

Results of risk stratification and accessory pathway ablation in patients with asymptomatic Wolf-Parkinson-White pattern at 108 Military Central Hospital

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Summary

Objective: To evaluate the electrophysiological characteristics, risk stratification and ablation outcomes in patients with asymptomatic Wolf-Parkinson-White pattern at 108 Military Central Hospital. **Subject and method:** A retrospective observational study on 45 asymptomatic Wolf-Parkinson-White patients underwent electrophysiology study and ablation by radiofrequency energy at Department of Cardiology, 108 Military Central Hospital, from December 2018 to December 2021. All patients were evaluated by electrophysiology study to stratify the risks. Indications of ablation was according to European Society of Cardiology guideline. **Result:** The average age of patients was 34.8 ± 15.1 years old. Majority of patients were men with the rate of 82.2%. The proportion of patients at high clinical risk was 31.1%. In electrophysiology study, the mean accessory pathway effective refractory period (APERP) was 215.5 ± 60.1 (in which 73.3% patients had $APERP \leq 240$ ms). Among patients with having spontaneous/induced atrial fibrillation (22.2%), the mean shortest pre-excited R-R interval in atrial fibrillation (SPERRI) was 232 ± 81.2 ms (80% of patients had $SPERRI \leq 250$ ms). The rate of patients with inducible atrioventricular reentrant tachycardia was 22.2%. There were 43 patients (95.55%) having indication for ablation (4.44% due to high-risk occupation and 91.11% due to high risk by electrophysiological study). The locations of accessory pathways included: 53.4% from left side (the most common region was anterior wall of mitral valve with 18.6%) and 46.6% from right side (14% from posterolateral wall of tricuspid valve). The mean number of attempt ablations before success was 3.1 times. The rate of successful ablation was 97.6%. There were no complications in our study sample. **Conclusion:** Among 45 patients with asymptomatic Wolf-Parkinson-White pattern, there were 95.55% patients having indication for ablation (4.44% due to high-risk occupation and 91.11% due to high risk by electrophysiological study). The locations of accessory pathways included: 53.4% from left side (18.6% from anterior wall of mitral valve) and 46.6% from right side (14% from posterolateral wall of tricuspid valve). The rate of successful ablation was 97.6%.

Keywords: Asymptomatic Wolf-Parkinson-White pattern, electrophysiology study.

1. Background

Wolf-Parkinson-White syndrome (WPW syndrome) is a syndrome caused by the existence of an accessory pathway (bundle of Kent), which

conducts impulses directly from the atria to the ventricles (without passing the atrioventricular node), can lead to arrhythmias, causing symptoms, even be life-threatening. The prevalence of Wolf-Parkinson-White syndrome in the general population is 1-3 persons per 1000 population [1]. The rate of sudden death due to WPW syndrome ranges from 0-0.6%/year, of which the symptomatic group (0.25%/year) is higher than the asymptomatic group (0.1%/year) [2]. In particular, among Wolf-

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Parkinson-White patients, up to 53% of patients are asymptomatic, only initially detected by dangerous arrhythmias and sudden cardiac death [2]. Therefore, early detection and risk stratification of patients with Wolf-Parkinson-White pattern is crucial, thereby prompt ablation helps to prevent dangerous arrhythmias that may occur. In Vietnam, at present, the number of centers that can conduct electrophysiological study and ablation of accessory pathways is still limited. Results of electrophysiological study, risk stratification and ablation have not been reported. Therefore, we conducted this study with the objective: *To evaluate the electrophysiological characteristics, risk stratification and ablation outcomes in patients with asymptomatic Wolf-Parkinson-White pattern at 108 Military Central Hospital.*

2. Subject and method

2.1. Subject

Including 45 asymptomatic Wolf-Parkinson-White patients underwent electrophysiology study and ablation by radiofrequency energy at Department of Cardiology, 108 Military Central Hospital, from December 2018 to December 2021.

Inclusion criteria:

Wolf-Parkinson-White pattern on electrocardiogram according to criteria: PR interval < 120ms, delta wave, wide QRS duration > 120ms.

Asymptomatic patients: No palpitations, no history of tachycardia.

Indication for ablation according to guideline of American College of Cardiology/American Heart Association in 2015 [1]: High-risk occupations (drivers, pilots, athletes, etc.) or electrophysiological study indicating high risk by having one of following characteristics:

Spontaneous/induced atrial fibrillation with shortest pre-excited R-R interval (SPERRI) $\leq$ 250ms.

Multiple accessory pathways:

Inducible sustained atrioventricular reentrant tachycardia.

Accessory pathway effective refractory period (APERP): $\leq$ 240ms.

Exclusion criteria:

Patients younger than 18 years old or older than 85 years old.

Patients with pregnancy.

Patients did not agree to intervention.

2.2. Method

2.2.1. Study design

A retrospective observational study.

2.2.2. Steps to conduct research

All patients' medical record were as follow as the study form. Patients were asked about medical history, had clinical and laboratory examination to select Wolf-Parkinson-White patients with indications for electrophysiological testing, then these patients were risk stratified and ablated accessory pathway if having indication. Clinical and echocardiographic parameters, results of electrophysiology study and ablation of were collected and analyzed.

Medical history and physical examination

Age, gender.

Medical history, comorbidities, occupation

Symptoms of tachycardia: palpitations, chest pain, shortness of breath, dizziness, fainting...

Subclinical

Basic blood panel: Full blood count, basic biochemistry test.

12-lead electrocardiogram.

Echocardiography: Assessment of left ventricular diameter and function, ejection fraction, left atrial size, mitral regurgitation, pulmonary artery pressure.

2.2.3. Electrophysiology study and accessory pathway ablation

Equipment and instruments: Phillip's angiogram system, Bard's electrophysiological study system (United States). Cardiac stimulator with Micro-Pace program (United States). Aktar II Radio frequency energy generator manufactured by Medtronic (United States).

Prepare the patient before the procedure: Electrocardiogram to evaluate the pre-excitation pattern (Wolf-Parkinson-White), echocardiography to evaluate structural heart diseases.

Electrophysiological exploration and ablation.

Introducer: Femoral vein and femoral artery (in case of left-sided accessory pathway around the mitral annulus).

Place diagnostic catheter into right ventricular apex, coronary sinus, His, high right atrium.

Programmed atrial and ventricular stimulation to evaluate the refractory time of the accessory pathway, the earliest signal location on the coronary sinus catheter (orientation to the accessory pathway), induce tachycardia, atrial fibrillation, stratify patient's risk based on criteria.

Ablation for high-risk accessory pathway or high-risk occupations.

Electrophysiological study after ablation.

Monitoring of complications: Local (vascular wall tear, venous thrombosis, aortic dissection, arteriovenous shunt), systemic (pericardial hemoperitoneum, atrioventricular block, valvular regurgitation).

2.3. Data analysis

The data were analysed by SPSS 20.0 software to calculate the average parameters. The "t" test was used to test the difference between two mean values. The p-value < 0.05 was considered to be statistically significant.

2.4. Research ethics

All patients were explained and voluntarily participated in the study. All content and research procedures were approved by the Ethics Committee of 108 Military Central Hospital.

3. Result

3.1. Clinical and subclinical characteristics

Table 1. Patients' age and gender characteristics

Characteristics		Value	
Age (mean $\pm$ SD, years old)		34.8 $\pm$ 15.1	Max 73
			Min 18
Gender	Male	37/45 (82.2%)	
	Female	8/45 (17.8%)	

In our study, the average age of patients was 34.8 $\pm$ 15.1 years old, of which the highest was 73 years old, the lowest was 18 years old. Majority of patients were men with the rate of 82.2%.

Table 2. Clinical risk stratification

Characteristics	Number (ratio)
Age < 20 years old	8/45 (17.7%)
History of atrial fibrillation/ congenital heart disease	3/45 (6.6%)
High-risk occupation	2/45 (4.4%)
Family history of pre-excitation	1/45 (2.2%)
High clinical risk	14/45 (31.1%)

In study population, the proportion of patients at high clinical risk was 31.1%, in which age < 20 years old (17.7%), history of atrial fibrillation/congenital heart diseases (6.6%) including 2 patients with paroxysmal atrial fibrillation and 1 patient with patent foramen ovale, high-risk occupation (4.4%) and family history of pre-excitation (2.2%).

Table 3. Electrocardiogram characteristics

Characteristics		Mean $\pm$ SD or n (%)
PR interval (millisecond-ms)		81 $\pm$ 1.9
QRS duration (millisecond-ms)		14.5 $\pm$ 2.6
Delta wave in V1	Positive (Type A)	21/45 (46.6%)
	Negative (Type B)	24/45 (53.4%)

About electrocardiogram results, the average of PR interval was 8.1 $\pm$ 1.9 millisecond and the average of QRS duration was 14.5 $\pm$ 2.6 millisecond. The proportion of type A Wolf-Parkinson-White pattern was 46.6% while type B pattern accounted for 53.4%.

3.2. Results of electrophysiology study

Table 4. Results of electrophysiology study and risk stratification

Parameters	Mean $\pm$ SD or ratio	Cut-off	n (%)
APERP (ms)	215.5 $\pm$ 60.1	$\leq$ 240ms	33/45 (73.3)
		> 240ms	12/45 (26.6)
Spontaneous/ induced atrial fibrillation	10/45 (22.2%)		
SPERRI (ms)	232 $\pm$ 81.2	$\leq$ 250ms	8/10 (80%)
		>250ms	2/10 (20%)
AVRT	10/45 (22.2%)		
Multiple accessory pathways	0/45 (0%)		
Total high-risk	41/45 (91.11%)		

APERP: Accessory pathway effective refractory period.

SPERRI: Shortest pre-excited R-R interval in atrial fibrillation.

AVRT: Atrioventricular reentrant tachycardia.

In electrophysiology study, the mean accessory pathway effective refractory period (APERP) was 215.5 $\pm$ 60.1 (in which 73.3% patients had APERP $\leq$ 240ms). There were 22.2% of patients having spontaneous/ induced atrial fibrillation during electrophysiological study. Among these patients, the mean shortest pre-excited R-R interval in atrial fibrillation (SPERRI) was 232 $\pm$ 81.2ms (80% of patients had SPERRI $\leq$ 250ms). The rate of patients with inducible atrioventricular reentrant tachycardia was 22.2%. Meanwhile, there was no patients having multiple accessory pathways. Finally, the total proportion of patients at high risk on electrophysiological study was 91.11%.

3.3. Results of accessory pathway ablation

Table 5. Results of accessory pathway ablation

Characteristics		n (%)	
Indication for ablation		43/45 (95.55%)	High risk occupation 2/45 (4.44%)
			High risk by electrophysiological study 41/45 (91.11%)
Location of accessory pathway		Right-sided	Left-sided
	Anterior	0	8/43 (18.6%)
	Anterolateral	1/43 (2.3%)	6/43 (15%)
	Lateral	3/43 (7.0%)	2/43 (4.6%)
	Posterolateral	6/43 (14.0%)	2/43 (4.6%)
	Posterior	5/43 (11.6%)	3/43 (7.0%)
	Posteroseptal	3/43 (7.0%)	2/43 (4.6%)
	Anteroseptal	2/43 (4.6%)	0
	Sumary	20/43 (46.6%)	23/43 (53.4%)
Times of ablation		3.1 ± 2.3	
Power of ablation (Walt)		29.5 ± 3.4	
Temperature of ablation (°C)		50.7 ± 3.2	
Successful ablation		42/43 (97.6%)	
Complications		0/43 (0%)	

Among 45 patients with asymptomatic WPW pattern, there was 43 patients (95.55%) having indication for ablation (4.44% due to high-risk occupation and 91.11% due to high risk by electrophysiological study). The proportion of patients with left-sided accessory pathway was 53.4% (the most common region was anterior wall of mitral valve). Meanwhile, the rate of right-sided accessory pathway was 46.6% (14% from posterolateral wall of tricuspid valve). The mean number of attempt ablations before success was 3.1 times with average power and temperature of ablation were 29.5 ± 3.4 (walt) and 50.7 ± 3.2 (°C), respectively. The rate of successful ablation was 97.6%. There were no complications in our study sample.

4. Discussion

In our study, the average age of patients was 34.8 ± 15.1 years old and majority of patients were men with the rate of 82.2%. In the large prospective observational study by Pappone et al (2014) in

2169 patients with WPW pattern (756 asymptomatic), the mean age was 19 years old and male gender accounted for 63% in asymptomatic patients [3]. Comparing to Pappone's study, both mean age and the proportion of male in our study population were higher. It might be due to the difference in sample size and location of sampling. In a prospective study in general population by Goudevnos et al, the mean age in the asymptomatic WPW group was remarkably older than the symptomatic group. Added to this, in patients with asymptomatic WPW, male gender was associated with a higher risk of arrhythmias than female gender. In a study by Timmermans et al., authors found that male gender was associated with a significantly higher rate of events than female gender (13 out of 15 events, $p=0.04$) [4]. Montoya et al also observed that male gender was markedly more prevalent in patients with ventricular fibrillation than the control group (87% versus 67%, $p<0.05$) [5]. Moreover, in a meta-analysis, Obeyesekere et al. found that risk of sudden cardiac

death in female patients was significantly lower than in male patients [6].

About clinical risk stratification, the proportion of patients at high clinical risk was 31.1%, in which age < 20 years old (17.7%), history of atrial fibrillation/ congenital heart diseases (6.6%) including 2 patients with paroxysmal atrial fibrillation and 1 patient with patent foramen ovale, high-risk occupation (4.4%) and family history of pre-excitation (2.2%). In subclinical parameter, the average of PR interval was 8.1 ± 1.9 millisecond and the average of QRS duration was 14.5 ± 2.6 millisecond. The proportion of type A Wolf-Parkinson-White pattern was 46.6% while type B pattern accounted for 53.4%. Compared to results of ablation, 53.4% accessory from left side (type A) and 46.6% from right side (type B). Therefore, the accuracy of determining sides of accessory pathways on electrocardiogram was 100%.

The mean accessory pathway effective refractory period (APERP) was 215.5 ± 60.1 (in which 73.3% patients had $APERP \leq 240$ ms). There were ten patients (22.2%) having spontaneous/ induced atrial fibrillation. The mean shortest pre-excited R-R interval in atrial fibrillation (SPERRI) was 232 ± 81.2 ms (80% of patients had $SPERRI \leq 250$ ms). The rate of patients with inducible atrioventricular reentrant tachycardia was 22.2%. Roberto et al. (2015) studied on 56 patients with asymptomatic ventricular pre-excitation persistent at exercise stress test and showed that 25/56 (45%) patients had $APERP \geq 250$ ms while 31/56 (55%) patients met at least one criterion for ablation: 27/31 (87%) had at least fast antegrade conduction over the accessory pathway and 19/31 (61%) had at least inducible AVRT [7]. Moreover, in this study, 25/56 patients had inducible atrial fibrillation. The difference in the results of our study with Roberto's study might be due to different selected population: Roberto chose only patients had accessory pathway persistent after stress test while we chose all patients with accessory pathway.

Among our study population, the rate of patients having indication for ablation was 95.55%. The locations of accessory pathways included: 53.4% from left side (the most common region was

anterior wall of mitral valve with 18.6%) and 46.6% from right side (14% from posterolateral wall of tricuspid valve). The mean number of attempt ablations before success was 3.1 times. The rate of successful ablation was 97.6%. There were no complications in our study sample. In study by Roberto et al (2015) studied on 56 patients with asymptomatic ventricular pre-excitation persistent at exercise stress test, 58 accessory pathways located as follows: Posteroseptal in 20 cases, septal (mid-septal or antero-septal) in 16, left free wall in 14, and right free wall in 8. In overall, the acute success rates for radiofrequency ablation in adults and children by other studies are quoted to be 93-96% [8]. The reason of no complications in our study sample might be due to limitation in size of study sample.

5. Conclusion

In this subset of patients with asymptomatic Wolf-Parkinson-White pattern, there were 95.55% patients having indication for ablation (4.44% due to high-risk occupation and 91.11% due to high risk by electrophysiological study). The locations of accessory pathways included: 53.4% from left side (18.6% from anterior wall of mitral valve) and 46.6% from right side (14% from posterolateral wall of tricuspid valve). The mean number of attempt ablations before success was 3.1 times. The rate of successful ablation was 97.6%. There were no complications in our study sample.

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