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Role of MRI in Evaluation of Acquired Cardiac Pathologies in Patients Referred for Cardiac MRI to Pravara Rural Hospital Loni, Maharashtra, India.

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ABSTRACT

Cardiovascular diseases are a leading cause of morbidity and mortality globally. Conventional imaging modalities like echocardiography have limitations in specific scenarios, necessitating the use of advanced imaging techniques like Cardiovascular Magnetic Resonance (CMR). This study evaluates the role of CMR in diagnosing various cardiac pathologies in patients referred to Pravara Rural Hospital, Loni. A descriptive longitudinal study was conducted on 37 patients over two years using a 3Tesla Philips Ingenia MRI machine. Data were collected through structured interviews and analyzed using appropriate statistical tests. Ethical approval was obtained before the study. The study demonstrated a male predominance. The prevalent cardiac pathologies included mitral regurgitation (46%), tricuspid regurgitation (36%), aortic regurgitation (30%), and pulmonary valve regurgitation (29%). Other findings included reduced left ventricular ejection fraction (20%), wall motion abnormalities (13%), and left ventricular hypertrophy (13%). CMR is an invaluable tool in comprehensively evaluating cardiac pathologies, offering detailed insights into myocardial function, viability, and various pathologies, thus significantly enhancing clinical decision-making.

Keywords: Cardiovascular Magnetic Resonance (CMR) , Cardiac Pathologies, Myocardial Function Evaluation.

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INTRODUCTION

Cardiovascular diseases (CVDs) are a leading cause of morbidity and mortality worldwide, imposing a significant burden on healthcare systems [1]. Early and accurate diagnosis is crucial for effective management and treatment of these conditions [2]. While echocardiography remains a commonly used imaging modality for initial assessment, it has inherent limitations such as poor acoustic windows, operator dependency, and restricted field of view. These limitations can hinder comprehensive evaluation, especially in complex cases.

Cardiovascular Magnetic Resonance (CMR) has emerged as a superior diagnostic tool, providing detailed and precise information about cardiac structure, function, and tissue characterization. Unlike echocardiography, CMR offers a comprehensive assessment of myocardial viability, perfusion, and fibrosis, making it invaluable in diagnosing a wide range of cardiac pathologies. Its non-invasive nature, combined with its ability to offer high-resolution images and functional assessment, positions CMR as an essential modality in contemporary cardiology [3, 4].

Our study aims to evaluate the role of CMR in identifying and characterizing cardiac pathologies among patients referred to Pravara Rural Hospital, Loni. By elucidating the diagnostic significance of CMR, this research seeks to highlight its potential in enhancing clinical decision-making and improving patient outcomes in a rural healthcare setting.

METHODOLOGY

Our study was conducted in the Radiology Department of Pravara Rural Hospital, Loni, employing a descriptive longitudinal study design. The sample size consisted of 37 patients, selected using purposive sampling over two years. A 3Tesla Philips Ingenia MRI machine was used for data collection. Ethical approval was obtained before initiating the study. Data collection involved structured interviews with patients or their guardians, ensuring informed consent. Patients meeting the predefined inclusion criteria were included in the study cohort. The collected data were analyzed using suitable statistical tests aligned with the study objectives.

RESULTS

The study encompassed 37 patients referred for cardiac MRI, with a notable male predominance. The prevalence of various cardiac pathologies is summarized in Table 1.

Table 1: Prevalence of Cardiac Pathologies

Cardiac Pathology	Prevalence (%)
Mitral Regurgitation	46
Tricuspid Regurgitation	36
Aortic Regurgitation	30
Pulmonary Valve Regurgitation	29
Reduced Left Ventricular Ejection Fraction	20
Wall Motion Abnormality	13
Left Ventricular Hypertrophy	13
Left-to-Right Shunt	13
Pulmonary Hypertension	13
Fibroma	6
Myocarditis	6
Fibrosis	6

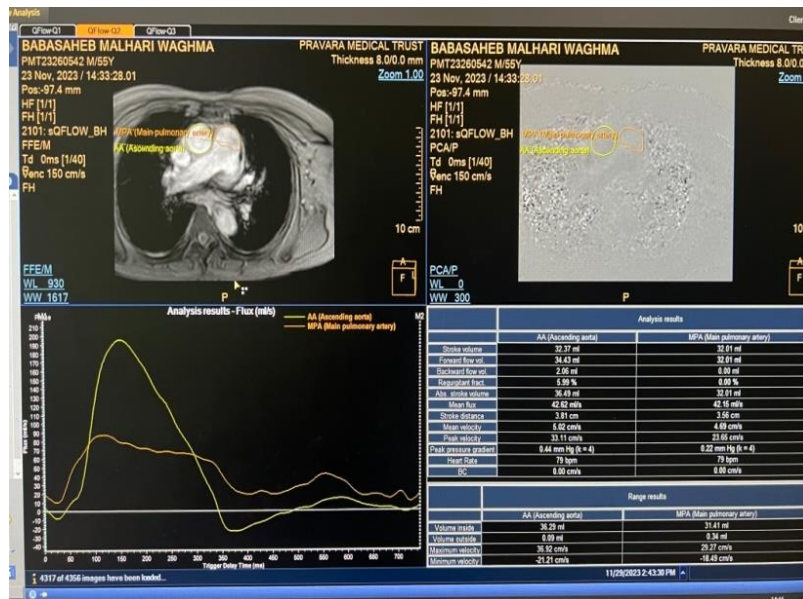


Figure 1: Sq. Flow

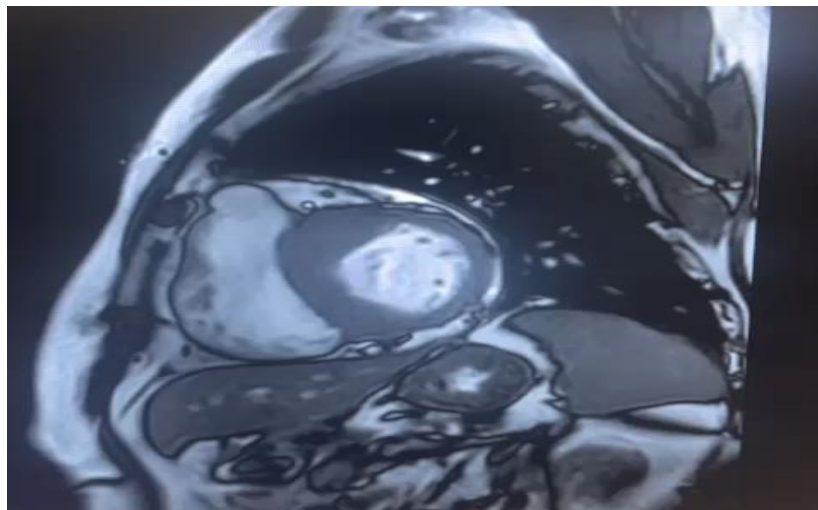


Figure 2: Left ventricular hypertrophy

Note: Given image of the sq flow sequence shows flow across the aorta and pulmonary artery and gives information about accurate regurgitation fraction, forward flow, and peak pressure gradient

DISCUSSION

Cardiovascular Magnetic Resonance (CMR) has emerged as a pivotal imaging modality in the evaluation of cardiac pathologies. Its ability to provide detailed images and functional information about the heart makes it superior to traditional methods like echocardiography, especially in cases where acoustic windows are poor or where precise measurements of myocardial function are necessary [5, 6].

Utility in Diagnosing Cardiac Pathologies

CMR is particularly valuable in diagnosing conditions such as mitral regurgitation, tricuspid regurgitation, aortic regurgitation, and pulmonary valve regurgitation. The high prevalence of these conditions in the study population underscores the importance of accurate diagnostic tools. For instance, mitral regurgitation was found in 46% of the cases, highlighting the need for precise imaging techniques to guide treatment strategies [7].

Assessment of Myocardial Function

One of the significant advantages of CMR is its ability to accurately measure left ventricular ejection fraction (LVEF) and myocardial mass. In this study, 20% of patients had a reduced LVEF, a critical parameter in assessing the severity of heart failure and guiding therapeutic decisions. Additionally, CMR's capability to detect wall motion abnormalities, as seen in 13% of the cases, provides essential insights into the functional status of the myocardium [8].

Detection of Myocardial Fibrosis and Viability

CMR's ability to identify myocardial fibrosis and scar tissue is particularly beneficial in patients with ischemic heart disease. The presence of fibrosis was noted in 6% of the patients, indicating its role in chronic myocardial injury. CMR can distinguish between viable and non-viable myocardium, which is crucial in planning revascularization procedures. Its superiority over echocardiography in this aspect is well-documented, as it can provide comprehensive information about myocardial viability and guide the management of myocardial infarction [9].

Role in Inflammatory Cardiomyopathies

In the diagnosis of myocarditis, CMR offers unparalleled advantages by identifying myocardial edema and fibrosis. In this study, myocarditis was observed in 6% of the cases. CMR not only aids in the initial diagnosis but also in monitoring the progression of the disease and response to therapy. Its role in decision-making for endomyocardial biopsy, especially in ambiguous cases, further enhances its clinical utility [10].

Clinical Decision-Making and Prognostic Value

The prognostic value of CMR extends beyond diagnosis to influencing clinical decisions, such as the necessity for implantable cardiac defibrillators (ICDs). By providing detailed insights into myocardial function and the extent of fibrosis, CMR helps in stratifying the risk of sudden cardiac death, thereby guiding the implantation of ICDs in appropriate patients.

Comparison with Other Imaging Modalities

While echocardiography remains a first-line imaging modality due to its accessibility and cost-effectiveness, CMR's detailed anatomical and functional information cannot be overlooked. This study supports the integration of CMR in routine clinical practice, particularly for complex cases where echocardiography falls short. The comprehensive evaluation provided by CMR, including assessment of myocardial mass, ejection fraction, and tissue characterization, underscores its indispensable role in modern cardiology.

CONCLUSION

Cardiovascular Magnetic Resonance (CMR) stands out as an ideal modality for comprehensively evaluating cardiac pathologies. Its ability to complement and supplement findings from 2D echocardiography is noteworthy. CMR's precision in assessing myocardial function, viability, and identifying various pathologies underscores its significance in clinical practice. The findings of this study highlight the essential role of CMR in diagnosing and managing diverse cardiac conditions, thereby enhancing patient outcomes.

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