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Israël Maoneo,  
Antoine Beltchika,  
Teddy Ketani,  
Glennie Ntsambi



# Epidemio-clinical and therapeutic profile of non-traumatic medullary-radicular compressions at the University Hospital of Kinshasa

Israël Maoneo<sup>1,2</sup>, Antoine Beltchika<sup>1</sup>,  
Teddy Ketani<sup>1</sup>, Glennie Ntsambi<sup>1</sup>

<sup>1</sup> Neurosurgery Department of the Hospital University of Kinshasa, University of Kinshasa, DRC

<sup>2</sup> Department of Surgery, Hospital University of Kisangani, University of Kisangani, DRC

## ABSTRACT

**Context and objectives.** As the world's population ages, non-traumatic medullary-radicular compressions are becoming more common. This work aims to describe their epidemio-clinical and therapeutic aspects at the University Hospital of Kinshasa.

**Methods.** It is a descriptive cross-sectional study from 2016 to 2022 concerning 61 cases. Variables of interest included: sex, age, cause, level of lesion, ASIA score, treatment, complications, and destination. Data were analyzed using SPSS 26 and STATA 16 software.

**Results.** One hundred and twenty patients were operated on for medullary-radicular compression, including 61 non-traumatic (50.8%) and 59 traumatic (49.2%). Among the non-traumatic, 31 patients were male (50.8%) and 30 females (49.2%). The average age was  $51.51 \pm 14.21$  years. Patients between the ages of 40 and 69 accounted for 68.8%. The annual curve was increasing. On admission, the clinical presentation was dominated by an incomplete neurological deficit (67.2%). The mean time to diagnosis was 188.57 days. Degenerative pathologies (63.9%) including 31 herniated discs (79.4%) and 8 cases of canal narrowing (20.6%) predominated, followed by tumors 14 (22.9%) half of which included metastases. The most performed surgical procedures included decompression laminectomy (26.2%), laminectomy-discectomy (24.5%) and laminectomy-arthrodesis (32.7%). The postoperative course was unremarkable in 67.2%, except for 15 cases of surgical site infection (24.6%) and 3 deaths (4.9%). ASIA score on discharged improved in 62.7% ( $p < 0.001$ ). Only 2 patients (9.8%) continued their treatment in a rehabilitation centre.

**Conclusion.** Non-traumatic medullary-radicular compressions are frequent in the service, more caused by herniated discs and tumours. Both sexes are equally affected and the age group is ranging from 40 to 69 years. The neurological deficit is often incomplete cord injury. Laminectomy, discectomy and arthrodesis are commonly performed. The postoperative outcome is generally better.

## INTRODUCTION

Medullary-radicular compression is a constriction of the spinal cord and nerve roots due to traumatic or non-traumatic causes

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**Keywords**  
myelopathies,  
non-traumatic spinal cord  
compression,  
spine surgery,  
traumatic spinal cord injuries,  
vertebro-spinal lesions

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Corresponding author:  
Israël Maoneo

Neurosurgery Department, Hospital  
University of Kinshasa, University of  
Kinshasa, DRC

maoneo@yahoo.fr

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(degenerative, tumoral, infectious, vascular) involving bony structures and/or disco-ligamentous complex of the spine. The spinal cord and nerve roots may be compressed by expansion of blood, tumoral processes, infectious collections, protrusion of bone or nucleus pulposus into the epidural space or meninges [1]. This lesion is a diagnostic and therapeutic emergency. If not treated early, it can lead to disabling neurological deficits in the short to medium term [2]. Medullary-radicular compression is much more common than other mechanisms: compromised blood flow, inflammatory processes, metabolic disorders or exposure to toxins [3].

The worldwide incidence rate of nontraumatic medullary radicular injuries (NTMRI) increases with age and ranges from 4 to 80 cases per million people per year [4]. The global prevalence rate ranges from 367.2 to 2,310 per million populations per year [5]. Only the study conducted in Malawi was able to give an idea of the incidence of NTMRI in Africa through a survey of all admissions across the country. According to this study, the incidence is 77 new cases per 1,000,000 inhabitants [6]. The prevalence of NTMRI should increase steadily with the aging of the population and exceed that of traumatic injuries [4].

NTMRIs pose various problems such as the low rate of publications compared to those of traumatic origin, devastating physical and functional damage for the patient and his family [7]. We can also mention the difficulty in establishing the diagnosis early for better care. Indeed, this diagnosis requires specific laboratory and medical imaging examinations, in this case CT-scan and MRI, which are often unavailable and inaccessible in several African regions [7]. The delay in diagnosis and the presence of comorbidities in elderly patients increase the mortality rate of NTMRI, which varies between 27,7% and 41 % [7,8].

Another challenge lies in the fact that the causes aforementioned of the NTMRI vary considerably between countries and regions. In developed countries, degenerative (16.4 to 50.9%), tumoral (15.5 to 30.5%) and vascular (12.5 to 40%) pathologies come first [9, 10, 11].

Whereas, in developing countries, infections such as tuberculosis (51 to 56%) and HIV/AIDS infection (18 to 50%) predominate [12,13,14]. Nevertheless, some African countries present the predominance of degenerative and tumoral causes. Gaddour et al [15], in Tunisia, Kassegne et al [16], in Togo, Ekouele Mbaki

et al [17], in Congo-Brazzaville, observed a high frequency of degenerative and tumoral causes.

The DRC has cosmopolitan and crowded cities such as the City of Kinshasa where tuberculosis and HIV/AIDS continue to be spreading [18]. Several Congolese hospitals are not equipped with CT scan and MRI machines. However, there is no publication on NTMRI in general, and nontraumatic medullary-radicular compression (NTMRC), in particular. Do infectious NTMRC's predominate as widely described in the medical literature? What is the average consultation time? What is the result of their treatment? These questions prompted us to conduct this study with the aim of drawing up the epidemiological, clinical and therapeutic picture of non-traumatic medullary-radicular compression. The specific objectives pursued are:

- Determine the hospital prevalence and the distribution of NTMRC across gender and age groups.
- Present the clinical picture and paraclinical explorations.
- Give the different causes of NTMRC.
- Describe the treatment, the operative outcome, the complications and the destination upon discharge from the hospital.

## MATERIALS AND METHODS

### Study design

This is a cross-sectional and descriptive study, conducted at the University Hospital of Kinshasa, from 01 January 2016 to 31 August 2022. The data were collected retrospectively and prospectively. During this 6-year period, 84 patients with non-traumatic radiculo-medullary compression lesions were hospitalised. Only the records of 61 patients were retained, as they met the selection criteria.

### Inclusion and exclusion criteria

All patients aged 10 years and older, admitted and operated in the Spinal Cord Injury Unit for non-traumatic medullary-radicular compression, with radicular medullary compression syndrome, from 1 January 2016 to 31 August 2022, were included. Patients with incomplete records were excluded.

**Data collection technique.** We collected data in two ways, retrospectively and prospectively, from hospitalization and operating room records. To

complete certain information, we contacted the patients and/or their direct family members.

Variables of interest were sex, age, cause, level of injury, neurological deficit according to the American Spinal Injury Association (ASIA) score [19,20], treatment, complications and destination after discharge.

**Statistical analysis**

Data were recorded and analysed using SPSS version 26 and STATA version 16 software. Descriptive analysis was performed for the main variables included in the study. We determined the possible associations between the different variables considered using Pearson's chi-square or Fisher's exact tests. Since the distribution was normal, we used Student's t-test to judge the effectiveness of the surgical treatment by comparing the mean ASIA scores at admission and discharge. The odds ratio and binary logistic regression model were used to estimate the risk of surgical site infection. A result was considered statistically significant when the p-value was less than 0.05.

**RESULTS**

**1. Prevalence of non-traumatic medullary-radicular compression**

One hundred and twenty patients were operated on for medullary-radicular compression, 61 of whom were non-traumatic (50.8%) and 59 traumatic (49.2%).

**2. Socio-demographic features**

The average age was 51.51±14.21 years. We counted 50.8% male patients and 49.2% female, sex ratio was 1. Patients aged between 40 and 69 years accounted for 42 cases (68.8%). There were 67.2% of married patients, 34.4% of housewives and 29.5% of patients whose occupations were not reported (Table 1).

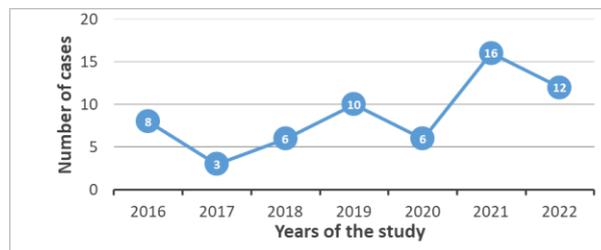
**Table 1.** Socio-demographic features

Parameters	frequency n=61	Percentage
Age (years)		
▪ 10 - 19	1	1,6
▪ 20 - 29	4	6,6
▪ 30 - 39	8	13,1
▪ 40 - 49	13	21,3
▪ 50 - 59	15	24,6
▪ 60 - 69	14	23,0

▪ 70+	6	9,8
sex		
▪ Female	30	49,2
▪ Male	31	50,8
Marital status		
▪ Married	41	67,2
▪ Single	12	19,6
▪ Widow	4	6,6
▪ Not reported	4	6,6
Profession		
▪ Households	21	34,4
▪ Not reported	18	29,5
▪ Public officials	6	9,8
▪ Health care workers	6	9,8
▪ Students and pupils	3	4,9
▪ Teachers	3	4,9
▪ Drivers and mechanics	2	3,3
▪ Soldiers	2	3,3

**3. Annual incidence of non-traumatic medullary-radicular compression**

We observed an increase in the number of cases in the years 2021 (16 cases) and 2022 (12 cases) (Fig. 1) while the annual average of cases during the 7-year period was 8.7 cases.



**Figure 1.** Annual frequency of NTMRC

**4. Etiological and clinical data**

The patients complained of low back pain in 47.5%, sometimes accompanied by bladder and bowel disorders (4.9%) and motor deficits, usually paraparesis (26.2%) or paraplegia (27.9%). Most patients had an incomplete spinal cord injury (67.2%: ASIA score B-D). ASIA E and D patients accounted for 32.8% and 29.5% of cases respectively compared to (16.4%) ASIA C and (21.3%) ASIA B on admission. Among the compressive causes, there were 39 (63.9%) cases of degenerative origin including 29 (74.3%) disc herniation and 10 (25.7%) narrow channel, 7 (11.5%) benign tumors, 7 (11.5%)

malignant tumors and 8 (13.1%) Pott's disease. On histopathological analysis, all benign tumors were meningiomas. In relation to the dura mater, they were intradural and extramedullary. All malignant tumors were metastases. The underlying primary malignant tumors were: 2 cases of breast cancer, 2 cases of hemangioma and 3 cases of prostate

cancer. Patients aged 50 years and over suffered more from degenerative compression ( $p=0.013$ ) and those under 50 years from infectious medullary-radicular compression, mainly tuberculosis ( $p=0.047$ ). Tumoral (benign tumor) radicular spinal cord compression was much more common in women ( $p=0.040$ ) (Table 2).

**Table 2.** Etiological and clinical data

Parameters	Total n=61	sex		p-value*	Age (years)		p-value
		Male	female		<50	≥50	
Etiology							
Compressive							
▪ Degenerative	39	20	19	0,923	12	27	0,013
- Disc herniation	31	16	15		11	20	
- Canal stenosis	8	4	4		1	7	
▪ Tumoral	14	4	10	0,058	8	6	0,211
- Benign	7	1	6	0,040	4	3	
Intradural et extramedullary	7	1	6		4	3	
- Malignant	7	3	4	0,654	4	3	
▪ Infectious	8	7	1	0,026	6	2	0,047
- TBC	8	7	1				
Complaints				0,070			
▪ Neck pain	2	2	0		1	1	
▪ Neck +low back pains	4	4	0		3	1	
▪ Back pain	11	4	7		6	5	
▪ Low back pain	29	14	15		9	20	
▪ Low back pain + sensory-motor deficit	12	7	5		5	7	
▪ Low back + bladder disorders.	3	0	3		2	1	
Neurological deficit				0,463			0,980
▪ Monoparesia	3	2	1		1	2	
▪ Tétraparesia	3	3	0		1	2	
▪ Paraplegia	17	8	9		8	9	
▪ Paraparesia	16	8	10		8	10	
▪ no deficit	20	8	12		8	12	
ASIA				0,466			0,663
▪ B	13	7	6		7	6	
▪ C	10	7	3		5	5	
▪ D	18	7	11		6	12	
▪ E	20	10	10		8	12	

**Table 3.** Association between causes of non-traumatic medullary-radicular compression and ASIA score on admission

Causes	Total n=61	ASIA in admission				p-value
		B	C	D	E	
▪ Herniation disc	31	0	5	10	16	<0,001
▪ Canal stenosis	8	2	0	2	4	

▪ Benign tumor	7	3	2	2	0
▪ Malignant tumor	7	3	1	3	0
▪ Pott's disease	8	5	2	1	0
Total	61	13	10	18	20

**Table 4.** Surgical site infection according to age, causes, duration of surgery, and surgical procedures

Surgical procedures	ISO-/ISO+	Univariate analysis		
		OR	IC	p-value
▪ Laminectomy		1,03	(0,27-3,85)	0,965
▪ Laminectomy + Discectomy		1,15	(0,30-4,37)	0,830
▪ Laminectomy + Arthrodesis		2,22	(0,66-7,37)	0,187
▪ Corporectomy + Arthrodesis		1,34	(1,15-1,55)	0,412
▪ Laminectomy + excision		1,38	(1,17-1,63)	0,108
▪ Laminectomy+ excision + arthrodesis		1,33	(1,15-1,54)	0,565

### 5. Association causes of non-traumatic medullary-radicular compression and ASIA score on admission

All 20 ASIA E patients had degenerative pathologies, of which 16 (80%) were cases of disc herniation and 4 (20%) cases of canal narrowing. Thirteen ASIA B cases were of tumoral (46.1%), infectious (38.5%) and degenerative (15.4%) origin. Ten ASIA C patients had degenerative (50%), tumoral (30%) and infectious (20%) pathologies. Of the 18 ASIA D cases, 66.7% were degenerative, 27.8% tumoral and 5.5% infectious. Tumoral and infectious causes were more associated with ASIA B-C (72.7%) and degenerative causes with ASIA D-E (82.05%). The relationship between the different causes and ASIA scores on admission was statistically significant ( $p = <0.001$ ) (Table 3).

### 6. Paraclinical diagnosis

The average time to diagnosis of NTMRC was 188.57 days. The diagnoses of tumoral and degenerative pathologies were established by MRI in 63.9% of cases, followed by CT scan in 24.6%. All tumor cases were confirmed and differentiated by histopathological analysis. The laboratory examinations helped to determine the specific causes of all infectious pathologies represented in our work by tuberculous spondylodiscitis.

### 7. Location of the injury

Six (9.8%) lesions were located on the cervical spine. We counted 10 lesions (16.3%) located on the thoracic segment, of which 8 (80%) were of tumoral

origin. The lumbar spine was the site of 42 cases (68.9%). Thirty-three cases (83.1%) of the lumbar pathologies were degenerative and consisted of disc herniations and canal narrowing. The relationships between the different causes and their respective locations on the spine ( $p <0.001$ ) and on the different vertebrae ( $p <0.001$ ) were statistically significant.

### 8. Medical treatment

All patients received medical treatment including analgesics, anti-inflammatory drugs, gastric antisecretory drugs, postoperative corticosteroids, neurotropes and anticoagulants, and postoperative antibiotics. Anti-tuberculosis drugs were administered to patients with tuberculous spondylodiscitis.

### 9. Surgical treatment

The cervical segment was approached by both anterior (2 cases) and posterior (4 cases) routes. All cases in the thoracic, thoracolumbar and lumbar segments were approached via the posterior route. The surgical procedures performed were simple decompression laminectomy 16 cases (26.2%), laminectomy + arthrodesis 20 cases (32.8%) and laminectomy + discectomy 15 cases (24.8%). There were 2 cases (3.3%) of corporectomy and arthrodesis at cervical level. Laminectomy and excision were performed for tumoral conditions

### 10. Association of surgical procedures and post-operative complications

After the surgical treatment, we recorded 41 (67.2%)

patients with unremarkable postoperative courses and 20 cases of complications (32.8%) including 15 cases (24.6%) of surgical site infections (SSI), 2 cases (3.3%) of fistulas and 3 (4.9%) deaths. The 3 deaths were due to complications of comorbidities. The infection of the site of operation was not significantly related to the different surgical treatments. Patients who received osteosynthesis implants were twice as likely to develop a surgical site infection as those who did not. But the difference was not statistically significant (Table 4).

### 11. Assessment of ASIA score before and after surgical treatment.

Among 13 ASIA B patients at admission, 8 (61.5%) kept the same score and 5 (38.5%) improved their ASIA score at discharge, of which 2 (40%) by one grade, 2 (40%) by two grades and 1 (20%) by three grades. Eight (63.6%) ASIA C patients at admission improved their discharge score of which 4 (57.1%) by one grade and 4 (57.1%) by two grades. One ASIA C patient (9.1%) moved back one grade and 3 ASIA C patients (27.3%) maintained their admission score. Out of 16 ASIA D patients at admission, 5 (31.2%) kept the same score, 8 (50%) improved the exit ASIA score by one grade and 3 (18.8%) cases moved back in admission score of which 1 (33.3%) by one grade and 2 (66.7%) by two grades. Eighteen (85%) ASIA E patients before surgery kept their score and 3 (15%) moved back, of which 2 (66.7%) by one grade and 1 (33.3%) by three grades. Overall, 40 (67.2%) patients improved their initial ASIA score at discharge and 21 (32.8%) patients either kept their initial ASIA or worsened. The difference in mean ASIA scores before and after surgery was statistically significant ( $p < 0.001$ ) (Table 5).

**Table 5.** ASIA score assessment before and after surgery

ASIA admission	Total	ASIA discharge				p-value
		B	C	D	E	
B	13	8	2	2	1	<0,001*
C	12	1	3	4	2	
D	18	2	1	3	12	
E	20	1	0	1	18	
TOTAL	61	12	6	13	30	

\* We used the t-test for paired samples

### 12. Physiotherapy

All patients benefited from rehabilitation sessions by

the physical medicine team. This rehabilitation should continue at home or in a rehabilitation centre. Physiotherapy improved the results of the surgical treatment and accelerated the functional recovery.

### 13. Discharge destination

Patients discharged to home accounted for 90.2% of cases. Two (3.3%) patients continued care in a rehabilitation centre. Three cases of death (4.9%) were recorded and only one patient was transferred to another specialist hospital outside the country.

## DISCUSSION

NTMRCs are known as pathologies of the elderly. They are increasing exponentially with the ageing of the world's population and may overtake traumatic spinal cord injuries [4,7]. According to the United Nations, the global population of people aged 65 years or older will triple by 2050 [21]. The average age varies from 48.5 to 67 years, depending on the different study series [4,14]. Our results support these data from the literature. The hospital prevalence of NTMRC (61 cases or 50.8%) was higher than that of traumatic origin (59 cases or 49.2%). The average age was  $51 \pm 14.21$  years. The curve of our series is increasing with a peak of 16 cases in 2021. Non-traumatic medullary-radicular injuries affect both sexes almost equally [22]. For some authors, men are more affected than women [23,24,25] and, for others, it is rather women who suffer more than men [15,26]. In this study, we observed a slight male predominance (51.8%), a sex ratio of 1. Twenty-five (67.2%) patients were married. McKinley et al recorded 57% married [27]. In people aged over 50, the incidence of degenerative and tumoral pathologies increases exponentially [28].

With regard to disc herniations, ageing favours dehydration of the intervertebral discs, disorganisation of the collagen architecture (IV, II, IX) and of the glycosaminoglycans of the nucleus pulposus and the annulus fibrosus. The annulus fibrosus becomes dry, fragile and causes the exit of the nucleus pulposus which compresses the intracanal nerve structures [29]. The increase in degenerative lesions of the spine in elderly women is linked not only to ageing but also to the fall in oestrogenic hormones at the menopause. The intervertebral disc is hormone-sensitive. Estrogens ensure the maintenance of the intervertebral disc

phenotype. Menopause is thought to accelerate the degeneration of intervertebral discs with the loss of their anatomical structure [30,31]. In addition, certain intrarachid tumours, such as meningiomas, are thought to be hormone-dependent in relation to the female sex hormones (oestrogen and progesterone) [32].

Tumors, especially metastases [17], and degenerative pathologies (herniated disc, narrow spinal canal) [9,10,15,33] are among the most frequent causes of NTMRC according to several studies. Our results show a predominance of degenerative diseases (herniated discs and narrow spinal canal, 63.9%) and tumoral diseases (meningiomas and metastases, 22.9%). This differs from previous series published by other researchers that give precedence to infectious pathologies, in particular tuberculosis and HIV/AIDS infection, in sub-Saharan Africa [12,13,14, 34]. Changing lifestyles, cultural mixing and increasing efforts to control the above-mentioned infectious diseases may justify this paradigm shift regarding the causes of NTRMRC in sub-Saharan Africa. Ones et al [35] pointed out that differences in the causes of NTMRC are dependent on social, cultural and genetic differences.

Neurologically, most patients (63.9%) had an incomplete neurological deficit (ASIA: B-D). Muller-Jansen et al [36] and McKinley et al [37] found similar results with all ASIA C-D patients. On further analysis, tumoral and infectious causes (Pott's disease) of NTMRI had a low ASIA score (B and C, 72.7%) and degenerative pathologies a high ASIA score (D-E, 82.05%).

New et al [21] reported a similar admission outcome for degenerative diseases, a high ASIA score (D-E: 65%) and for infections a low ASIA score (A-C: 62.1%).

The neurological manifestation of NTMRC is generally an incomplete neurological deficit [22,23, 37]. This would depend on the non-traumatic pathology itself and the stage of the spinal cord compression. Spinal cord compression of infectious origin and, to a certain extent, that of a tumour are often early and of acute deficits, with an ASIA score that is lower than that of a degenerative origin [38]. In the acute phase, Pott's disease can damage vertebral bodies, discs, and paraspinal soft tissues, resulting in the formation of caseous necrotic tissue, pus, and dead bone, which can enter the spinal canal

and rapidly cause mechanical compression of the spinal cord resulting in early low ASIA score paraplegia [39, 40, 41]. Spinal cord compression in tumoral pathologies is usually caused by the collapse of a metastasised vertebral body but can also result from direct extension of the tumour into the spinal canal, mechanically compressing the cord and rapidly deteriorating its function [42]. Degenerative pathologies are much more insidious than the two previous ones, the ASIA score remains high for a long time [37].

Simple laminectomy, laminectomy-discectomy and laminectomy-arthrodesis by posterior approach were the most performed surgical procedures in our department with 26.2%, 24.5% and 32.8% of cases respectively. Similar results were observed by Gaddour et al [15], 39.5% of laminectomy and arthrodesis (16.6%), Dios et al, [43] 57.4% of laminectomy and 42.6% of laminectomy + arthrodesis. The predominance of degenerative pathologies in this study would justify these results.

A simple decompression laminectomy, well performed, a laminectomy-discectomy or a laminectomy-arthrodesis, following the importance of laminectomy levels, constitute sufficient surgical acts in case of radiculo-medullary compression. Furthermore, some studies have not found a significant difference between simple laminectomy and laminectomy-arthrodesis [43].

In general, the rate of surgical site infection for spinal surgery varies from 0.5 to 18.8% [44]. In our series, this rate is high (24.6%). Surgical site infection is not an uncommon complication after spinal surgery, but it remains a serious problem [45]. The important thing is to identify the risk factor and try to eliminate it. In our study, no factor was found to be significantly at risk, although the infection rate was high. Hence the need for a targeted study to identify risk factors for post-spinal surgery SSI. In relation to the three deaths due to comorbidities, it should be noted that comorbidities are described in the medical literature as significant risk factors for mortality after spinal surgery [4,46,47].

Forty-one (67.2%) patients were discharged with an improved ASIA score compared to 22.8% of cases with a stationary ASIA score. When comparing the mean ASIA scores before and after surgery, the relationship was statistically significant ( $p < 0.001$ ). Other authors have also described the effectiveness of well-conducted surgery in improving the ASIA

score. With compressive pathologies, the surgical procedure removes compression and frees the nerve structures, thus favouring the progressive restoration of spinal cord function [38,48].

At the end of the hospital stay, 90.2% of patients went home. Halvorsen et al [49] recorded 73% and New et al 80.5% [22] of patients who returned home after hospital discharge. Once discharged from hospital, many patients prefer to continue outpatient rehabilitation in the family environment. The family atmosphere is said to provide comfort and speed up their recovery. In addition, patients mention the additional care costs of revalidation centres as well as the continuity of hospital isolation. Nevertheless, according to the work of Choi et al [50], the continuation of post-hospital physiotherapy exercises in a rehabilitation centre offers more benefits (e.g. early return to work) than those performed at home.

### Strengths and limitations

This study is the first one to provide a general overview of the management of NTMRC in the city of Kinshasa in particular and in the Democratic Republic of the Congo in general. Despite some discrepancies, this work reveals many points of similarity with studies carried out in other countries. The limitations of this study concern the data collection technique, which was largely retrospective. Some records were missing such as BMI, types of surgical site infections, occupations of some patients, some laboratory tests. The small sample size does not allow us to generalise our conclusions. Some epidemiological aspects are missing because the study was not conducted in the general population, it was based only on data from the Neurosurgery Department.

### CONCLUSION

NTMRCs managed in hospitals are increasing. They are caused more by herniated discs and tumors and affect both sexes indiscriminately. On admission, the majority of patients present an incomplete neurological deficit. Patients with tumours and Pott's disease have a low ASIA score (B-C) while those with degenerative pathology have an ASIA score of D-E. Decompression laminectomy, discectomy and laminectomy-arthrodesis are the most commonly performed surgical procedures. Many patients have a simple postoperative outcome. Surgical site

infection remains the major complication and opens new research perspectives to identify a reliable predictive factor. Much work remains to be done to bring patients to revalidation centres.

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