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Original Article

Comparison of Intra Cardiac Echo (ICE) Guided Verses Non- Intra Cardiac Echo Radiofrequency Catheter Ablation of Cavotricuspid Isthmus dependent Atrial Flutter

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ABSTRACT

The isthmus-dependent atrial flutter can be effectively treated with Radiofrequency (RF) catheter ablation. **Objectives:** To compare the ICE guided versus non-ICE radiofrequency catheter ablation of Cavo tricuspid isthmus dependent atrial flutter. **Methods:** A cross-sectional study was carried out on 40 patient's atrial flutter data in the Cardiac Electrophysiology Department, Hayatabad medical Complex Peshawar, Pakistan from August 2017 to August 2022. Patients were categorized into two groups: Group-I (ICE-guided RF catheter ablation) and Group-II (non-ICE RF catheter ablation). The standard protocol of ablation was followed using 40-50 watts power at temperature 60°C. In the case of an irrigated cooled tip catheter, the flow was limited to 30 mL/hour and the power was limited to 30 watts. **Results:** The overall mean ablation and flouro time was 9.44 ± 6.93 minutes and 20.64 ± 9.77 minutes respectively. The frequency of patients in Group-I and Group-II was 29 (72.5%) and 11 (27.5%) respectively. Out of the total patients, about 8 (20%) patients had shown failed status in terms of procedure success, out of which 5 (62.5%) were from Group-II. Compared to non-ICE guided procedure, the ICE guided procedure had lesser flouro and ablation time with higher rate of success and lower complications and recurrence. **Conclusions:** The present study observed that intracardiac echocardiography (ICE) can effectively disclose the Cavo tricuspid isthmus and guide ablation anatomy. Additionally, ICE guided radiofrequency catheter ablation had higher success rate, less flouro and ablation time, and lower complications than non-ICE guided radiofrequency catheter ablation.

INTRODUCTION

Isthmus-dependent atrial flutter (AFI) has been treated with standard protocol of Radiofrequency (RF) catheter ablation [1]. A frequent arrhythmia is atrial flutter [2]. The mechanism is known as a reentry circuit [3]. When the CTI is used in the circuit, CTI dependent flutter or usual flutter occurs [4]. Atypical flutter, also known as non-isthmus-dependent atrial flutter, occurs when the circuit rotates around scar tissue. Flutter can occur in either a clockwise or anticlockwise direction. The rate of atrial flutter in its circuit can exceed 350 beats per minute, however ventricular conduction is reduced due to the decremental features of the atrio-ventricular node (AV node) [5]. Its reentrant circuit revolves around the tricuspid valve annulus (TV), with the CTI being the primary location of sluggish conduction. The crista terminalis protects the shortcut activation towards the posterior right atrium (CT). Pharmacological therapy is rarely helpful in converting AFL and in controlling the elevated ventricular rate during continuous arrhythmia [6, 7]. Intracardiac echocardiography (ICE) is the implantation of ultrasound probe on catheter tip, which is subsequently delivered through peripheral blood arteries to the heart cavity. As a result, this approach allows for exact heart architecture imaging without the interference of air or other variables,

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resulting in optimal results [8]. ICE may quickly assess the safety and effectiveness of ablation by monitoring the creation, location, amount, and degree of ablation damage. Moreover, ICE continually monitors and evaluates the location and severity of problems [9, 10]. Furthermore, by functioning in the correct cardiac system, ICE may exhibit all cardiac edifices and precisely pinpoint the pulmonary sinus. Reduced radiation, and elimination of the general anesthesia requirement were the additional advantages of ICE [11, 12]. Atrial flutter management options are not straightforward. Overdrive pacing, antiarrhythmic medications, or electric cardioversion may be used to return the patient to sinus rhythm. Cardioversion and overdrive pacing cannot ensure sustained sinus rhythm, and recurrence is possible [13, 14]. Moreover, anticoagulation is required for certain treatments. Instead, the patient may be required to take anti-arrhythmic as well as anticoagulants for the rest of his or her life, despite the danger of antiarrhythmic and anticoagulant medication problems. Patient adherence to such complex regimens may be another issue [15]. The success rate of ablation in typical flutter is highly reasonable and cost effective, although it is acceptable in atypical flutter [16, 17]. Fluoroscopy and electrocardiographic guiding are used to perform atrial flutter ablation. Because to the complex and varied architecture of the CTI, fluoroscopy alone is insufficient to portray the endocardial surfaces and anatomic features essential for exact localization [18]. Nevertheless, using ICE during ablation boosts the success rate, minimizes recurrence, and reduces the incidence of complications by many folds [19].

METHODS

A cross-sectional study was carried out on 40 patient's arterial flutter data in the Cardiac Electrophysiology Department, Hayatabad Medical Complex Peshawar, Pakistan from August 2017 to August 2022. Patients of either gender ≥18 years were enrolled. Patients with atypical atrial flutter and scar associated flutter were excluded. Patients were categorized into two groups: Group-I (ICE-guided RF catheter ablation) and Group-II (non-ICE RF catheter ablation). The standard protocols of ablation were followed using 40-50 watts power at temperature 60°C. In the case of an irrigated cooled tip catheter, the flow was limited to 30 mL/hour and the power was limited to 30 watts. Cavotricuspid isthmus (CTI) was identified, and booster burns were performed. All patients with atrial flutter who were hemodynamically stable were electively scheduled for radiofrequency ablation. They were anticoagulated for four weeks before to the elective operation using new anticoagulants. The anticoagulant was discontinued 24 hours before the elective operation. An ECG baseline and transthoracic echocardiography were performed. Several outcomes were measured, including procedure length, fluoroscopy time, and RF time evaluation, post-procedural problems, and procedural success. SPSS version 26.0 was used for data analysis.

RESULTS

Of the total 40 arterial flutter patients, there were 28 (70%) male and 12 (30%) females. The overall mean age was 43.6±12.48 years. The overall mean ablation and flouro time was 9.44±6.93 minutes and 20.64 ± 9.77 minutes respectively. The frequency of patients in Group-I and Group-II was 29 (72.5%) and 11 (27.5%) respectively. Of the total patients, about 8 (20%) patients had shown failed status in terms of procedure success, out of which 5 (62.5%) were from Group-II. Compared to non-ICE guided procedure, the ICE guided procedure had lesser flouro and ablation time with higher rate of success and lower complications and recurrence. The demographic details and clinical characterization compared in ICE guided and non-ICE guided radiofrequency catheter ablation of CW isthmus dependent arterial flutter are shown in Table 1.

Table 1: Demographic details and clinical characterization compared in ICE guided and non-ICE guided radiofrequency catheter ablation of CW isthmus dependent arterial flutter

Parameters	Group-I (N=29)	Group-II (N=11)	p-value
Age (years)	44.6 ± 13.52	45.8±14.56	0.005
Gender N (%)			
Male	22 (75.9)	6 (54.5)	NS
Female	7 (24.1)	5 (45.5)	
BMI Kg/m2	28.6+2.9	27.4+2.6	0.07
Flouro time (minutes)	17.08±7.57	18.86±8.67	0.01
Ablation time (minutes)	9.89±7.88	10.34±8.83	0.01
Diabetes N (%)	2 (6.7)	4 (36.4)	0.72
Hypertension (%)	5 (17.2)	6 (54.5)	0.07

DISCUSSION

The present study mainly compared the ICE guided versus non-ICE radiofrequency catheter ablation of CW isthmus dependent arterial flutter and found that Cavo tricuspid isthmus can be efficiently shown and guided by intracardiac echocardiography (ICE). Furthermore, as compared to non-ICE guided radiofrequency catheter ablation, ICE guided radiofrequency catheter ablation had a greater success rate, less flouro and ablation time, and fewer complications. These findings were comparable to a previous study by Zhang *et al.*, and Benhayon *et al.*, [20, 21]. Additionally, over time, the broad muscle ridge of the Eustachian valve will prevent the tip of the ablation catheter from reaching the CTI, causing it to dangle above the CTI and fail to transmit energy to the ablation site [22]. The catheter must then be turned around on the muscle ridge to reach the CTI. This cannot be accomplished using

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fluoroscopy or a three-dimensional activation mapping method. Since appropriate block is not produced at CTI, this not only raises the incidence of complications but also the frequency of recurrence [23]. Moreover, ICE allows for no fluoroscopy throughout the procedure, which benefits both the patient and the operator by avoiding radiation-related problems such as carcinogenesis and tissue remodeling. ICE does not require General anesthetic and allows the patient to remain awake, move as needed, and be aware of potentially life-threatening events occurring throughout the procedure. Furthermore, when technical limits with the use of TEE develop, most notably the inability to swallow a probe, undergo anesthesia previously, or numerous pathological conditions that prevent esophageal access, the patient can be reliably directed to ICE [24, 25]. Using ICE for atrial flutter ablation is a highly successful way for treating AFL permanently. The procedure allows for a real-time, intra-procedure assessment of the CTI and LAA anatomical parameters, may detect the existence or development thrombi, and has a very high success rate with a low complication rate. As compared to fluoroscopic study by Ventura *et al.*, ICE avoids the use of radiation, does not need anesthesia, and reduces the total procedure duration, RFA time, and exposure [26]. ICE is critical in recognizing and monitoring procedural complications. The use of ICE to evaluate the heart in real time assists operators in determining the likely causes of difficulties and implementing remedial actions to reduce the negative repercussions [27]. The most significant consequences that arise during the ablation procedure are pericardial effusion and cardiac tamponade.

CONCLUSIONS

The present study observed that intracardiac echocardiography (ICE) can effectively disclose the Cavo tricuspid isthmus and guide ablation anatomy. Additionally, ICE guided radiofrequency catheter ablation had higher success rate, less flouro and ablation time, and lower complications than non-ICE guided radiofrequency catheter ablation.

Authors Contribution

Conceptualization: SA
Methodology: JI, AZ
Formal analysis: ZAK, ZI
Writing-review and editing: AZ, 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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