

A Comparison Study between the Trans-Septal and the Trans-Aortic Approaches in Left Sided Accessory Pathway Ablation in Ibn Albitar Cardiac Center

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ABSTRACT:

BACKGROUND:

Catheter ablation is the most effective treatment for patients with accessory pathway-related arrhythmias. There have been no clear recommendations on the optimal approach for left-sided accessory pathway ablation.

OBJECTIVE:

To compare the efficacy and safety of the trans-septal approach versus the retrograde trans-aortic approach for left sided accessory pathway ablation.

PATIENTS AND METHODS:

All patients with left-sided, accessory pathway who underwent electrophysiological procedure and radiofrequency ablations in Ibn Albitar Cardiac center from January 2017 till February 2019 were included (79 patients). The procedures (87 procedures) were divided according to the approach used into the trans-septal and trans-aortic groups, and different parameters were measured and compared between the groups.

RESULTS:

The mean age was 36.28 ± 13.5 (range 8-67) years, male gender was slightly more predominant (58.2%). The trans-aortic approach was pursued in 36 procedures (41.4%), while the trans-septal approach was used in 51 procedures (58.6%).

The success rate was significantly better with the trans-septal approach (96.1%) than with the trans-aortic one (66.7%) $p=0.0002$, other parameters that showed significant differences including the procedure time and fluoroscopic time in favor of the trans-septal approach. While the number of ablations, the presence of accessory pathway potential, and the time needed for successful ablation at the target sites showed no significant difference between the two approaches. Complications were generally low and were recorded in 3 patients (3.4%) ; 2 pericardial effusion and one deep vein thrombosis.

CONCLUSION:

There was a higher success rate with the left-sided, accessory pathway ablation then with the trans-septal approach as compared to the traditional retrograde trans-aortic approach with similar safety profile.

KEYWORDS: Radiofrequency (RF) Ablation, Accessory pathway ablation, Trans-septal approach, Trans-aortic approach, Electrophysiology (EP) Study.

INTRODUCTION:

Cardiac Accessory Pathways are generally divided into manifested Wolf Parkinson White (WPW) syndrome, with ventricular preexcitation by surface ECG, or concealed; presenting as SVT with no preexcitation in sinus rhythm.

Less than 1% of patients with cardiac pre-excitation may present a significant risk of sudden cardiac death, due to very high

conduction properties of the atrioventricular accessory pathway (AP) ¹.

Treatment is warranted to prevent this risk of sudden death in high-risk asymptomatic patients, or to prevent re-entrant tachycardias in symptomatic patients.

Transcatheter ablation of the AP is the most effective treatment for patients affected by Wolff-Parkinson-White syndrome and for high-risk asymptomatic pre-excitation.

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TRANS-SEPTAL TRANS-AORTIC ABLATION

The most recent guidelines recommend transcatheter ablation as first-line treatment for these patients²,

The APs can be situated everywhere in the tricuspid or mitral annuli, with the exception of the aorto - mitral continuity.

Left accessory pathways are the most commonly found in clinical practice and account for 40%-70% of all AP cases referred for catheter ablation³

Left-sided APs can be approached by the trans-aortic retrograde pathway or transseptal puncture. These two approaches differ in terms of technique, materials, potential complications and easy access to the AP, and are usually chosen alternatively according to the operators' comfort level and preference. However, no clear recommendation has been proposed on the ideal approach for transcatheter ablation of left-sided APs.

AIM OF THE STUDY:

To compare the efficacy and safety of the trans-septal approach versus the retrograde trans-aortic approach for left-sided accessory pathway ablation.

PATIENTS AND METHODS:

Study population:

We consecutively collected data from patients who presented with a left-sided accessory pathway in Ibn Albitar Cardiac Center from January 2017 till February 2019 (79 patients).

All patients gave written informed consent about the procedure, after a full explanation of the procedure and its possible complications to the patients.

Procedure Protocol:

The patients were usually admitted to the hospital on the same day of the procedure, and usually discharged within 24 hours. The patients informed to stop antiarrhythmic medications for more than five half-lives of the drug taken. The procedure was started while the patient is in a fasting state with local anesthesia to the right groin (except in young children where general anesthesia is used), mild sedation was used in selected cases.

Three Right femoral venous access was usually used, 2 quadripolar catheters were used for recording His and Right Ventricle (RV) apex, and one deflectable decapolar catheter for

coronary sinus (CS) recording.

When the diagnosis of the left-sided accessory pathway was confirmed, either a retrograde aortic approach via a right femoral artery or a trans-septal approach using SL-0 long sheath and Brockenbrough needle technique were used according to operator preference (figure 1). All patients received intravenous Heparin 5000-10000 units according to the body weight. A multi-curve deflectable 4mm dry tip ablation catheter is used for mapping and ablation in both approaches.

The recording system used is EP Workmate 4.2, radiofrequency (RF) ablation was used using ibi 16 Generator. Temperature control (50-60 degree) with Power (40-50 Joules). Ablation was usually done in sinus rhythm for manifested AP, and during ventricular pacing in concealed AP. We interrupted the RF application in the event of catheter displacement, unsuccessful blocking of AP conduction in 20 seconds or after sixty seconds of the effective RF application. Programmed atrial and ventricular stimulation was done 30 minutes after successful ablation to confirm the results.

Procedure time, Fluoroscopy time, number of RF applications, time needed for RF application at target site to terminate the accessory pathway activity, Atrial/Ventricular (A/V) ratio at successful ablation site and presence of AP potential were recorded (figure 2).

The Patients were followed up in 2 to 4 weeks after the procedure and further follow up according to the case.

Statistical analysis:

Categorical variables were expressed as counts and percentages, and continuous variables as means and standard deviations. Data were analyzed using IBM SPSS Statistics 21, and the categorical variables were compared by Chi-square analysis and the continuous variables by Student's t-test. A p value < 0.05 was taken to denote statistical significance.

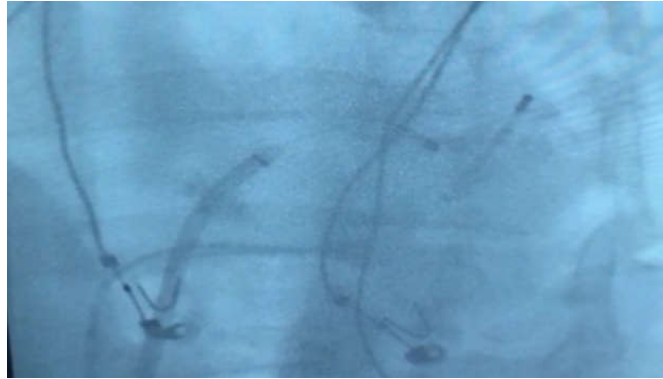


Figure (1): Radiofrequency catheter ablation of patient with left posterior accessory pathway, through trans-septal approach



Figure (2): Intracardiac electrogram of a patient with manifested left posterior accessory pathway, with (*) denotes for Accessory Pathway potential, and the line demarcate for atrial activity.

RESULTS:

The total EP procedures were 87, for 79 patients with left-sided AP, the mean age was (36.28±13.5) years, with a range of 8-67 years, male gender was slightly more predominant (58.2%), figure (3).

The trans-aortic approach was done in 36 procedures (41.4%), while the trans-septal approach was done in 51 procedures (58.6%).

There was no significant difference between the two groups regarding age and sex.

Patients characteristics and procedure parameters of both approaches are shown in table (1).

The success rate was significantly better with the trans-septal approach (96.1%) than in trans-aortic one (66.7%) with (p=0.0002), other parameters that shows a significant difference are the procedure time and fluoroscopic time in favor of the trans-septal approach.

The A/V ratio was also different between the two approaches, with values higher in the trans-septal approach, p= 0.01.

While other parameters showed no significant difference between the two approaches, including the number of RF applications, the presence of AP potential, and the time needed for successful ablation at the target sites.

Complications were generally low 3 patients (3.4% of the procedures) (table 2), there were 2 cases of pericardial effusion encountered, one in each group, of note the one in the trans-septal approach was not due to the trans-septal puncture as the patient already had a PFO through which the catheters accessed the left atrium. Only one case of DVT developed which was in the trans-aortic approach group.

TRANS-SEPTAL TRANS-AORTIC ABLATION

Table (1): Patient characteristics data and procedural electrophysiological parameters for trans-aortic and trans-septal approaches.

		TRANS-AORTIC	TRANS-SEPTAL	P-VALUE
Procedures (87)		36(41.4%)	51(58.6%)	
AGE	MEAN (SD)	35.97(14.9)	36.08(12)	0.97
	RANGE	12-67	8-66	
GENDER	MALE	21 (58.3%)	29 (56.8%)	0.89
	FEMALE	15 (41.7%)	22 (43.2%)	
AP	MANIFEST	14 (38.9%)	20 (39.2%)	0.97
	CONCEALED	22 (61.1%)	31 (60.8%)	
PROCEDURE TIME		140.8	97.25	< 0.001
FLOURO TIME		32.33	17.12	0.001
A/V RATIO		0.6	1.3	0.01
AP POTENTIAL		36.8 %	27.1 %	0.43
NUMBER OF RF APPLICATION		15	10.9	0.13
TIME NEEDED FOR SUCCESSFUL APPLICATION		7.8	9.0	0.42
SUCCESS RATE		66.7%	96.1%	<0.001

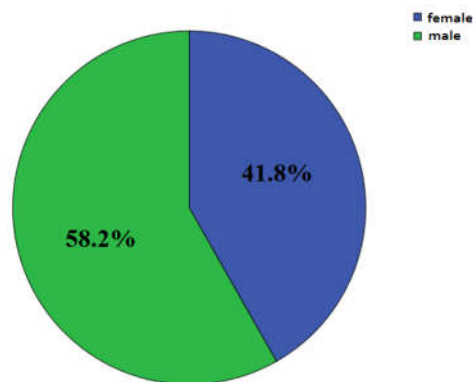


Figure (3): gender distribution in patients treated with left sided accessory pathway ablation.

Table (2): complications encountered in patient with left sided Accessory pathway ablation.

Complication	Transaortic	Transseptal	P-Value
Pericardial effusion (conservatively treated)	1	0	
Pericardial effusion (requiring paracentesis)	0	1	
Deep Vein Thrombosis	1	0	
Total complications	2 (5.5%)	1 (1.9%)	0.31

DISCUSSION:

In a set of 79 patients, 87 procedures were done and we retrospectively compared the Trans-aortic approach with the trans-septal approach used for catheter ablation of Accessory Pathways located on the left side of the heart to compare the efficacy and safety of both approaches. Our results showed a mean age of 36.3 ± 13.5 years with a male predominance (58.2%) is similar to

other studies and registries,^{4,5} and there was no significant difference in these characteristics between the two groups (the trans-septal and trans-aortic approaches).

The significant improvement in the success rate of the trans-septal approach over the trans-aortic approach is also seen by Natale et al⁶, and in a recent meta-analysis⁷, of 29 studies including

2030 patients, showed higher success rate of left sided accessory pathway ablation using trans-septal approach.

The improved success rate with the trans-septal approach can be explained by better catheter maneuverability and more stability and the ability to map oblique pathways with a higher atrial insertion sites.

Other studies like Silva et al⁸, and Schwagten et al⁹, showed no statistically significant difference between the two approaches, and this can be explained by the small sample size, and the operator experience with the traditional approach.

Our study showed a significant reduction in both fluoroscopy time and procedural time with trans-septal approach, similar to other studies like Law et al¹⁰, Long et al¹¹, and Capone et al¹², reflecting the easier catheter manipulation to reach the target site, and the reduction in the time required for trans-septal puncture with increasing operator experience, despite that some studies showed no significant difference in the procedural and fluoroscopy time between the two approaches^{7,8}, this might also be explained by the operator experience in the traditional trans-aortic approach.

A significantly higher A/V ratio in the trans-septal approach at the successful site of accessory pathway ablation represents a preferable atrial insertion site approached by this technique, while ventricular insertion site of the accessory pathway is preferred with the trans-aortic approach due to more catheter stability, these results are similar to other studies like Silva et al⁸, and Kim et al¹³.

The non-significant difference between the two approaches in successful ablation site parameters (number of RF applications, the time needed for ablation at the target site, and the presence of accessory pathway potential) reflects the strategy of ablating the accessory pathway after profound and careful mapping regardless the approach used. This finding is similar to what is seen in many previous studies.^{7,8,14}

There was no statistically significant difference in the complication rate between the two approaches, and this was due to small sample size and a relatively low rate of complications.

Of note, all the 3 reported complications occurred in the first 3 months of the study, and the DVT occurred in the retrograde approach could be due to prolonged compression required for arterial puncture site.

The complication rate reported in other studies are comparable to ours^{15,16}, Pappone et al¹⁷ reported 3.9% and Chen et al¹⁸ reported 2.4% complication rate in accessory pathway ablation.

CONCLUSION:

The trans-septal approach showed a higher success rate of left sided accessory pathway ablation in comparison to the traditional retrograde trans-aortic approach with a similar safety profile.

REFERENCES:

1. T.M. Munger, D.L. Packer, S.C. Hammill, et al., A population study of the natural history of Wolff-Parkinson-White syndrome in Olmsted County, Minnesota, 1953–1989, *Circulation*. 1993 Mar;87(3):866-73.
2. R.L. Page, J.A. Joglar, M.A. Caldwell, et al., ACC/AHA/HRS guideline for the management of adult patients with supraventricular tachycardia: a report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines and the Heart Rhythm Society, *J. Am. Coll. Cardiol.* 2016 (67) (2015) e27–e115.
3. Calkins H, Kim Y-N, Schmaltz S, Sousa J, El-Atassi R, Leon A, et al. Electrogram criteria for identification of appropriated target sites for radiofrequency catheter ablation of accessory atrioventricular connections. *Circulation*. 1992; 85: 565-73.
4. Borregaard R., Lukac P., Gerdes C., Møller Peter D., Mortensen T., Pedersen L., et al. Radiofrequency ablation of accessory pathways in patients with the Wolff-Parkinson-White syndrome: the long-term mortality and risk of atrial fibrillation. *EP Europace*, Volume 17, Issue 1, January 2015, Pages 117–122

5. Garg J, Shah N, Krishnamoorthy P, Mehta K, Bozorgnia B, Boyle NG, et al. Catheter ablation of accessory pathway: 14-year trends in utilization and complications in adults in the United States. *Int J Cardiol.* 2017 Dec 1;248:196-200.
6. Natale A, Wathen M, Yee R, Wolfe K, Klein G. Atrial and ventricular approaches for radiofrequency catheter ablation of left-sided accessory pathways. *Am J Cardiol* 1992; 70: 114-6.
7. Anselmino M, Matta M, Saglietto A, Calò L, Giustetto C, Scaglione M, et al. Transseptal or retrograde approach for transcatheter ablation of left sided accessory pathways: a systematic review and meta-analysis. *Int J Cardiol.* 2018 Dec 1;272:202-207.
8. Silva MA, Nadalin E, Kraemmer A, Berardi GR, Jorge JC, da Cunha CL. Radiofrequency Catheter Ablation of Left Accessory Pathways by Transeptal Approach. *Arq Bras Cardiol.* 2006 May;86(5):331-6.
9. B. Schwagten, L. Jordaens, M. Rivero-Ayerza, et al., A randomized comparison of transseptal and transaortic approaches for magnetically guided ablation of left sided accessory pathways, *Pacing Clin. Electrophysiol.* 2010 Nov;33(11):1298-303.
10. Law IH, Fischbach PS, LeRoy S, Lloyd TR, Rocchini AP, Dick M. Access to the Left Atrium for Delivery of Radiofrequency Ablation in Young Patients: Retrograde Aortic vs Transseptal Approach. *Pediatr Cardiol.* 2001 May-Jun;22(3):204-9.
11. Long DY, Dong JZ, Sang CH, Jiang CX, Tang RB, Yan Q, et al. Ablation of left-sided accessory pathways with atrial insertion away from the mitral annulus using an electroanatomical mapping system. *J Cardiovasc Electrophysiol.* 2013 Jul;24(7):788-92.
12. C.A. Capone, S.R. Ceresnak, L. Nappo, G.J. Gates, C.B. Schechter, R.H. Pass, Three-catheter technique for ablation of left-sided accessory pathways in Wolff-Parkinson-White is less expensive and equally successful when compared to a five-catheter technique. *Pacing Clin. Electrophysiol.* 2015 Dec;38(12):1405-11.
13. Kim KH, Kim DK, Im HJ, Seo JS, Jin HY, Jang JS. Local Atrial/Ventricular Ratio as an Adjuvant Marker for Catheter Ablation of Atrioventricular Accessory Pathways. *Korean Circ J.* 2017 Jul; 47(4): 462–468.
14. J.P. Joseph K. Rajappan. Radiofrequency ablation of cardiac arrhythmias: past, present and future. *QJM.* 2012 Apr;105(4):303-14.
15. Pison L. Transseptal or retrograde approach for transcatheter ablation of left sided accessory pathways: Do all roads lead to Rome?. *Int J Cardiol.* 2018 Dec 1;272:213-214.
16. Bunch, T. and Harmon, T. Is It Time to Rethink Our Approach to Asymptomatic WPW? - American College of Cardiology. [online] American College of Cardiology. Available at: <https://www.acc.org/latest-in-cardiology/articles/2015/02/13/08/49/is-it-time-to-rethink-our-approach-to-asymptomatic-wpw> [Accessed 17 Sep. 2019].
17. Pappone, C., Vicedomini, G., Manguso, F., Saviano, M., Baldi, M., Pappone, A., et al. Wolff-Parkinson-White Syndrome in the Era of Catheter Ablation Insights From a Registry Study of 2169 Patients. *Circulation.* 2014 Jul; 130(10), pp.811-819.
18. Chen TH, Tsai ML, Chang PC, Wo HT, Chou CC, Wen MS, Risk factors of recurrence and complication in radiofrequency catheter ablation of atrioventricular reentrant tachycardia in children and adolescents. *Cardiol Young.* 2013 Oct;23(5):682-91.