradural lesions. These results were like those found by previous authors [14,15]. These results obtained in our study confirm the data according to which, in our environments, patients do not consult as soon as the first clinical signs appear and most of the lesions compressing the spinal cord come from the spine.

For extradural lesions, these are degenerative (81.1%), traumatic (27%) and infectious (12%). On the other hand, some studies reported inverse frequencies due to their study method and used materials [4,16,17]. This preponderance of degenerative lesions is due to the constitutional, mechanical and psychological risk factors to which our populations are exposed.

The herniated discs were seated in cervical segment with 58.50%, lumbar with 33.50% and dorsal with 8.00%. Similar results were observed in some previous study [3,18,19]. This higher frequency of herniated disc at the cervical level is due to the fact that this spine is the most exposed to mechanical factors. The absence of herniated disc at C1-C2 is related to the absence of disc between C1 and C2 vertebrae.

The intramedullary lesions were largely dominated by trauma with 77.09%, myelitis with 14.48%, tumors with 6.25% and multiple sclerosis with 2.08%. Tumors and cystic lesions were noted as predominance lesions related to another study due to different of used methods [2,20,21].

Of the traumatic injuries, fractures were the most represented with 74.08%. Fractures were present at the cervical segment in 80% and 20% at the lumbar level. These results are like those found in some previous reported studies in the literature [5,22,23]. The higher frequency of fracture in the cervical stage is due, in our tropical environment, to the recrudescence of the motorcycle-taxi phenomenon which exposed population to traffic road trauma and indirect attacks among urban populations.

The spondylodiscitis was frequent with 83.33% followed by 16.67% of epiduritis. Spondylodiscitis has affected the cervical and dorsal stage with predominance of the lumbar spine, similar findings were reported by other authors [13,24,25]. The predominance of spondydilodiscitis than epiduritis is related to the high frequency of Koch's bacillus spondylodiscitis more often found in human with HIV subjects and *Staphylococcus aureus* spondylodiscitis often found in sickle cell patients. Indeed, tuberculosis remains a public health problem in developing countries in Africa facing the challenges of hygiene and poverty.

The 5 vertebral tumors found were all malignant. Secondary malignant tumors accounted for 80%. This rarity of vertebral tumors found is related to the young age of the majority of the study population. The 5 cases of medullary tumors were located on the dorsal segment. These results were little inverse to previous reported findings in the literature due to study used methods [26-28].

Conclusion

Spinal cord compression remains in African countries, a frequent daily concern. It is a diagnostic and therapeutic emergency condition. Spinal cord compression mostly affects the young male subject. The main signs are dominated by radiculalgia and paraparesis. The cervical spine is the most affected. The etiologies are dominated by degenerative pathologies, arachnoid cysts and intramedullary sequels trauma. MRI is the best imaging tools for positive, topographical and etiological diagnostic of spinal diseases.

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