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Pelvic magnetic resonance imaging: Extension assessment and monitoring of cervical cancer

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Abstract
Cancer of the cervix is common in Madagascar. The recent advent of MRI in our country has changed the management of this pathology. The objective of this work is to describe the aspects of cervical cancer on MRI by establishing a FIGO-MRI classification and to assess the role of MRI in post-treatment follow-up. It was a prospective descriptive study lasting 11 months, at the Medical Imaging Center of the Joseph Ravoahangy Andrianavalona University Hospital Center (CHUJRA); on the extension assessment and follow-up of cervical cancer by pelvic MRI, using a 0.35 Tesla device from the SIEMENS® brand, by studying the files and images of patients who have undergone pelvic MRI for initial work-up or post-treatment evaluation of cervical cancer with histological evidence. Thirty-three cases were collected, with a prevalence of 35.87%. The average age was 55, with extremes of 34 to 76. The main risk factor found is the absence of HPV vaccination. The main reason for consultation was metrorrhagia. Adenocarcinomas accounted for a large number (64%). On MRI, 61% of patients had a tumor size greater than 4 cm. Loco-regional infiltrations were the most recorded. Cancer of the cervix is common in Madagascar. Pelvic MRI plays an important role in the initial extension assessment and post-treatment follow-up of this pathology.

Keywords: uterine cervix; hydronephrosis; magnetic resonance imaging; neoplasia

Introduction
Cervical cancer is a sexually transmitted disease caused by an oncogenic virus, Human Papilloma Virus (HPV) [1]. According to the World Health Organization (WHO), it ranks second among cancers in women in terms of incidence and first in terms of mortality. [2, 3]. The prevalence is 20 to 25% of cancers seen in the Oncology-Radiotherapy department of the Joseph Ravoahangy Andrianavalona University Hospital Center (CHUJRA) in 2010 [4]. Pelvic magnetic resonance imaging (MRI) is a powerful imaging test for the local extension assessment of cervical cancer and to know the tumor stage [5]. This is a pioneering study in Madagascar. The objective is to describe the epidemiological aspects of cervical cancer and the aspects of cervical cancer on pelvic MRI by performing FIGO-MRI classification.

Methods
It was a prospective, descriptive, single-center, 11-month study, from December 2017 to October 2018, at the CHUJRA Medical Imaging Center. The study looked at the records and images of patients with histologically proven cervical cancer, with an initial extension assessment or follow-up-post-treatment by MRI. The device used was a 0.35 Tesla open-field MRI, brand SIEMENS®. We included women with pelvic MRI for extension workup or post-treatment evaluation for cervical cancer during this time period. Women performing pelvic MRI for other indications were excluded. The variables studied were occupation, geographic origin, risk factors including contraception, sexually transmitted infections (STIs), active smoking, menopause status, vaccination status, familial cancer, clinical signs, histological type, on MRI: signal abnormalities, locoregional extension: vaginal wall, bladder wall, rectal wall, parameters, iliac lymphadenopathy, extension to the wall, distance extension, treatment, as well as variables quantitative such as patient age, parity, number of abortions.
Statistical data was analyzed using Excel® 2010 software.

Results
1. Socio-demographic data
During this period, 33 files of women with tumors of the cervix were collected, out of the 92 pelvic MRI scans performed, and these examinations were indicated for initial extension assessment or follow-up-post therapy, with a prevalence of 35.87 %. The average age was 55 years with extremes of 34 to 76 years. The 60-69 age

group was the most representative. Women housewives are the most represented (48%), followed by traders (18%), 12% were teachers, 9 in the administrative field and farmers (3%). Regarding the risk factors, no woman received a vaccine against HPV, 33.33% were on contraceptives, 48.18% had a history of STIs, 12.20% were active tobacco users, a notion of familial cancer was noted (6.06 %). According to the number of pregnancies and parity: 39% of women are pauciparous, multiparous (33%), first-time (24%) and nulliparous (3%). According to the histological type, squamous cell carcinoma was the most representative (64%), and adenocarcinoma (36%).

2. Characteristics of lesions on MRI

Among the 33 women, 20 (61%) had a tumor size greater than 4 cm. The lesions were polymorphic on MRI, including T1 hypointense and T2 hypersignal lesions (Figure 1). After injection of gadolinium contrast product, lesion enhancement was moderate in 68% of cases, heterogeneous in 29% of cases and intense enhancement in 03% of cases. Bladder wall involvement was observed in 07 patients (21%). We noted rectal infiltration (15%) or 5 patients. The infiltration of parameters observed in 08 patients (15%). The existence of hydronephrosis and the affected side are shown in Table II. Bilateral hydronephrosis (18%) and unilateral (6%) cases (Figure 2). The presence of iliac lymphadenopathy was observed in 07 women (21%). FIGO stage IB1 was the most representative (42%), followed by stage IVA (27%), stage IB2 (9%), IIIA (9%), IVB (3%). We did not observe stages IIB and IIIB, (Figure 3).

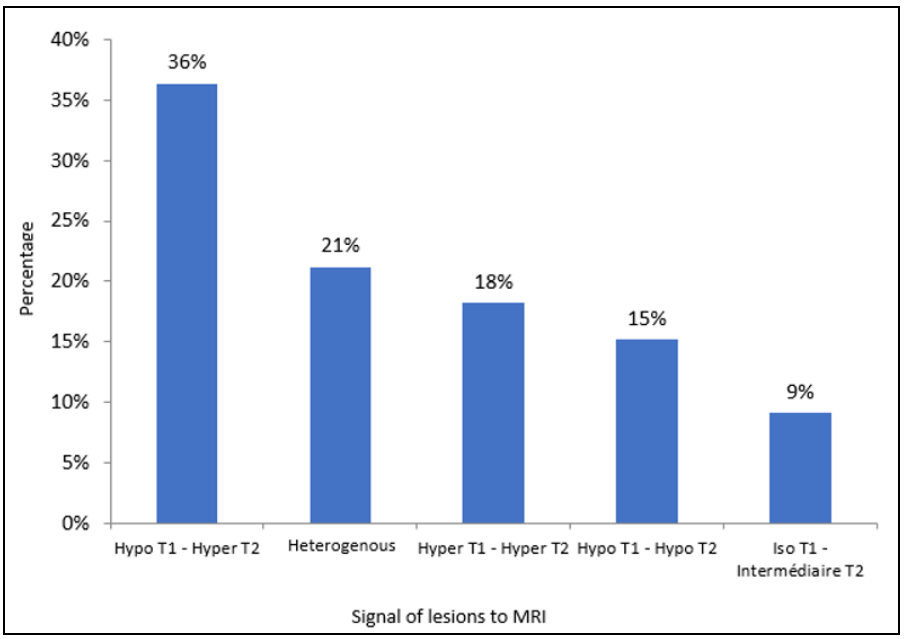

Fig 1: Distribution of patients according to lesion signals on MRI.

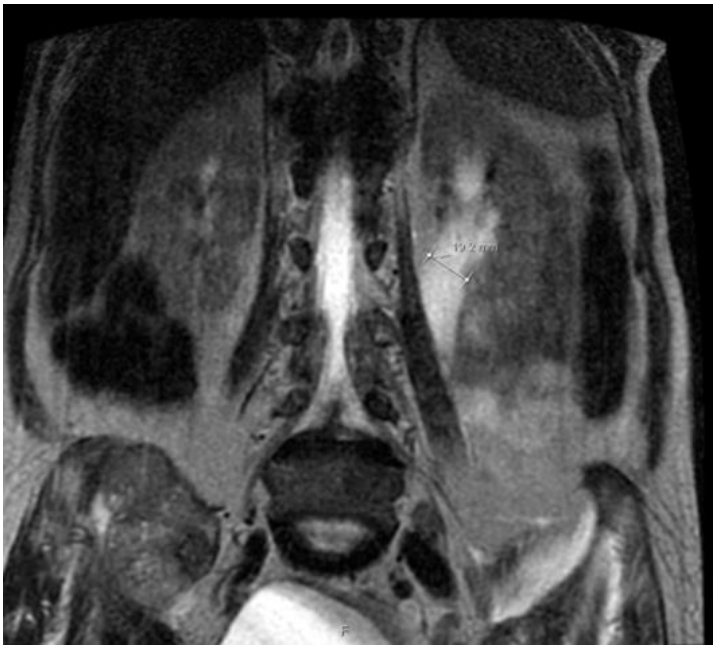

Fig 2: Coronal T2-weighted image of a pelvic MRI, taking both kidneys, showing left hydronephrosis.

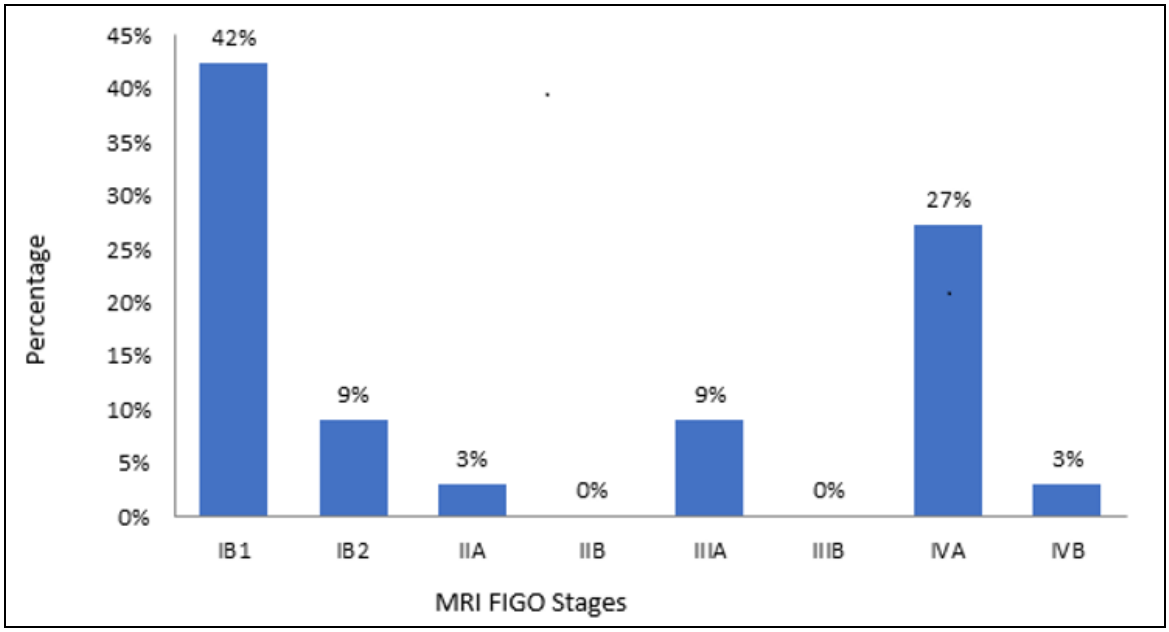

Fig 3: Distribution of patients according to the FIGO-IRM classification.

Discussion

Socio-demographic data

Our study population was representative compared to the literature, like the studies carried out in other African countries, in particular that of Kikwaya [6], carried out at the Fann hospital center in Dakar which covered 30 cases, that of FELFEL and al [7] covering 14 cases in two years.

The average age of our patients was 55 years, with extremes of 34 to 76 years. The 60 to 69 age group was the most represented with 12 cases, or 36.36% of cases. These results are comparable to those found in the literature, in particular the series by Suk Hee Heo *et al* [8]. However, our patients were older compared to those in the Sanchez series [9] where the mean age was 48.5 years. This could be explained by the delay in diagnosis and treatment of cervical cancer in Madagascar because accessibility to screening for this disease is still limited.

The high prevalence of women with a low economic level was found in the series of Sanchez [9], this perhaps in relation to the low rate of vaccination in these patients.

According to the histological type, squamous cell carcinoma was the most frequent, accounting for 64% of cases, followed by adenocarcinoma in 36% of cases, this agrees with the data in the literature [9, 10].

Characteristics of lesions on MRI

The estimation of tumor size is important for the choice of treatment because tumors larger than 4 cm require treatment with concomitant radiotherapy and chemotherapy, while the treatment of tumors smaller than 4 cm is not standardized and may call for other therapeutic modalities [9].

MRI is of particular importance in evaluating the extension of the tumor to the uterine isthmus, which is not clinically detectable.

Eight women had parametrial involvement, in the other series including that of Felfel *et al* [7], the parameters were infiltrated in 11 cases out of 14 patients. On MRI, the best sign for the absence of invasion of the parameters is the visibility over its entire circumference of the hypo-intense fibrous ring of the cervix in T2 sequence. When this hypointense border is visible in its entirety, the negative predictive value of MRI is 97%. The performance of MRI for stage IIB lesions has a sensitivity of 71 to 92% and a specificity of 82 to 93%, superior to that of clinical examination [11]. Parameter invasion is suspected when the hyposignal of the cervix in T2-weighted sequence is interrupted laterally.

Infiltration of fat adjacent to the parameters is also a sign of parametrial invasion. MRI may also be of prognostic interest as it has been proven that parameter invasion is correlated with tumor size calculated on MRI. Our study, 18 women had received an initial extension assessment with a tumor size greater than 4 cm, 8 women achieving parameters (44%) [11].

The vaginal involvement is shown in Figure 4. We noted 02 cases of involvement of neighboring organs out of 14 cases. This can be explained by the late diagnosis linked to a delay in consulting patients in our country.

MRI is said to have a negative predictive value of 100% and a diagnostic accuracy greater than 80%. It is superior to clinical FIGO staging which underestimates bladder or rectal involvement. It avoids invasive examinations such as cystoscopy and proctoscopy [9]. It also helps highlight any fistulas [11].

In our series, the FIGO MRI stage most encountered was stage IB1 (figure 4) with 15 cases, i.e. 42%, given the limits of our 0.35 Tesla device, followed by stage IVb (figures 5 and 6), being since most patients do not come for consultation until the advanced stage of the disease. Our case agrees with the literature.

Fig 4: Pelvic MRI, T1 sequence before gadolinium, showing a tumor of the cervix FIGO Ib1.

Fig 5: Pelvic MRI, sagittal T1 sequence before injection of gadolinium, showing a tumor of the cervix, invading the upper 2/3 of the vagina, infiltrating the posterior bladder wall and the anterior rectal wall, FIGO IVA.

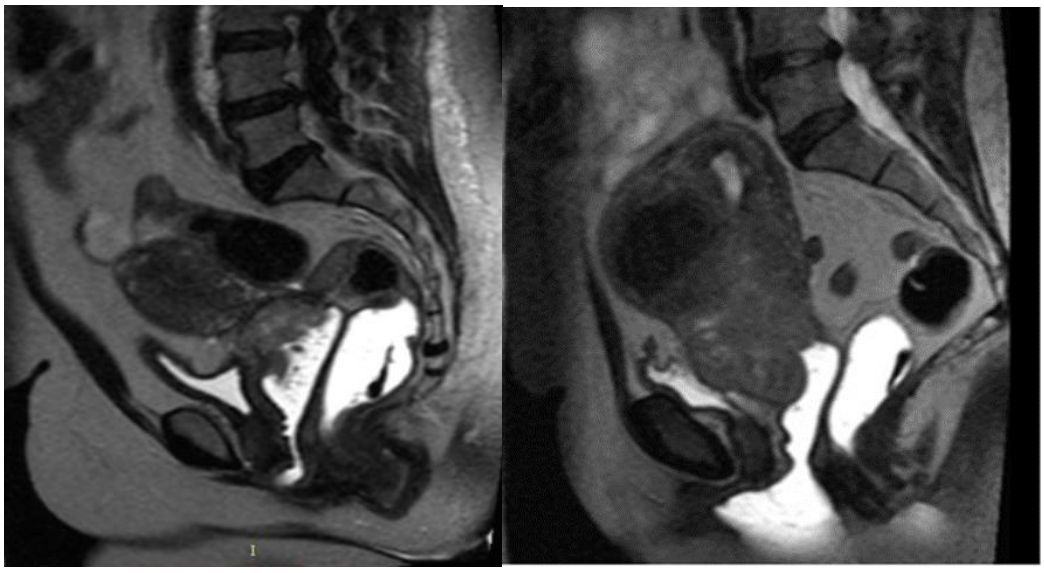

Fig 6: Pelvic MRI, sagittal T2 sequence before injection of gadolinium, showing a tumor of the cervix, invading the upper 2/3 of the vagina, infiltrating the posterior bladder wall and the anterior rectal wall, i.e. FIGO IVA

MRI allows staging of cervical cancer, which is essential in therapeutic management. According to a study by Togashi *et al* [13] in 1998, the overall diagnostic accuracy is 76 to 83% against 70% for clinical staging. For Sala *et al* [14] in 2017, the overall diagnostic accuracy is 75 to 96%.
MRI optimizes possible radiotherapy treatment by specifying the shape, volume and direction of the growth of the targeted tumor [15].
MRI could be used to determine the existence, location and extent of a possible locoregional or distant tumor recurrence. Clinical examination is insufficient to detect local recurrences, especially when treatment is conservative [16].
According to the retrospective study by Hricak *et al* [17] on 246 women with histologically proven cervical cancer, the total cost of care in patients with a tumor of at least 2 cm is lower if they receive an MRI at the initial workup only if they undergo various invasive or irradiating examinations without an initial MRI.
By comparison, MRI is clearly superior to CT for the assessment of locoregional extension of cervical cancer because unlike CT, MRI allows the analysis of different cervical tissue contrasts (zonal anatomy). In contrast, the performance of MRI and CT, for the assessment of lymph node extension its neighbors. A meta-analysis reports similar results from CT and MRI for the detection of pelvic or lumbar-aortic lymph node metastases.
Compared to MRI, ultrasound can be offered as an alternative to determine the size of the tumor and its extension at depth [17].
Ultrasound via the trans-parietal route is not very efficient but nevertheless makes it possible to measure the tumor volume when it is important and to highlight a dilation of the pyelocalicial cavities often related to an invasion of the ureter in the parameters [17].

Conclusion

Cancer of the cervix is common worldwide and in Madagascar, constituting 32% of pelvic MRIs performed at the Medical Imaging Center of the Joseph Ravoahangy Andrianavalona University Hospital Center. This is a pioneering study in Madagascar.
The lesions were polymorphic on MRI and these lesions were at an advanced stage, requiring extensive medical and surgical management. Urological complications are frequent, marked by the appearance of ureterohydronephrosis.
MRI thus plays an important role in the initial extension workup and post-treatment follow-up for cervical cancer.

Competing Interests

The authors declare no competing interest.

Authors' Contributions

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