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## **Mansoura conventional electrophysiological study and ablation registry at time between March 2020 to March 2021**

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**Abstract**---Background: Catheter ablation has been described as a standard therapy for cardiac tachyarrhythmias. Although multiple registries have been reported from different geographical regions, like Europe and the USA, little is known about the criteria and outcomes of such patients in the Egyptian setting. Herein, we report the distribution of cardiac arrhythmias, success rate, and complications of catheter ablation in our tertiary care cardiac setting. Methods: This prospective cross-sectional study included 50 patients who underwent catheter ablation for cardiac tachyarrhythmias. Results: Most patients were older than 40 years (62%). Our study revealed the following types of arrhythmias; atrioventricular reciprocating tachycardia (AVRT) (30%), atrioventricular nodal reentry tachycardia (AVNRT) (48%), atrial tachycardia (4%), Wolff-Parkinson-White syndrome (12%), and atrial flutter (6%). Decremental retrograde conduction was noted in 62% of patients, while non-decremental conduction was present in 38% of them. A slow pathway was ablated in most patients (48%), while other ablated areas included the upper and lower crista terminalis (4%), posterior septum (10%), lateral annulus either right or left one (26%), anterior septum (2%), mid septum (4%), and cavotricuspid isthmus (6%). Our general success rate was 98%. AVNRT was significantly associated with older age, as 67.7% of their patients were older than 40 years. Conclusion: Catheter ablation is associated with a high success rate in patients with cardiac tachyarrhythmias and an acceptable complication rate. AVNRT is the most common arrhythmia pattern requiring catheter ablation, and it is associated with older age.

**Keywords**---catheter ablation, cardiac arrhythmias, Egypt.

## **Introduction**

Although pharmacological therapy is frequently effective in the management of cardiac arrhythmias, it has several drawbacks. It carries some risk of proarrhythmia and drug toxicity. Additionally, a high failure rate is expected [1, 2]. Non-pharmacological modalities, like catheter ablation, have gained wide acceptance among cardiologists as an effective option for life-threatening tachyarrhythmias [3-5]. Catheter ablation was introduced into clinical cardiac practice about 40 years ago [6, 7]. It aims to ablate the most accessible point that will lead to either destruction of the arrhythmogenic focus, or interruption of the re-entrant circuit [8]. The growing number of catheter ablation settings and the complexity of the ablation techniques have increased our need for independent and reliable data regarding the outcomes of that modality [9]. Multiple surveys and multi-center studies have been published from Europe, the USA, and Latin America, describing patient criteria and outcomes after catheter ablation [10-13]. Nonetheless, little has been reported from the Egyptian setting. That was a good motive for us to conduct the present study to report the distribution of cardiac arrhythmias, success rate, and complications of catheter ablation in our tertiary care cardiac setting.

## **Patients and methods**

This prospective cross-sectional study was conducted at the Mansoura University Cardiology Department after gaining scientific approval from the Institutional Review Board (IRB) of our medical school. The study was designed for all patients diagnosed with cardiac tachyarrhythmias, presented to our fluoroscopic electrophysiology (EP) laboratory during the period between March 2020 and March 2021, and needed catheter ablation for their arrhythmias. Patients who required a non-fluoroscopic EP study, and patients with either atrial fibrillation or ventricular tachycardia were excluded from our trial.

Basic patient evaluation included detailed medical history taking, clinical cardiac examination, 12-lead electrocardiography, and transthoracic echocardiography. Other investigations included ECG during tachycardia, exercise stress ECG, transesophageal echocardiography, and Holter monitoring. An invasive percutaneous EP study was done for all patients to assess the function of each component of the conducting system, identify the exact arrhythmogenic focus, and ablate the aberrant electric circuit. The recorded EP study data included baseline AH and HV, antegrade and retrograde AV nodal Wenckebach cycle length (WCL) and effective refractory period (ERP), type of retrograde conduction, accessory pathway antegrade WCL, accessory pathway antegrade and retrograde ERP, V/A relationship, VA time, type of tachycardia and the method of induction, post pacing interval tachycardia cycle length (PPI-TCL), stimulus atrial and ventricular atrial intervals (SA\VA), the use of intraprocedural medications, and the incidence of block with tachycardia. We also recorded the study time, ablation time, ablated region, temperature, number of trials, and incidence of complications.

Our main outcome was the procedural success rate (defined as complete resolution or cessation of the detected arrhythmias), while secondary outcomes included the distribution and associations of tachyarrhythmia subtypes in the

selected population. Our numerical variables were presented as means (with standard deviations) or medians (with minimum and maximum values), while categorical variables were presented as numbers and frequencies. Data tabulation and analysis were done via the SPSS software (version 26 for Windows). Comparison between more than two groups was done via the Chi-square or Fischer Exact tests. A p-value less than 0.05 was considered statistically significant.

## Results

Most patients were older than 40 years (62%), while the age of the remaining participants ranged between 15 and 40 years. Regarding their marital status, 82% of them were married. Manual and professional workers represented 18% and 34% of the study population, respectively, whereas the remaining patients were non workers. Only eight patients reported a positive family history of cardiac arrhythmias. Diabetes and hypertension were present in 26% and 36% of patients, respectively (Table 1).

Table (1): Demographic data of the study patients

Demographic data	The study group (n=50)	
	no	%
Age (years)		
15-40 y	19	38.0
>40 y	31	62.0
Residence		
Outside Dakahlia	9	18.0
Dakahlia	41	82.0
Marital status		
Married	41	82.0
Single	9	18.0
Occupation		
Non worker	24	48.0
Manual	9	18.0
Professional	17	34.0
Positive family history		
Negative	46	92.0
Positive	4	8.0
Medical history		
Diabetic	13	26.0
Hypertension	18	36.0
Other Co -morbidity	13	26.0

Baseline ECG was normal in 68% patients, while 20% of them showed sinus tachycardia. Other findings Wolff-Parkinson-White syndrome (WPW) in 12%, and sinus ischemic changes in 2%. ECG during tachycardia revealed supraventricular tachycardia in 84%. Other findings included atrial flutter in 6%, wide complex tachycardia either regular or irregular in 4%. Some patients have no documented

tachycardias. Echocardiography showed normal findings in 56% of patients, while the remaining patients had valvular heart disease. Other investigations performed included 24-hour Holter (90%), 48-hour Holter (4%), transoesophageal echocardiography (4%), and coronary angiography (2%) (Table 2).

Table (2): Investigations of the study patients

Investigations	The study group (n=50)	
	no	%
Basal ECG		
Normal	34	68.0
Sinus tachycardia	10	20.0
WPW	6	12.0
Sinus tachycardia with ischemic changes	1	2.0
ECG during tachycardia		
Supraventricular	42	84.0
Atrial. Flutter	3	6.0
Wide complex	2	4.0
Non documented tachycardia	3	6.0
Echocardiography		
Average normal	28	56.0
Mild mitral regurge with left ventricular hypertrophy	15	30.0
Mitral and aortic regurge	4	8.0
Mild tricuspid and pulmonary regurge	1	2.0
IHD, RWMA, MR	2	4.0
Other investigation		
Holter 24h	45	90.0
Holter 48h	2	4.0
TEE	2	4.0
Coronary angiography	1	2.0

Table 3 expresses the EP study findings in the study patients. The mean values of baseline AH and HV intervals were 54.97 and 38.37 msec, respectively. Decremental retrograde conduction was noted in 62% of patients, while non-decremental conduction was present in 38% of them. Dual AV nodal pathologies were detected in 26 patients (52%).

Table (3): Electrophysiological study parameters in the study patients

EPS	The study group (n=50)
Basal AH intervals (Mean $\pm$ SD)	54.97 $\pm$ 19.29
Basal HV intervals (Mean $\pm$ SD)	38.37 $\pm$ 16.17
Antegrade AV nodal WCL(ms) (Mean $\pm$ SD)	276.77 $\pm$ 39.19
Antegrade AV nodal ERP(ms) (Mean $\pm$ SD)	287.24 $\pm$ 61.17

Retrograde AV nodal WCL (ms) (Mean ± SD)	335.3± 82.37
Retrograde AV nodal-ERP (ms) (Mean ± SD)	358.09± 56.09
Retrograde conduction	
Decremental	31 (62.0%)
Non decremental	19 (38.0%)
If present, Accessory pathway antegrade WCL (ms) (n=10, 20%)	248.1± 69.98
Accessory pathway antegrade ERP (ms) (n=7, 14%)	250.0± 41.63
Accessory pathway retrograde ERP (ms) (n=6, 12%)	283.3± 90.70
Evidence of dual AV nodal pathology	26 (52.0%)
A/V relationship	
1:01	47 (94.0%)
2:01	3 (6.0%)
VA time (ms)	
Median (Min-Max)	14 (0-98)

Most patients used no medications on tachycardia induction (70%), while the remaining patients used either atropine alone (26%) or in combination with adrenaline (4%). Induction of tachycardia was done via atrial burst stimulus (24%), atrial extrastimulus (44%), ventricular extrastimulus pacing (6%), or ventricular pacing (6%). Our EP studies revealed the following types of arrhythmias; atrioventricular reciprocating tachycardia (AVRT) (30%), atrioventricular nodal reentry tachycardia (AVNRT) (48%), atrial tachycardia (AT) (4%), WPW (12%), and atrial flutter (6%) (Table 4).

Table (4): Features of accessory pathways and types of cardiac tachycardias in the study patients

	The study group (n=50)
OVP response (VAV)	47 (94.0%)
PPI- TCL Median (Min-Max)	126.5 (88- 100 000)
SA/VA (more/less 85 ms)	94.59± 6.36
Block on tachycardia	4 (8.0%)
Use of medication	
No	35 (70.0%)
Atropine 2mg amp	13 (26.0%)
Atropine 2mg amp/Adrenaline	2 (4.0%)
Types and features of detected tachycardia	
Termination of tachycardia	
✓ Atrial	38 (76.0%)
✓ Ventricular	12 (24.0%)
Induction of tachycardia	
✓ Atrial burst stimulus	12 (24.0%)
✓ Atrial extra stimulus	22 (44.0%)
✓ Stimulus / Ventricular pacing	3 (6.0%)
✓ Ventricular pacing	3 (6.0%)

Type of tachycardia	
✓ AVRT	15 (30.0%)
✓ AVNRT	24 (48.0%)
✓ Atrial Tachycardia	2 (4.0%)
✓ WPW	6 (12.0%)
✓ Atrial Flutter	3 (6.0%)

EP study time had a mean value of 65.04 minutes, while the same value was 8.97 minutes for the ablation process. A slow pathway was ablated in most patients (54%), while other ablated areas included the AV node (2%), posterior septum (10%), lateral septum (4%), anterior septum (2%), mid septum (4%), and cavotricuspid isthmus (6%). The number of trials ranged between 0 and 35 (median = 4) (Table 5). Our success rate was 98%. Complications included intraprocedural recurrence (two patients, 4%), ventricular pacing (12 patients, 24%), and Parahisian pacing (two patients, 4%) (not shown in the tables).

Table (5): Ablation properties

	The study group (n=50)
Study time (min) (Mean ± SD)	65.04± 15.32
Study Flouro time (min) (Mean ± SD)	20.82± 8.35
Ablation time (min) (Mean ± SD)	8.97± 4.85
Ablation site	
Slow pathway	24 (48.0%)
Crista terminalis either upper or lower	2 (4.0%)
Posterior septum	5 (10.0%)
Lateral annulus either right or left one	13 (26.0%)
Anterior septum	1 (2.0%)
Mid septum	2 (4.0%)
CTI	3 (6.0%)
Ablation Flouro time (min) (Mean ± SD)	4.36± 2.04
W (Mean ± SD)	36.50± 8.48
Temp (Mean ± SD)	52.60± 14.56
Number of trials Median (Min-Max)	4 (1-35)
Global success rate	49 (98%)

On analyzing the relationship between the type of cardiac tachyarrhythmias and patients' demographic parameters, AVNRT was significantly associated with older age, as 67.7% of their patients were older than 40 years. No significant difference was noted between the different six types of tachyarrhythmias in our study and the remaining demographic or clinical data (Tables 6 and 7).

Table (6): Relation between type of tachycardia and demographic data

	AVNRT (n=24)	WPW (n=6)	AVRT (n=15)	Atrial Flutter (n=3)	AT (n=2)	P value
15-40 y	3 (15.8%)	3 (15.8%)	12 (24.5%)	3 (15.8%)	0 (0%)	≤.001*
>40 y	21 (67.7%)	3 (9.7%)	3 (9.7%)	0 (0%)	2 (6.5%)	
Non worker	10 (41.7%)	5 (20.8%)	13 (26.5%)	0 (0%)	0 (0%)	0.449
Manual	4 (44.4%)	0 (0%)	1 (11.1%)	1 (11.1%)	1 (11.1%)	
Professional	10 (58.8%)	1 (5.9%)	1 (5.9%)	2 (11.8%)	1 (5.9%)	
Negative	23 (50.0%)	6 (13.0%)	5 (10.9%)	3 (6.5%)	2 (4.3%)	0.156
Positive	1 (25.0%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	

Table (7): Relation between type of tachycardia and associated comorbidities

	AVNRT (n=24)	WPW (n=6)	AVRT (n=15)	Atrial Flutter (n=3)	AT (n=2)	P value
Diabetic	6 (46.2%)	2 (15.4%)	2 (15.4%)	0 (0%)	0 (0%)	0.835
Hypertension	13 (72.2%)	2 (11.1%)	2 (11.1%)	0 (0%)	0 (0%)	0.082
Other Comorbidities	10 (76.9%)	2 (15.4%)	1 (7.7%)	0 (0%)	0 (0%)	0.13

## Discussion

Recently, the number of catheter ablation procedures has increased because of their high success rate [5, 14, 15]. Our study was performed to express the distribution of tachyarrhythmias in patients undergoing catheter ablation and to discuss procedural success and complications. Our study is the first Egyptian delta study to handle that scientific point of view, and that poses an advantage in favor of our study. In our trial, AVNRT was the most common type of tachycardia (48%). Other causes included, WPW (12%), AVRT (30%), atrial flutter (6%), and AT (4%). Likewise, Keegan and his associates reported that AVNRT was the most common type of arrhythmia managed via catheter ablation in the Argentinian centers included in the registry, while other countries showed the superiority of accessory pathways over AVNRT [10].

On the other hand, Quesada et al. reported that atrial fibrillation was the most common targeted substrate (27.8%), followed by the cavotricuspid isthmus (21.1%), while AVNRT accounted for only 11% of patients [9]. Kusano et al. reported a similar distribution (atrial fibrillation 65.6%, cavotricuspid isthmus

10.1%), and AVNRT 7.4%) [14]. The difference between studies could be explained by different sample sizes, inclusion criteria, and epidemiology of tachyarrhythmias in each geographical region.

Resolution of the preexisting tachycardia occurred in 49 patients, making our success rate 98%. In the previously published Latin American registry, the overall success rate was 92% (range, 84% - 100%) [10]. Additionally, Quesada et al. reported a 91% success rate in their Spanish registry [9]. Kusano et al. reported overt 90% success rates for all target arrhythmias in their Japanese registry [14]. These high success rates could be attributed to the growing experience and recent advancements in ablation equipment and techniques [16-18]. Nonetheless, other studies reported that the success rate could drop below 90% in patients with ventricular arrhythmias, especially when there is concomitant ischemic heart disease [19, 20].

In our study, intraoperative recurrence occurred in 4% of patients, while ventricular and Parahisian pacing occurred in 24% and 4% of patients, respectively. Keegan et al. reported that the incidence of complications after catheter ablation ranges between 0% and 13% [10]. A previous American report highlighted that the overall complication rate was 5.46% [21]. Kusano et al. reported that complications were encountered in 2.8% of patients (major bleeding 1.1%, embolism 0.2%, and death 0.1%) [14]. Another study reported a low complication rate (0.7%), and these complications included 12 AV blocks, 11 vascular complications, 1 embolism, and 1 heart failure [9]. In the current study, there was a significant association between older age and AVNRT ( $p < 0.001$ ). Other previous studies confirmed that association [22, 23]. Our study has some limitations, manifested in the small sample size which may be attributed to Covid 19 pandemic which limited medical services all over the world and collected from one single center. A larger-scale Egyptian registry covering the whole Egyptian governorates should be done.

## **Conclusion**

Based on the preceding findings, catheter ablation is associated with a high success rate in patients with cardiac tachyarrhythmias and an acceptable complication rate. AVNRT is the most common arrhythmia pattern requiring catheter ablation, and it is associated with older age.

**Conflicts of interest:** Nil.

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