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Contribution of MRI to the exploration of spinal pathologies in the medical imaging department of the CNHU/HKM in 2021

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Abstract

Introduction: Radiological exploration of the spine and spinal cord is now well codified. Nevertheless, technical evolutions, in particular magnetic resonance imaging (MRI), allow new diagnostic avenues to be opened up and it is interesting to know what their place in clinical practice might be today. With the recent installation of the 1.5 Tesla MRI at the CNHU-HKM and with the aim of a preliminary evaluation of the activities, this work was carried out with the objective of studying the contribution of MRI in the exploration of cervical spinal pathologies at the CNHU-HKM of Cotonou.

Materials and Methods: A prospective cross-sectional study with descriptive and analytical aims was carried out in the medical imaging department of the CNHU-HKM from June 1, 2021 to November 30, 2021 (6 months). All subjects referred to the MRI unit for cervical spine MRI were included. The parameters studied were the frequency of request for MRI, age, sex, clinical indication and MRI results.

Results: 57 patients were collected. The frequency of requesting cervical MRI was 20.62% of all MRI examinations. The average age of the patients was 46.88 years, with extremes of 08 and 77 years. There was a male predominance with a sex ratio of 2.16. Cervicobrachial neuralgia (CBN) was the most frequent reason for requesting cervical MRI (38.6%). The abnormalities detected on MRI were degenerative in 84.2% of cases and traumatic in 8.8% of cases. Degenerative pathology was dominated by disc herniation (68.4%) and cervicarthrosis (61.5%). Spinal cord contusion (7%) was the most frequent traumatic injury. There was a statistically significant agreement between cervicobrachial neuralgia, cervical trauma and MRI result.

Conclusion: MRI remains the examination of choice and is of considerable value in the exploration of cervical spinal pathologies. In most cases, it allows the lesion responsible to be identified and appropriate therapeutic decisions to be taken. However, access to the entire population remains limited.

Keywords: MRI, cervical spine, Benin

Introduction

Radiological exploration of the spine and spinal cord is now well codified. Nevertheless, technical developments, particularly MRI, are opening up new diagnostic avenues and it is interesting to know what place they may have today in clinical practice ^[1].

With the recent installation of the 1.5 Tesla MRI at the CNHU-HKM since June 2021 and with the aim of a preliminary evaluation of the activities, we conducted the present study whose general objective is to study the contribution of MRI of the cervical spine in the exploration of cervical spinal pathologies at the CNHU-HKM of Cotonou.

Materials and Methods

The study took place in the MRI unit of the medical imaging department of the National Hospital and University Center Hubert Koutoukou MAGA (CNHU-HKM).

It was a cross-sectional, descriptive and analytical study with prospective collection that covered a period of 6 months from June 1, 2021 to November 30, 2021. All patients referred to the MRI unit for a cervical MRI scan for suspected or confirmed cervical spinal pathology were included in this study. Patients with incomplete clinical records were excluded from the study. All patients underwent MRI with a SIEMENS MAGNETOM AMIRA 1.5 Tesla machine. T1TSE T2TSE STIR, T2 Medic and T2 space3D sequences were performed.

The variables studied were epidemiological data (frequency of MRI of the cervical spine, age, sex), indications for requesting MRI (cervical spinal neuralgia, cervical pain, cervical trauma, myelopathy, spinal cord compression, paraplegia, tetraplegia, paraparesis, monoparesis, tetraparalytic syndrome), and MRI data. The different MRI lesions were grouped into degenerative, traumatic, infectious and tumorous pathologies. Degenerative pathologies included disc herniation defined as a focal disc protrusion (protrusion, extrusion); bulging discopathy (global disc protrusion); cervicarthrosis; myelopathy (abnormal signal and medullary morphology); foraminal narrowing. Traumatic pathologies were made up of abnormalities of the container (fracture, dislocation, sprain, soft tissue haematoma) and abnormalities of the content (medullary contusion, medullary section). Infectious pathologies included spondylodiscitis. Tumour pathologies

represented any abnormal spinal occupying process.

The clinical-MRI concordance was done by crossing the clinical suspicion and the results obtained on MRI. The different symptoms or indications were grouped according to the suspicion of degenerative pathologies, traumatic pathologies, infectious pathologies and tumours.

Statistical analysis was performed using SPSS 25 and Excel 2016. The mean and standard deviation were used to describe the quantitative variables, while the frequency calculation was used to present the qualitative variables. For the concordance analysis, Cohen's Kappa index was used. The statistical significance of this index is assessed using the non-parametric Cohen's Kappa test. The decision threshold was 5%.

From an ethical point of view, we obtained the authorisation of the head of the medical imaging unit of the CNHU-HKM. The confidentiality of the data was guaranteed.

Results

Frequency

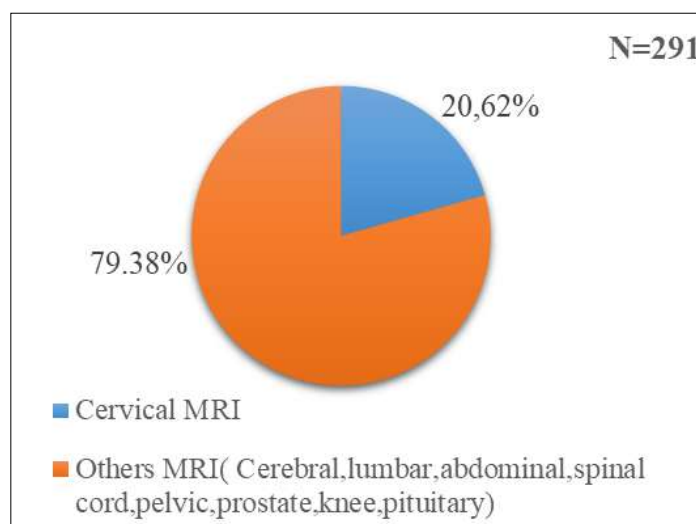


Fig 1: Frequency of MRI of the cervical spine

During the study period, 291 MRI examinations were performed, including 60 MRIs of the cervical spine, i.e. 20.62% of the activity of the MRI unit (figure 1). Of the 60

MRI scans performed, only 57 (95%) patients were included in our study.

Epidemiological and clinical profile

Age

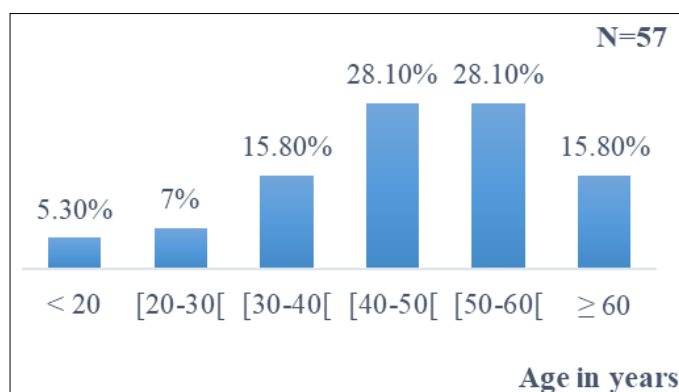


Fig 2: Age distribution of patients

The average age was 46.88 years with extremes of 08 years and 77 years. A predominance of the 40-60 age group

(56.2%) was observed (Figure 2).

Sex

A predominance of males was observed with 39 males to 18 females, a sex ratio of 2.16.

Indications for requesting MRI of the cervical spine

Table I shows the indications found in the requests for MRI

of the cervical spine.

Cervicobrachial neuralgia was the main reason for requesting MRI of the cervical spine, accounting for 38.6% of cases.

Table 1: Distribution of reasons for requesting a cervical MRI

	Effective	Percentage (%)
Cervico brachial neuralgia	22	38,6
Neck pain	7	12,3
Cervicarthrosis myelopathy	5	8,8
Cervical trauma	6	10,5
Suspicion of spinal cord compression	17	29,8
Spinal Cord Compression	4	7,0
Tetraplegia	4	7,0
Paraparesis	2	3,5
Paraplegia	2	3,5
Brachial monoparesis	1	1,8
Lhermitte's sign	1	1,8
Spinal Cord Syndrome	1	1,8
Tetrapyramidal syndrome	1	1,8
Tetra-paresis	1	1,8
Total	57	100

Distribution of patients according to MRI abnormalities found The MRI abnormalities found are presented in tables II and III

Table 2: Distribution of lesion groups found

	Effectif (N=57)	Pourcentage (%)
Degenerative diseases	48	84,2
Traumatic diseases	5	8,8
Infectious diseases	1	1,8
Tumor pathology	2	3,5
Normal MRI	1	1,8

The abnormalities detected on MRI were degenerative in 84.2% of cases and traumatic in 8.8% (Table II).

Degenerative pathology was dominated by disc herniation

(68.4%) and cervicarthrosis (61.5%). Spinal cord contusion (7%) was the most frequent traumatic pathology (table III).

Table 3: Distribution of patients according to MRI lesions

	Effective (n=57)	Percentage (%)
Degenerative diseases		
Disc herniation	39	68,4
Compressive disc herniation of the spinal cord	16	28,1
Non-compressive disk hernia	23	40,4
Cervicarthrosis	35	61,5
Cervico-discarthrosis with intra-canal repercussions	12	21,1
Cervico-discarthrosis without intra-canal repercussions	23	40,4
Bombing discopathy	13	22,8
Myelopathy	16	28,1
Inflammatory changes MODIC 1	2	3,5
Foraminal narrowing	15	26,3
Traumatic diseases		
Fracture	1	1,8
Spinal contusion	4	7,0
Medullary section	1	1,8
Dislocation	1	1,8
Sprain	1	1,8
Left brachial plexus tear (C5 to T1)	1	1,8
Infectious diseases		
Myelitis	1	1,8
Tumor pathologies		
Astrocytoma	1	1,8
C7 bone tumor with spinal cord compression	1	1,8
MRI normal	1	1,8

Concordance between reason for consultation and MRI results

The concordance analysis between clinical indications and

MRI lesions is summarised in the following tables (IV, V, VI, VII).

Table 4: Cross-tabulation of suspected degenerative diseases with degenerative diseases on MRI

Suspicion of degenerative pathologies		Degenerative pathologies (IRM)		Total	Kappa
		No	Yes		0,191 Weak agreement
	No	6	17	23	
		26,1%	73,9%	100,0%	
	Yes	3	31	34	
8,8%		91,2%	100,0%		
Total		9	48	57	
		15,8%	84,2%	100,0%	

The rate of agreement is statistically significant but low. It appears that patients who consulted for a clinical

indication pointing to a degenerative pathology actually had a degenerative pathology after the MRI was performed.

Table 5: Cross-tabulation of suspected traumatic conditions with traumatic conditions on MRI

Suspicion of traumatic pathologies		Traumatic pathologies (IRM)		Total	Kappa
		No	Yes		
	No	51	0	51	
		100,0%	-	100,0%	
	Yes	1	5	6	
		16,7%	83,3%	100,0%	
Total		52	5	57	
		91,2%	8,8%	100,0%	

The rate of agreement was statistically significant with a high degree of concordance. This shows that patients who consulted for a clinical indication pointing to a traumatic

pathology actually had a traumatic pathology after the MRI was performed.

Table 6: Cross-tabulation of suspected infectious diseases/infectious diseases on MRI

		Infectious pathologies (IRM)		Total	Kappa -0,035 Disagree
		Non	Oui		
Suspicion of infectious pathologies	No	27	1	28	
		96,4%	3,6%	100,0%	
	Yes	29	-	29	
		100,0%	91,2%	100,0%	
Total		56	1	57	
		98,2%	1,8%	100,0%	

The agreement rate was not statistically significant. Patients who consulted for a clinical indication pointing to an infectious pathology did not actually have an infectious pathology after the MRI was performed.

Table 7: Cross-tabulation of suspected tumour pathology with tumour pathology on MRI

		Tumor pathologies (IRM)		Total	Kappa
		No	Yes		0,045 Weak agreement
Suspicion of tumor pathologies	No	39 97,5%	1 2,5%	40 100,0%	
	Yes	16 94,1%	1 5,9%	17 100,0%	
Total		55 96,5%	2 3,5%	57 100,0%	

The agreement rate was not statistically significant. Patients who consulted for a clinical indication pointing to a tumour pathology did not actually have a tumour pathology after the MRI was performed.

Discussion

Frequency

During the study period, 291 MRI examinations were

performed, including 60 MRIs of the cervical spine, i.e. 20.62% of the activity of the MRI unit.

The spine examinations in the study by Adamounou ^[2], Werner *et al.* ^[3] and Jeune Homme *et al.* ^[4] represented 31.62%, 33.4% and 23.3% of the total examinations respectively. This frequency of examinations of the cervical spine can be explained by the fact that MRI remains the reference examination in most vertebro-medullary

pathologies.

Epidemiological and clinical profile

Age

The mean age of the patients was 46.88 years with extremes of 08 and 77 years. These results are similar to those of Akanni ^[5] in Benin and Adambounou ^[2] in Togo who found an average age of 44.6 and 45 years respectively. This is consistent with the literature. These data can be explained by the fact that it is the same type of population (neighbouring countries).

However, they are different from those of Z Belhadj ^[6] and M. Ouali Idrissi ^[7] who found an average age of 36 and 30 years respectively. This difference could be linked to the fact that this study included more patients, but also to the fact that these authors mainly dealt with cervical spine injuries.

Sex

In our study, we found a male predominance (68.4% of cases), with a sex ratio of 2.16. This is in line with the data from the study on the number of patients with cervical spine injuries. This agrees with the data of Basroui ^[8] who found 86.6%. This male predominance could be explained by the nature of the occupations performed by men, which generally require repeated efforts, the carrying of heavy loads and the maintenance of forced positions of the cervical spine ^[9, 10, 11].

Indications for requesting MRI of the cervical spine

Cervicobrachial neuralgia was the main reason for

requesting cervical MRI with 38.6% of cases. It is the most common symptom in rheumatology and neurology.

The results of our study seem to be similar to those of Rousselle ^[12] (32%) who made the same observation for or cervico-brachial neuralgia as a frequent reason for requesting MRI of the cervical spine.

In his study on the profile of MRI examinations in Togo, Adambounou found that 9.29% of patients came for an MRI. This difference could be explained by the fact that our study was limited to the cervical spine.

MRI data

Degenerative lesions (84.2%) were the predominant pathology in our series. This rate is consistent with those of Badji ^[13], Adambounou ^[2] and Ekouele ^[14] who also found a high frequency of degenerative pathology in 32%, 30.47% and 11.9% respectively. The high rate of degenerative lesions is probably due to the advanced age of some patients.

Degenerative pathology was dominated by herniated discs (figure 3), which were found in 68.4% of cases, and cervicarthrosis (61.5%). Youlkif ^[10] also found a predominance of disc herniation in his study with proportions of 48%. According to Youklif ^[10], cervical MRI is the examination of choice. It allows the demonstration of disc herniation, spinal cord and radicular compression and is also of great importance for the discussion of the indication of a surgical procedure. According to Scotti ^[15], MRI is the most effective, least harmful and most comfortable examination for the patient in the investigation of cervical disc herniation.

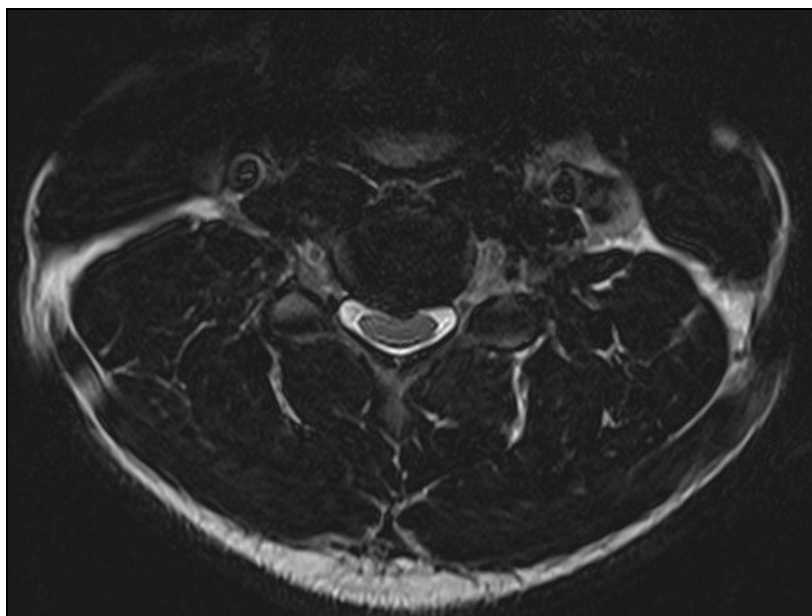


Fig 3: Cervical spinal MRI in axial section T2 Space sequence showing a posteromedial disc herniation discreetly lateralized to the left with spinal cord compression (CNHU-HKM)

Traumatic lesions (figure 4) in our series represented 8.8% of all anomalies found. Adambounou ^[2] and Ekouele ^[14] found respectively 11.77% and 54.35% of cases of traumatic pathology in their study. This difference could be related to the sample size of our study and the type of study population.

Regarding traumatic pathology, spinal cord contusion (7%) was predominant. Akanni ^[5], Belhadj ^[6] and Ouali Idriss ^[7] found spinal cord injuries, such as spinal cord oedema, in

38.5%, 74.2% and 51.28% of cases respectively. They also reported intramedullary haematomas, which we did not observe in this study.

This difference could be explained by the low accessibility of MRI during the study period, but also by the exclusively traumatic aspect addressed by the different authors. Furthermore, the higher percentages could be linked to their study population, which consisted solely of patients with trauma.



Fig 4: Sagittal T2 sequence showing a C6-C7 fracture-luxation with spinal cord transection and signs of spinal cord distress reflected by an intramedullary hypersignal best seen on the T2 STIR sequence.

Infectious lesions in our series were rarely found, with myelitis in the lead.

El Ganouni ^[16] *et al.* found in their study 31.3% of infectious causes of slow medullary compression, 26% of which were related to tuberculous spondylodiscitis, 5.3% to pyogenic spondylodiscitis with one case of primary epidural abscess due to staphylococcus. Adambounou ^[2] found 31.14% of infectious pathologies. This high rate of infectious pathology was explained by the precarious sanitary conditions, probably related to their socio-economic and educational system. The high rates in El Ganouni ^[16] *et al.* and Adambounou ^[2] are related to their higher numbers and study population.

On the other hand, Badji *et al.* ^[13] found 5% of infectious lesions, a rate similar to ours. He also found a case of abscessed myelitis which was isolated in a context of multifocal spondylodiscitis. This is a rare condition as shown by the literature where its incidence is estimated at 01 cases per year ^[17, 18]. It most often occurs in an immunocompromised environment.

Cervical spinal tumours represent 3.5% of cases. Adambounou ^[2] and Badji ^[13] found respectively 8.56% and 16% of cases of tumour pathology. Tumour pathology constituted 75% of cases with a predominance of malignant tumours (65%) in the series by MR KHALIL *et al.* ^[16]. Astrocytoma was present in 28.4%, one of which was pilocytic and the other anaplastic. In our series, we had one case of astrocytoma. It is a tumour lesion and its MRI appearance was not always typical.

Concordance between clinical suspicion and MRI results

Four (04) clinical suspicions of pathology were identified in this work. These patterns were correlated with the results of the pathological MRI in order to determine the influence of the presence or absence of an "x" pattern on the MRI results.

From this correlation, it was found that 83.3% of the subjects with clinical suspicion of traumatic pathology had

an MRI result that confirmed this. Furthermore, there was a statistically significant relationship ($p=0.002$) between the presence of traumatic pathology and the MRI result.

The same was true for degenerative pathology where 91.2% of suspected pathology was confirmed on MRI.

The clinical diagnoses taken individually were globally concordant with the MRI diagnosis with the exception of infectious and tumour pathology. This exception could be related to the low number of infectious and tumorous pathologies in our sample. These elements underline the importance of a well-conducted clinical evaluation (history and physical examination) as a prerequisite to any imaging examination.

Conclusion

MRI remains the examination of choice and is of considerable help in the exploration of cervical spinal pathologies at the CNHU-HKM.

In most cases, it allows to find the responsible lesion and to take adapted therapeutic decisions. However, access to the entire population remains limited. The establishment of universal health coverage on the one hand and the installation of MRI equipment, especially high field equipment, in public establishments on the other hand are necessary for better access to MRI.

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