



## Original Article

## Radiofrequency Catheter Ablation of Mahaim Tachycardia in Adult Patients

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## ABSTRACT

Mahaim pathways causing reentrant tachycardia are rare but potentially dangerous arrhythmia. Catheter ablation is the definitive treatment option for individuals with this kind of tachycardia. **Objective:** To evaluate the efficacy and safety of radiofrequency catheter ablation of mahaim tachycardia in adult patients. **Methods:** A retrospective study investigated total of 40 adult patients referred to the Cardiac Electrophysiology Department of Hayatabad medical Complex Peshawar from 4<sup>th</sup> January 2017 to 21<sup>st</sup> September 2022 were enrolled. Patient's age (20-68 years) of both male and female genders referred for radiofrequency ablation of mahaim tachycardia were studied. The tachycardia was invariably antidromic, resulting from anterograde conduction via the Mahaim pathway. All the cases were followed for complications. **Results:** The overall mean age was  $43.60 \pm 12.4$  years. The mean ablation and flouro time was  $9.44 \pm 6.93$  minutes and  $20.64 \pm 9.77$  minutes respectively. Hypertension and diabetes were found in 11 (27.5%) and 6 (15%) patients respectively. The successful ablation was achieved in 31 (77.5%) patients whereas 1 case was abandoned. During follow-up, one patient developed femoral hematoma as a complication. Typical Atrioventricular nodal reentry tachycardia (AVNRT) and atrial fibrillation were other tachycardia found in 3 (7.5%) and 4 (10%) respectively. The incidence of congenital anomalies such as ASD Secundum, HOCM, DCM, and Ebstein Anomaly was 2 (5%), 1 (2.5%), 1 (2.5%), and 1 (2.5%) respectively. **Conclusion:** The present study found that Radiofrequency ablation is effective and safe for treating Mahaim tachycardia. The success rate of RFA was 77.5%.

## INTRODUCTION

Catheter ablation is becoming a more prevalent treatment option for individuals with tachycardia. The radiofrequency energy introduction for catheter ablation transformed the reentrant tachycardias patients arbitrated by auxiliary circuits. Majority of population now consider radiofrequency ablation the best suitable treatment for symptomatic tachycardia. The restricted variation as Mahaim tachycardia is not clear since Mahaim fibers have electrical features that make traditional mapping and ablation approaches ineffective. Mahaim described abnormal conduction pathways linking the atrioventricular node or His-Purkinje system to the ventricle over 50 years ago [1, 2]. Subsequent research shown that these fibers possessed unique features, such as exclusive anterograde and decremental conduction, and that they could be identified far from the atrioventricular node and removed

using surgery or catheter ablation [3-6]. Most of these routes have recently been categorized as atriofascicular fibers with decremental features that connect the right atrium to distal sections of the right branch of the His bundle [7, 8]. Mahaims tachycardia is a reentrant atrioventricular tachycardia induced by the right accessory pathway with attenuated antegrade conduction that acts as the anterograde terminal in retrograde atrioventricular tachycardia [9, 10]. These additional pathways may enter the ventricular myocardium through the distal right leg or directly into the ventricular myocardium at the tricuspid annulus. Catheter ablation is becoming a more prevalent treatment option for children with supraventricular arrhythmias. The success rate was 90-98%, while significant problems like as atrioventricular (AV) block occur in 0.7-2.65% of young ablated patients [11].

Additionally, no substantial indication of reversing conduction has been found in Mahaim pathways. Therefore, the present study aimed to evaluate the efficacy and safety of Mahaim tachycardia radiofrequency catheter ablation in adult patients.

## METHODS

After approval from the hospital ethical committee, the retrospective study was conducted in the Department of Cardiac Electrophysiology Hayatabad Medical Complex Peshawar from 4<sup>th</sup> January 2017 to 21<sup>st</sup> September 2022. A total of 40 patients were enrolled. Consecutive sampling technique was used for data collection. Patient's age (20-68 years) of either gender referred for radiofrequency ablation of Mahaim tachycardia were enrolled. The sample size of 40 was calculated based on 95% confidence interval, 5% margin of error, and complication rate 2.65% [11]. Patients (<20 years or >68 years) with no signs and symptoms of tachycardia were excluded. All the patients experienced symptoms and either had tachycardia or produced during an electrophysiological examination. The tachycardia was invariably antidromic, resulting from anterograde conduction via the Mahaim pathway. All the cases were followed for complications. Following providing informed written consent, all patients received electrophysiological study and ablation. Prior to intervention, all antiarrhythmic medications had been discontinued. Diazepam and diamorphine were used to sedate the patients. After confirmation of Mahaim tachycardia, a large-tip deflectable electrode catheter with a 4 mm distal electrode was inserted into the femoral vein to map the tricuspid annulus. Target ablation sites were chosen based on the existence of distinct Mahaim potentials, which mimicked signals obtained from the His bundle electrode but at different locations. Moreover, atrial pacing and Mahaim tachycardia might disassociate such potentials from the His bundle electrogram. Radiofrequency radiation was carried for up to three and a half minutes, but if no impact was noticed after 15 seconds, the supply was halted. For statistical analyses, Stata 15.1 was utilized. Data were displayed as percentages (%) or as the median (range or quartiles). The 2-test or Mann-Whitney test was used to compare groups.  $P < 0.05$  was found to be significant.

## RESULTS

Age-wise distribution of patients were as follows: 8 (20%) in 20-32 years, 13 (32.5%) in 33-44 years, 12 (30%) in 45-56 years, and 7 (17.5%) 57-68 years. Age-wise distribution of patients are shown in Table 1.

**Table 1:** Age-wise distribution of patients

Age groups (years)	Frequency (%)
20-32	8 (20)
33-44	13 (32.5)
45-56	12 (30)
57-68	7 (17.5)

The overall mean age was  $43.60 \pm 12.483$  years with an age range 20-68 years. Of the total 40 patients, there were 28 (70%) male and 12 (30%) females. The mean ablation and flouro time was  $9.44 \pm 6.93$  minutes and  $20.64 \pm 9.77$  minutes respectively. Hypertension and diabetes were found in 11 (27.5%) and 6 (15%) patients respectively. The successful ablation was achieved in 31 (77.5%) patients whereas 1 case was abandoned. During follow-up, 1 patient developed femoral haematoma as a complication. Typical Atrioventricular nodal reentry tachycardia (AVNRT) and atrial fibrillation were other tachycardia found in 3 (7.5%) and 4 (10%) respectively. Baseline characteristics of patients are shown in Table 2.

**Table 2:** Baseline characteristics of patients

Variables	Value (Mean $\pm$ SD)
Age (years)	$43.60 \pm 12.483$
Ablation time (minutes)	$9.44 \pm 6.93$
Flouro time (minutes)	$20.64 \pm 9.77$
HTN	11(27.5)
DM	6(15)
Success	31(77.5)
Failure	8(20)
Abandon	1(2.5)
Others tachycardia	
AVNRT	3(7.5)
A fib	4(10)
No	33(82.5)

The incidence of congenital anomalies such as ASD Secundum, HOCM, DCM, and Ebstein Anomaly was 2 (5%), 1 (2.5%), 1 (2.5%), and 1 (2.5%) respectively. Non irrigated APT, irrigated cool flow, and non-irrigated Therapy were the different catheters used in 37 (92.5%), 1 (2.5%), and 2 (5%) respectively. Tachycardia was induced after ablation in 10 (25%) patients. Details of congenital anomalies, catheter, and ablation in tachycardia, are shown in Table 3.

**Table 3:** Details of congenital anomalies, catheter, and ablation in tachycardia

Variables	Value (Mean $\pm$ SD)
Congenital anomalies	
ASD Secundum	2(5)
HOCM	1(2.5)
DCM	1(2.5)
Ebstein Anomaly	1(2.5)
Catheters	
Non irrigated APT (4mm)	37(92.5)
Irrigated cool flow (4mm)	1(2.5)
Non irrigated Therapy (4mm)	2(5)
Ablation in tachycardia	
Yes	10(25)
No	30(75)

## DISCUSSION

The present study mainly focused on the radiofrequency catheter ablation of Mahaim tachycardia in adult patients and found that Radiofrequency radiation is effective and safe for treating Mahaim tachycardia (an uncommon but potentially dangerous arrhythmia) by targeting Mahaim potentials. Other prevalent arrhythmia substrates necessitate a gradual reasonable method to identify and treat the perpetrator arrhythmia. The Mahaim pathways can be blocked by mechanical induction rather than other accessory atrioventricular pathways. Radiofrequency ablation is effective and safe for treating Mahaim tachycardia. Additional auxiliary pathways appear to be frequent in Mahaim tachycardia patients. Hypertension and diabetes were the most prevalent conditions. The success rate of treatment was 77.5%. The detection of Mahaim potentials reveals the majority of pathways, allowing for effective ablation and the elimination of accompanying tachycardia. Another successive study indicated that a highly effective method for treating tachycardia is radiofrequency ablation [12]. In line with earlier data demonstrating that Mahaim tachycardia treatment with surgical procedure or catheter-based procedures, no individual had the substrate described by Mahaim.' Moreover, de Alencar *et al.*, reported the atrioventricular fibres may represent the foundation for Mahaim tachycardia; these auxiliary bundles showed the histological hallmarks of atrioventricular nodal tissue [13]. Lee *et al.*, reported that Mahaim tachycardia treated with effective catheter ablation by direct current of high intensity aimed at the atriofascicular pathway distal insertion [14]. Another short series reported that two patients had persistent right bundle branch block [15]. Additionally, the ablation of right bundle branch of distal can be performed without harming the atriofascicular fibre. This can cause a prolonged tachycardia cycle length and perhaps persistent tachycardia [16]. Target ablation has been identified in the majority of our patients based on Mahaim tachycardia except in direct atrioventricular connection condition. Conduction in both regular and auxiliary channels can be stopped by applying pressure to the mapping electrode of catheter. During electrophysiological research, transient right bundle branch block is fairly rare; nevertheless, traumatic block is significantly more prevalent in Mahaim pathways than in conventional accessory atrioventricular connection. Silva *et al.*, and Soares *et al.*, reported that "successful ablation of an atriofascicular fibre by radiofrequency energy application on the ventricular side of the tricuspid annulus at a place where catheter tip pressure produced serendipitous elimination of pre-excitation" [17, 18]. Moreover, it has also been proposed that catheter-induced

mechanical block is the ideal marker for guiding radiofrequency energy administration at the tricuspid annulus in Mahaim pathways [13]. Osman *et al.*, shown that high-energy shocks in the right ventricular apex at a position proximal to the fiber's implantation in the right ventricle or in the right bundle-branch may be used to ablate the right atriofascicular fibres while retaining the conduction system [19]. Nevertheless, owing of the increased duration of ventriculoatrial conduction, this might have proarrhythmic consequences, making tachycardia crises more common [20, 21].

## CONCLUSIONS

The present study found that Radiofrequency ablation is effective and safe for treating Mahaim tachycardia. Additional auxiliary pathways appear to be frequent in patients with this kind of tachycardia. The success rate of RFA was 77.5%. The detection of Mahaim potentials reveals the majority of pathways, allowing for effective ablation and the elimination of this tachycardia.

## Authors Contribution

Conceptualization: ZAK

Methodology: ZAK, AZ

Formal analysis: HU

Writing-review and editing: AZ, JI, ZAA

All authors have read and agreed to the published version of the manuscript.

## Conflicts of Interest

The authors declare no conflict of interest.

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