

Atrioventricular Nodal Reentrant Tachycardia and Orthodromic Reentrant Tachycardia in Patients of Narrow Complex Tachycardia During Electrophysiological Study

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ABSTRACT

Tachyarrhythmias are dangerous heart rhythms that can disturb the hemodynamics of the patient leading to cardiac arrest and death. Knowing the exact burden of AVRT and AVNRT in our population can help in early diagnosis and management with radiofrequency ablation. Aim of this study was to determine the frequency of AVNRT and AVRT in relation with concealed and manifested types of accessory pathways, in patients with previous history of Narrow Complex Tachycardia (NCT).

Methods: In this retrospective study, 160 patients were enrolled from Punjab Institute of Cardiology, Lahore, Electrophysiology Department. All patients who had experienced two or more episodes of narrow complex tachycardia (NCT) were included. Main outcome variable was primary etiology of NCT as seen on EP study. Age, gender, co-morbid conditions like diabetes and hypertension were documented for each patient.

Results: Mean age of the patients was 38.25 SD 13.6 years, 60% were females and only 8 patients had diabetes (5%) all were above 50 years of age, 24 patients had hypertension (15%) with majority of cases of age 31-50 years. On electrophysiological (EP) study, patients of NCT were later diagnosed to be AVNRT in 60% (n: 96) cases and ORT in 40% cases (n: 64), (24 of 64 cases of manifested type and 40 of 64 cases of concealed type). Among the factors like diabetes, hypertension, old age, old age with hypertension and old age with diabetes, old age alone was a significant risk factor, $p=0.03$.

Conclusion: Narrow complex tachycardia (NCT) patients should be follow-up for EP study to determine the cause and manage using catheter ablation. The percentages and statistics concluded in our study are more or less in coherence with international studies. We have not been able to identify any significant differences which could initiate the basis and lead us to another study.

Keywords: AVNRT, ORT, SVT, Re-entry tachycardia, Arrhythmia, Electrophysiology, EP

INTRODUCTION

Tachyarrhythmias are abnormal heart rhythms with heart rates over 100 beats per minutes. These may be dangerous rhythms that disturb the hemodynamics of the patient leading to cardiac arrest and death, and should be treated immediately and definitively to prevent recurrence. Long term dreadful consequences like LV dysfunction and heart failure with serious effects on the patient's life style and increasing the morbidity and mortality of life are also seen.¹

There are a wide range of tachyarrhythmias including regular narrow complex tachycardia which comprises of sinus tachycardia, atrial tachycardia, atrial flutter (with regular AV block), AVNRT, AVRT (ORT), junctional tachycardia²

In the normal cardiac conduction system an electrical impulse is usually generated in the sinus node that passes through the atrial myocytes to the AV node. In the AV node the impulse passes down the Fast pathway other than the slow pathway to the His Purkinji system and then to the ventricles called the SAN-AVN-HPS (SA node - AV node - His Purkinji System)³

In Atrioventricular nodal reentrant tachycardia (AVNRT), a re-entrant tachycardia is induced by a premature atrial beat or ventricular beats and then uses both the slow and fast pathways in the AV node in maintaining the tachyarrhythmia and causing a regular narrow complex tachycardia (AVNRT)⁴

Patients with AVRT have accessory pathways (AP) which is an additional pathway connecting the atria and ventricles. There are two types of AP one which is manifested on surface ECG and the other is concealed AP. AP can conduct antegradely and retrogradely creating a reentrant circuit and causing narrow complex tachycardia.^{5,6}

ORT is a type of AVRT in which the AV conduction system conducts the antegrade portion and the accessory pathway conducts the retrograde portion (ORT)⁷ WPW patients are more

prone to have re-entry tachycardia. In 35% of AF patients, a premature atrial beat during atrial refractoriness triggers AVRT⁸

Knowing the exact burden of AVRT and AVNRT in our population can help in early diagnosis and management with radiofrequency ablation, which remains the mainstay treatment of AVRT and AVNRT and have a 95 % success rate and a very good prognosis and a low complication rate. The aim of this study was to determine the frequency of AVNRT and AVRT in relation with concealed and manifested types of accessory pathways, in patients with previous history of Narrow Complex Tachycardia (NCT).

MATERIAL AND METHODS

This retrospective study was conducted at Punjab Institute of Cardiology, Lahore, in the Electrophysiology Department. Patients included in the study were both male and female genders between the ages 18-65 years and had experienced at least two or more episodes of narrow complex tachycardia (NCT) and diagnosed on a 12 lead ECG or on 24 hours Holter monitoring. These patients electively presented for electrophysiological (EP) study and Radiofrequency ablation (RF) management in PIC outdoor.

A written informed consent was taken regarding use of data for study. All the data (as per designed performa) was noted in context with the operational definitions. The objective of the study was to determine the frequency of patients diagnosed with AVNRT and ORT in relation with concealed and manifested types of accessory pathway who presented with Narrow complex tachycardia in electrophysiology lab in a Pakistani population.

Any patient with evidence of Ischemic heart disease based on history, exercise tolerance test (ETT), Stress thallium, CT angiography or invasive coronary angiography; patients with Hyperthyroidism or hypothyroidism; patients taking tachy-arrhythmic drugs or having valvular heart disease were excluded from the study.

We enrolled all those patients who had a history of NCT identified on surface ECG or 24-48 hours Holter monitoring. The specific criteria used for NCT on surface ECG was any patient with a regular rhythm with a heart rate between 140 and 250 beats/min, QRS complex duration shorter than 120 ms (i.e 3 small squares on surface ECG) and 1:1 conduction of P:QRS complex, P wave may not be visible but when visible they are inverted in the inferior lead and seen just after the QRS complex.

Among these patients of NCT, any patient with evidence of an Accessory pathway when in sinus rhythm that is having a short PR (P-delta) interval (less than 120 milliseconds), slurred upstroke of the QRS (delta wave) and wide QRS (>120 milliseconds) on surface ECG were labeled as having manifested accessory pathway (AP).

All these patients with NCT undergone electro-physiology study in the cath-lab of PIC, Lahore. By using the various standard electrophysiological maneuvers during the EP study we determined the exact mechanism of each NCT arrhythmia and made definitive diagnosis of all the AVNRT, AVRT/ORT (manifested AP or concealed AP) and other causes. These patients were treated with specific radiofrequency ablation.

Primary variable was primary etiology of NCT patients presenting in the PIC. On EP study all the NCT enrolled were definitively diagnoses as either AVNRT or ORT (manifested AP or concealed AP). Age, gender, co-morbid conditions like diabetes and hypertension, features of NCT (heart rate, presence of P wave, duration of QRS complex) and features of AP in sinus rhythm (including presence of delta wave, length of PR interval and of QRS interval were documented for each patient. NCT can be either due to AVNRT, ORT or few others causes like atrial tachycardia, atrial flutter, and fascicular ventricular tachycardia. We only documented NCT patients with ORT or AVNRT.

The data was analyzed using SPSS version 20. Frequency and percentage was calculated for qualitative variables like gender, co-morbidities, presence of P-wave, delta wave and cause of NCT. For the quantitative variables like age, PR interval, duration of QRS complex, mean ±SD will be calculated. Effect modifiers will be controlled by stratification to find out the effect of these on the outcome, through chi square (p<0.05 will, be considered significant).

RESULTS

In this retrospective study, mean age of the patients was 38.25 SD 13.6 years. Of 160 patients with NCT, 60% (n: 96) were females while 40 % (n: 64) were males, with a ratio of 3:2. Among the 160 patients, 8 patients had diabetes (5%) all were above 50 years of age, 24 patients had hypertension (15%) with majority of case of age 31-50 years.

Among all these patients of narrow complex tachycardia – NCT, mean heart rate of the patients was 180.5 SD 25.8 beats per min, p- wave was present in 136 of 160 patients (85%) and mean QRS complex duration was 115.2 SD 4.62 ms.

On electrophysiological (EP) study, patients of NCT were later diagnosed to be AVNRT in 60% (n: 96) cases and ORT in 40% cases (n: 64), (24 of 64 cases of manifested type and 40 of 64 cases of concealed type). Among the 96 patients of AVNRT, 40 (42%) were male and 56 (58%) were female. Similarly, among the 64 patients of ORT, 40 (63%) were female and 24 (38%) were male. Details of the frequency of patients with respect to various age groups and gender are shown in the table no. 1.

Table 1: showing the details of the age and gender of the patients with narrow complex tachycardia (n=160)

Variables		AVNRT (n=96)	ORT(n=64)	P value
Gender	Male	40	24	0.59
	Female	56	40	
Age Groups	<30	24	24	0.19
	31-50	48	24	
	>50	24	16	

Of 64 male cases 40 were AVNRT and 24 were ORT whereas of 96 cases females 56 had AVNRT and 40 were found with ORT, p value 0.59, regarding age group of <30 years, regarding age group, of 48 cases of <30 years 24 were male and 24 were females, of 72 cases in 31-50 years of age range 48 were male and 24 were females, those 40 cases with >50 years 24 were and 16 were females. (as shown in the table no. 1)

In Table 2, we calculated factors like diabetes, hypertension, old age, old age with hypertension and old age with diabetes, it shows 8/96 AVNRT and 1/64 of ORT were diabetics, p=0.07, hypertension was recorded as 16/96 in AVNRT and 8/64 had ORT, p=0.47, old age were 24/96 and AVNRT and 16/64 had ORT, p=0.03 showing significant difference, old age with hypertension shows 8/96 cases had AVNRT and 1/64 had ORT, p value was 0.06, old age with diabetes had 8/96 AVNRT and 1/64 had ORT, p=0.06.

Table 2: showing various factor in relation the frequency of AVNRT and ORT

Factors	AVNRT (n=96)	ORT (n=64)	P value
Diabetes	8	1	0.07
Hypertension	16	8	0.47
Old age	24	16	0.03
Old age with Hypertension	8	1	0.06
Old age with diabetes	8	1	0.06

DISCUSSION

Rapid heartbeat that originate and persist above the bundle of His are known as supraventricular tachycardia. AVNRT, AVRT, and AT are all forms of atrial tachycardia generated by reentry events or automaticity in the atrioventricular node or above. AVNRT, AVRT, and AT are the most common forms. People with tachyarrhythmias typically have perfectly healthy hearts. An increase in heart rate may cause symptoms such as dizziness, lightheadedness, anxiety, dyspnea, or exhaustion⁹

The overall frequency of SVT in the general population is two or three per 1,000 people. The average age of incidence is 45 years, and women account for 62% of all instances¹⁰ The most prevalent kind of SVT in adults is AVNRT. SVT affects one in every 250 to 1,000 babies and children, with AVRT accounting for the majority of occurrences¹¹

Women are twice as likely as males to suffer from AVNRT. It is associated with lower oestrogen levels and greater progesterone levels, and hence occurs more frequently during the luteal phase of the menstrual cycle and less frequently during pregnancy¹² AVNRT is a reentry tachycardia with two paths in the atrioventricular (AV) node, one slow and the other fast. These routes allow an impulse to form a self-propagating, continuous circuit. P waves are generally concealed in the QRS complex or apparent early after the QRS complex on electrocardiography (ECG). The second most prevalent kind of SVT is AVRT. The proportion of SVT caused by AVRT decreases with age, from 60% in the first decade to 9% beyond 70 years of age^{13,14}

Among all these patients of narrow complex tachycardia – NCT, P- wave was present in 136 of 160 patients (85%) and all the patients of NCT were later diagnosed to be AVNRT in 60% cases and ORT in 40% cases. Among AVNRT cases, 42% were male and 58% were female. Similarly among ORT cases, 63% were female and 38% male. 13.4 % cases with NCT had a history of atrial fibrillation. None of our patients had clinically significant heart failure or coronary artery disease, and 20.7% had hypertension. On electrophysiological (EP) study, patients of NCT were later diagnosed to be AVNRT in 60% (n: 96) cases and ORT in 40% cases (n: 64).

In a similar study on patients of NCT, mean age of the patients was 43.9±14 years, female gender were 60%, with AVNRT among 45 of 82 cases (55 %) and AVRT 37 of 82 cases (45 %)¹⁵ In one study a total of 456 patients who met the inclusion criteria as our study, after EP study it was shown that 303 (66.5 percent) had AVNRT and 162 (35.5 percent) had AVNRT (ORT)¹⁶

In another study, 73 cases of SVT were enrolled and 29 (39.7%) were diagnosed to be AVRT while the remaining 44 (60.3%) had AVNRT¹⁷ AVNRT 14.9%, AVRT 5.4%, atrial tachycardia 38.8% and atrial fibrillation 40.8% cases were seen among the total 456 cases of supra-ventricular tachycardia¹⁸

Another extensive investigation found that the average age was 45 +/- 19 years old, with a male to female ratio of 2:3. AVNRT was the most common (56%) followed by AVRT (27%) and AT (17%). AVRT declined with age in both sexes, although AVNRT and AT increased. The majority of AVRT patients (273/500 [54.6 percent]) were men, whereas the majority of AVNRT and AT patients (727/1,042 [70 percent] and 195/315 [62 percent], respectively) were women. In women, AVNRT was used by 63%, AVRT was used by 20%, and AT was used by 17.0%. Men had 45 percent AVNRT, 39 percent AVRT, and 17 percent AT.[8]

Men made up 1,299 (90.4 percent) of the 1,437 patients in a retrospective study on SVTs. The average age in the group was 26.7 years old. In 55 (3.8 percent) of the patients, relapse bouts occurred on many occasions. EPS is a helpful tool for identifying and controlling arrhythmias such as AVRT in high-risk patient populations for the purposes of risk classification and medical treatment¹⁹

Supraventricular tachycardia is a kind of rhythm disorder that affects one in every 300 to 1200 children in Australia each year. The distinction between supraventricular tachycardia (SVT) symptoms and age of onset by subtype is not well understood. The majority of research relay primarily on ECG criteria to characterize the SVT subtype, which is not applicable to all subtypes. On 364 people who underwent an EP study, a retrospective study and a prospective survey were done. The SVT subtype of each patient was used to categories them. A total of 233 young individuals with SVT (131 men and 102 women) were recruited in the study. AVRT (n = 153, 65.6 percent) was the most common SVT subtype, followed by Atrioventricular Nodal Reentrant Tachycardia (AVNRT) (n = 55, 23.6 percent), Atrial Tachycardia (AT) (n = 17, 7.3 percent), and other SVT subtypes (n = 8, 3.4 percent), which included Atrial Fibrillation, Atrial Flutter, and Junctional Tachycardia. With the exception of AVNRT, all subtypes exhibited a male predominance. The mean age of symptom onset varied across groups, with AVRT being younger and AVNRT being older, with a significant difference between AVRT with unidirectional retrograde accessory pathway (URAP) and AVNRT subtypes (P 0.01)²⁰

After electrophysiological study (EPS), Catheter ablation is the gold standard for treating these individuals with atrioventricular reentrant tachycardia (AVRT), with excellent long-term outcomes and a low risk of complications.

CONCLUSION

Narrow complex tachycardia (NCT) patients should be follow-up for EP study to determine the cause and manage using catheter ablation. The percentages and statistics concluded in our study are more or less in coherence with international studies. We have not been able to identify any significant differences which could initiate the basis and lead us to another study.

Limitations of the Study: This study cannot be extrapolated to the full population of people as we were only able to include individuals who had SVT symptoms that necessitated an invasive treatment and patient underwent an EP procedure. While this may appear to be a restriction, it is also strength of our study because all of the individuals included had a confirmed diagnosis of SVT and hence their symptoms are subtype specific. Other limitations were the ethnicity of nearly 25% of the patients included in this study was unknown because it was not noted in the medical record. Although no significant link was identified between ethnicity and SVT subtype, there may have been if complete data had been provided for study.

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