EAS Journal of Radiology and Imaging Technology
Abbreviated Key Title: EAS J Radiol Imaging Technol
ISSN: 2663-1008 (Print) & ISSN: 2663-7340 (Online)
Published By East African Scholars Publisher, Kenya

Volume-3 | Issue-5 | Sept-Oct-2021 | DOI: 10.36349/easjrit.2021.v03i05.017

OPEN ACCESS

Original Research Article

Epidemio-Clinical and MRI Aspects of Cardiac Pathologies in Sub-Saharan Africa, About 70 Cases

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Article History
Received: 14.09.2021
Accepted: 19.10.2021
Published: 29.10.2021

Journal homepage:
https://www.easpublisher.com

Quick Response Code

Abstract: ***Objective*****:** Show the interest of MRI in cardiac pathology in our context. ***Method*****:** Transversal retrospective study with descriptive aim carried out in Abidjan(Côte d'Ivoire). It covered six months. Black and white blood sequences, T1, T2, STIR, T1 SPIR Gadolinium in small axis VG, larger axis VG and four cavities were used in all patients. The study population consisted of patients who came for a cardiac MRI and excluded control MRI reports. ***Results*****:** The average age of the patients was 50,09±15,46 from 9 to 84 years old. it was male predominance 82.19%, a sex ratio of 4.62. Ischemic heart disease accounted for 16.44% of indications and myocarditis (15.07%). Diagnostic efficiency of cardiac MRI was 47.95%. Morphological analysis objectified cardiomyopathies dominated by dilated cardiomyopathies (11%) and myocarditis (9.6%). Myocardial infarction(12,4%), cardiac malformations (11%) and pericarditis (1.37%). Functional analysis noted valvulopathies dominated by mitral insufficiency (6,9%) and hypokinesia(19,2%). ***Conclusion*****:** MRI is an excellent tool for heart disease exploring. Its safety and performance make it a tool of choice for the diagnosis of cardiopathies dominated by cardiomyopathies and myocardial infarction in our context.

Key words: Cardiac MRI, cardiopathy, Abidjan.

INTRODUCTION

The cardiac imaging, difficult by the complexity of the organ both in anatomical and dynamics situation, wasn't easy to access. In MRI, not only these progresses have materialized by the increase of the gradients' speed but also by the appearance of new antennas and new ultra-fast sequences [1].

By using a good spatial and temporal resolution associated with a three-dimensional approach and to an excellent contrast between the circulating blood and the myocardium, cardiac MRI becomes a reference method for the cardiomyopathies imaging, congenital heart diseases, cardiac tumors, great vessels and pericardium.

Its major advantage is to combine the myocardial viability's study firstly with the analysis of myocardial perfusion and secondly to a functional approach of the cardiac muscle through the study of the right and left ventricular functions in rest and during myocardial ischemia provocation tests [2].

Cardiac MRI has just newly introduced in our country. The low demand for this examination contrasts with the need of practitioners who will take care of the patients.

So, we decided to carry out this study which objective was to show the value of MRI in cardiac pathology.

MATERIAL AND METHODS

It was a retrospective and transverse descriptive study carried out in Abidjan over a period of six month from December 2018 to May 2019. We used a brand new PHILIPS 1.5 Tesla's high field MRI.

Our study was based on a population of patients who're arriving for their cardiac MRI included a sample of all cardiac MRI reports except follow-up MRI.

The examination room was well-equipped with a safety equipment which is regularly checked (emergency cart, defibrillator) and an automatic double-barrel injector.

After checking all the contraindication, a venous line was placed and the patient trained to apnea practice.

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After explaining the constraints of the examination to the patient, a phased array antenna (dedicated cardiac) was placed on him with control of the quality of the ECG curve by a sequence (BB Thorax heart) for locating the heart.

The entire exam strictly followed the cut orientation rules. The sequences in black blood and white blood; T1, T2, STIR, T1 SPIR Gadolinium and T1 mapping were performed according to the minor VG axis, major VG axis and four cavities. The post treatment was based on the morphological study which consisting to analyze the signal abnormalities of the myocardium and the measurement of the wall thickness. The functional study involved the moving analysis of the cavities by systolic ejection fraction, contractility and kinesia.

Our studies were essentially based on socio-demographic data, indications for MRI, morphological lesions and functional abnormalities.

The survey sheets were analyzed before the clearance carried out on the Stata14 software. The distribution of continuous variables will be described by their mean, standard deviation, interquartile range and extremes. The distribution of discrete variables will be described by their different proportions expressed as a percentage.

RESULTS

The mean age of the patients was 50.09 ± 15.46 years with extremes of 9 and 84 years. A male predominance was noticed in 82.19% of cases, with 4.62 of sex ratio. The ischemic heart diseases represented 16.44% of the indications, followed by the myocarditis (15.07%) (Table I).

Table-I: Patient Distribution by Cardiac MRI Patterns

Indications	Patients	Percentage
Ischemic heart disease	12	16,44
Myocarditis	11	15,07
Dilated cardiomyopathy	8	10,96
Precordialgia	8	10,96
Arterial hypertension	3	4,11
Intracardiac mass	3	4,11
Systolic dysfunction	3	4,11
Tetralogy of Fallot	2	2,74
No compaction of VG	2	2,74
Sinusal bradycardia	1	1,37
Aortic narrowing	1	1,37
Pericarditis	1	1,37
Aortic mass	1	1,37
Situs-invertus	1	1,37

Ischemic cardiopathy represented 16.44% of cardiac MRI indications.

The diagnostic profitability ratio of cardiac MRI was 47.95%, the morphological and functional analysis made perceptible the cardiomyopathies with the dilated cardiomyopathies (11%) and the myocarditis (9.6%). The myocardial infarction represented 12.4%, 11% for the heart defects and 1.37% for the pericarditis (Table II).

Table-II: Distribution of patients according to morphological lesions on cardiac MRI

Lesions	Patients	Percentage
Cardiomyopathy		
Dilated cardiomyopathy	8	11
Hypertrophic cardiomyopathy	3	4,11
VG no compaction	3	4,11
Myocarditis	7	9,6
Myocardial infarction	9	12,4
Congenital Heart Malformations	8	11
Intracardiac mass (myxoma)	1	1,37
Péricarditis	1	1,37
Valvulopathy		
Mitral insufficiency	5	6,9
Tricuspid insufficiency	3	4,11

Cardiomyopathies were observed in 21 patients (28,9%)

The valvular heart diseases with a mitral regurgitation (6.9%), the hypokinesia (19.2%) and the reduced ejection fraction (13.7%) (Table III).

Table-III: Distribution by functional abnormalities on cardiac MRI

Anomalies	Patients	Pourcentage
Decrease in systolic fraction ejection	10	13,70
Cardiac flow decreasing	3	4,11
Hypokinesia	14	19,2
Hyperkinesia	1	1,37

Hypokinesia was observed in 19,18% des patients.

The cardiomyopathies were observed at a mean age of 50 years. The men of 50 years are those who showed more lesions (Table IV).

Table-IV: Distribution of lesions by age and sex

Lesions	Average age ±ET	M/F
Cardiomyopathy		
Dilated cardiomyopathy	48,12±21,36	8/0
Cardiomyopathie hypertrophique	50,33±4,16	2/1
VG no compaction	49,67±10,26	2/1
Myocarditis	48,00±12,67	6/1
Myocardial infarction	56,33±10,29	8/1
Congenital Heart Malformations		
Situs-invertus + VG no compaction	28,00±26,87	1/1
Tetralogy of Fallot	9,50±0,70	1/1
Atrial communication	9,00±0	0/2
Inter-ventricular communication	50,09±15,46	1/1
Intracardiac mass (myxoma)	55,00	1/0
Pericarditis	59,00	0/1
Valvulopathy		
Mitral insufficiency	50,40±5,77	5/0
Tricuspid insufficiency	36,00±23,30	3/0

Lesions were predominant around 50 years in males.

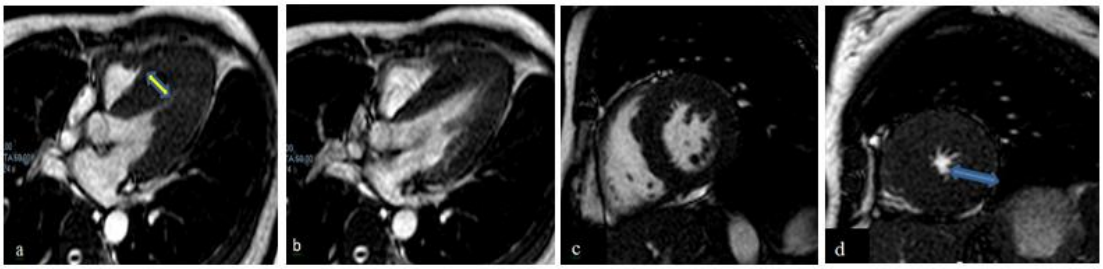

Fig-1: Cardiac IRM, a (04 cavities diastole), b (04 cavities systole), c (minor axis, left ventricle diastole), d (minor axis left ventricle systole): Thickening of the septal wall (yellow arrow) and lateral wall (blue arrow) of left ventricle from 26 mm in diastole to 29 mm in systole: Hypertrophic cardiomyopathy

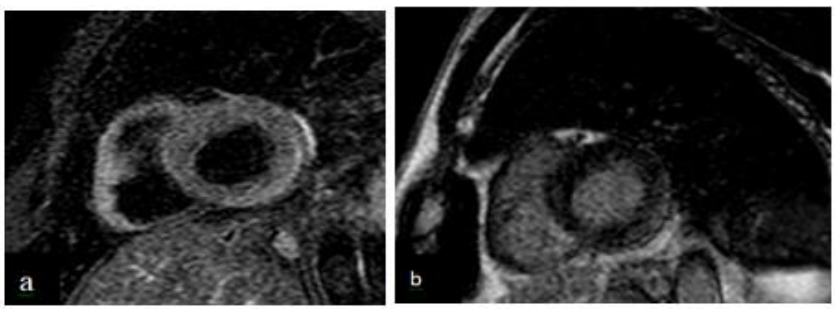

Fig-2: Cardiac IRM, a (minor axis left ventricle T2 STIR), b (minor axis left ventricle T1 SPIR Gadolinium , early and late enhancement to 15 minutes): Hypersignal STIR of apical and septal wall of left ventricle(blue arrow), enhancement of this area at late (yellow arrow): Myocarditis .

DISCUSSION

The mean age of our patients was 50 years with a standard deviation of 15.46 years. This age is the same as several studies regardless of the nature of the heart disease. The mean age was 52.2 years in Pio's study [3] with a standard deviation of 16.7 years.

Otherwise, in Thiam's series on ischemic heart diseases, the mean age of patients was 56 years [4].

We observed the same tendency of a clear male predominance like Thiam. The ischemic heart diseases were the primary indication for MRI in our context (16.44%). Our results are lower than Doyle's results which said that a third of them are directly related to coronary artery disease and almost half of the deaths from coronary artery disease usually occur without warning signs [5].

The cardiomyopathy was the most common heart injury. Based on the imaging phenotype, the cardiomyopathies are divided into five characteristic subtypes: arhythmogenic, hypertrophic, dilated, restrictive, and non-compaction of the left ventricle [6]. We have recorded a prevalence of 10.96% related to dilated cardiomyopathy, 4.11% related to hypertrophic cardiomyopathy and 4.11% related to non-compaction of the left ventricle.

Dilated cardiomyopathy (DCM) is the most common form of cardiomyopathy [7]. It can be diagnosed through the dilation of the cavities, LV diameter greater than 55 mm on the minor axis. According to the World Health Organization (WHO), the idiopathic DCM is considered to be the ultimate stage of myocardial damages due to immunological, viral, metabolic, cytotoxic or genetic damage.

The MRI diagnosed the hypertrophic cardiomyopathies (Figure1) by showing the areas of apical and lateral hypertrophy which aren't easy to access with ultrasound and atypical forms of hypertrophy. It shows the septal thickening in diastole of more than 15mm, and the most discrete forms associated with the mutations in troponin chains and sarcomere proteins [8]. The late enhancement was appeared in two third of the patients. Several studies have shown a strong complementary relationship between the presence of late enhancement, the risk of sudden death and ventricular arrhythmia [9, 10]. The potential role of the microvascular dysfunction in the development of intramyocardial fibrosis can be used as an early point during the progress of the disease.

The left ventricular non-compaction was about 4.11%. Paule et al reported 3 cases [11]. According to the World Health Organization (WHO), this is the result of an alteration in the structure of the myocardium, which following an incomplete embryogenesis. The Transthoracic echocardiography (TTE) allows the diagnosis, which is supported by cardiac MRI especially on patients with low echogenicity [11]. The diagnosis of our patients was made by measuring the ratio between the compacted area and the non-compacted area. This significant index beyond a value of 2.3 is calculated from the measures made in diastole in four cavities incidence. Otherwise, the MRI shows a hypersignal in uncompacted areas during T2 sequences for the presence of fibrosis [12]. Late enhancement means presence of fibrosis which extension could be a prognostic argument [13].

9.59% of cases evoked the myocarditis (Figure2), its diagnosis was related to sub-epicardial and transmural hypersignal on the short axis with late enhancement at 15 minutes. It is an acute attack of the myocardium leading to a myocytic necrosis with variable extent. The areas of myocytic necrosis begin in the subepicardial locations and then tend to spread transmurally in the subacute stage.

About 20% of cases often showed a moderate pericardial effusion .During the late enhancement sequence, there are frequently subepicardial nodular or thick band centromyocardial enhancements which are found in the same territory as the edema when it is present, and which never correspond to a vascular distribution. These late enhancements are always located in the inferolateral area, rather than in the apical area. This topography can almost formally eliminate the infarction where the involvement is initially subendocardial rather than transmural in a coronary territory, and where kinetic disturbances are correlated with the late contrast enhancement [9, 10].

The myocardial infarction was the most common lesion in our series (Figure 3). This could be explained by the high prevalence of coronary artery disease in the world especially in Africa. Dujardin and Cambou recorded an annual incidence of myocardial infarction which estimation is 224 for men and 160 cases for women on a population of 100,000 patients [14].

The morphological and kinetic study deserved such an interest for the good evaluation of segmental kinetics [15], an analysis of the cardiac chambers and the pericardium, the search for LV thrombus, a septal rupture and pericarditis. The Late enhancement allows a precise quantification of the size and transmural character of the infarction [16]. It also makes it possible to determine the exact territory of the infarction (specificity greater than the ECG currently used as a reference examination) and to diagnose an extension to the right ventricle [17, 18]. It could be an independent factor of death [19].

The congenital heart defects were about 2.74%. This was the tetralogy of Fallot. Dacher reported a case [20]. The MRI is often required in Fallot

patients who are treated on a long-term in order to analyze RV function (ejection fraction, volumes, mass), to measure pulmonary regurgitation and to look for possible pulmonary arterial stenosis and the related areas of late myocardial enhancement often with an arrhythmogenic fibrosis [20].

The other heart defects were the interatrial and interventricular communication. The classic form of Atril Septum Defect (ASD) is the ostium secundum, an ovoid defect that develops in the middle of the inter-atrial septum. The MRI allows the diagnosis of abnormal pulmonary venous return, to quantify the shunt, usually left-right. The quantification of this shunt is important because it will help in the taking of decision about the surgical treatment (large defect) or endovascular (Amplatzer prosthesis).

The intracardiac tumors were less frequent with a proportion of 1.37% myxoma. The autopsy series report the presence of a primary cardiac tumor in 0.001 to 0.28% of cases for the general population [21]. More than 70% of the primary cardiac tumors are benign and mainly represented by myxomas (more than 50% of benign tumors). On MRI, most of the myxomas are isointense in T1 and hyperintense in T2. However, the myxomas are frequently heterogeneous. The tumor calcifications appear in T1 and T2 asignal. The areas of subacute bleedings have a T1 and T2 hypersignal appearance, recent bleedings which are showing T1 hypointense or isosignal and T2 hypointense [22]. The enhancement is classically heterogeneous after injecting the contrast product.

The Pericarditis; The MRI provides an excellent visualization of the pericardium, through the spontaneous contrast of mediastinal fat and epicardial fat. This contrast allows a constant visualization of the pericardium comparing to the right cavities [23]. It appears in hypointense on the T1 and T2 weighted sequences. The indications for CT scan and MRI are: localized effusion, effusion of non-liquid echostructure, effusion not found on ultrasound when there is a strong clinical suspicion, the suspicion of pericardial thickening on a ultrasound of average quality [24, 25]. The differential diagnosis between restrictive left ventricular disease and chronic pericarditis is also an indication for a sectional examination [26].

The valve disease involved mitral (6.85%) and tricuspid (4.11%) insufficiency. The diagnosis was made on the dynamic functional analysis in four cavities, the hypointense jet in the atria. Mitral regurgitation may be due to sequelae of rheumatic fever, sequelae of endocarditis, myocardial ischemia and congenital pathology [27].

The proportion of the mitral regurgitation was greater than tricuspid regurgitation. Didier D also observed the same tendency [27]. According to him, the tricuspid valve is less affected than the other heart valves and the tricuspid insufficiency is more often functional than organic [27]. The cine-MRI sequences make it possible to appreciate in semi-quantitatively way the severity of the tricuspid regurgitation based on the importance of the hypointense jet spreading in systole in the right atrium, which will be best demonstrated on the incidence of the four cavities and two straight cavities [27].

CONCLUSION

Magnetic Resonance Imaging is a non-invasive imaging tool with remarkable performance. This imaging tool has been available in Côte d'Ivoire for few year. At the end of our study which general objective was to draw the activity report of cardiac MRI in Côte d'Ivoire, it appears that the heart disease is diagnosed at an average age of 50 years with 5 times more men than women. The indications were dominated by the ischemic heart diseases and myocarditis. The main lesions observed were the cardiomyopathies and myocardial infarction.

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Cite This Article: Aboulaye Toure *et al* (2021). Epidemio-Clinical and MRI Aspects of Cardiac Pathologies in Sub-Saharan Africa, About 70 Cases. *EAS J Radiol Imaging Technol, 3*(5), 298-303.