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Transseptal or retrograde approach for transcatheter ablation of left sided accessory pathways: a systematic review and meta-analysis

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ABSTRACT

Background: Transcatheter ablation is the most effective treatment for patients with symptomatic or high-risk accessory pathways (AP). At present, no clear recommendations have been issued on the optimal approach for left sided AP ablation. We performed this meta-analysis to compare the safety and efficacy of transaortic retrograde versus transseptal approach for left sided AP ablation.

Methods and results: MEDLINE/PubMed and Cochrane database were searched for pertinent articles from 1990 until 2016. Following inclusion/exclusion criteria application, 29 studies were selected including 2030 patients (1013 retrograde, 1017 transseptal) from 28 observational single Centre studies and one randomized trial. Patients approached by transseptal puncture presented a significantly higher acute success (98% vs. 94%, $p = 0.040$). The incidence of late recurrences ($p = 0.381$) and complications ($p = 0.301$) did not differ among the two groups, but the pattern of complications differed: vascular complications were more frequent with transaortic retrograde approach, while cardiac tamponade was the main transseptal complication. No difference was noted in terms of procedural duration and fluoroscopy time ($p = 0.230$ and $p = 0.980$, respectively). Meta-regression analysis showed no relation between year of publication and acute success ($p = 0.325$) or incidence of complications ($p = 0.795$); additionally, no direct relation was found between age and acute success ($p = 0.256$) or complications ($p = 0.863$).

Conclusions: Left sided AP transcatheter ablation is effective in around 95% of the cases, with a very limited incidence of complications. Transseptal access provides higher acute success in achieving AP ablation; late recurrences are rare but observed similarly following both approaches. Retrograde approach is affected by a relatively high incidence of vascular complications.

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1. Introduction

Wolff-Parkinson-White syndrome is characterized by the concomitant presence of cardiac pre-excitation and arrhythmias as atrioventricular re-entrant tachycardia or atrial fibrillation (AF). 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 [2, 3].

The APs can be situated everywhere in the tricuspid or mitral annuli, with the exception of the mitral-aortic continuity. 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. The most recent guidelines recommend transcatheter ablation as first-line treatment for these patients [2], due to its high efficacy and safety in experienced Centres.

Bearing in mind the different possible localizations, right APs can be approached for ablation from the femoral or subclavian veins, while left sided APs can be approached by transaortic 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. In particular, common practice is mainly based on single-Centre,

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observational studies, and no large randomized trials or registries have been published.

We therefore performed this systematic review and meta-analysis including randomized and observational studies comparing the outcome of transaortic retrograde versus transseptal approach, aiming to assess the optimal approach for left sided AP transcatheter ablation, in terms of both safety and efficacy.

2. Materials and methods

2.1. Search strategy and studies selection

The present study was conducted in accordance with current guidelines, including the recent Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) [4] amendment to the Quality of Reporting of Meta-analyses (QUOROM) statement, as well as recommendations from The Cochrane Collaboration and Meta-analysis Of Observational Studies in Epidemiology (MOOSE) [5]. All subjects included in the studies gave informed consent.

MEDLINE/PubMed and Cochrane database were searched for pertinent articles published in English from 1990 until December 2016. The following terms: (“Left accessory pathway” OR “left Wolff Parkinson White”) AND “catheter ablation” AND “radiofrequency” were used. Retrieved citations were screened through abstract reading independently by two reviewers (M.M. and A.S.), and divergences resolved after consensus. If the citations were deemed potentially pertinent, they were then appraised as complete full-text reports according to the following explicit selection criteria: (i) human observational or randomized studies, (ii) published in English between 1990 and 2016, (iii) investigating patients with left accessory pathways, (iv) including any duration of follow-up. Exclusion criteria were (one enough for exclusion): (i) non-human setting, (ii) duplicate reporting (in which case the manuscript reporting the largest sample of patients was selected), (iii) case reports or papers including <10 patients; (iv) surgical AP ablation. Data concerning study design and year of publication, population characteristics, intervention, complications, acute and mid- or long-term outcome were extracted by two Authors and reviewed independently by a third one (M.A.), being inserted in a single study database.

2.2. Statistical analysis

Since most of the included studies had an observational design, meta-analysis and meta-regressions were performed using random effect models. Primary outcomes of this systematic review were: proportions of initial success (calculated as the ratio between successful procedures and number of patients or as the ratio between successfully ablated pathways and the total number of treated pathways), proportion of recurrences after a mid-term follow-up and proportion of complications. Secondary outcomes were: total procedural time, fluoroscopy time (excluding those studies characterized by a “zero-fluoroscopy” approach) and number of energy applications per procedure. Meta-analysis of proportions was performed using STATA command “metaprop” [6], while meta-analysis of continuous variables was performed using STATA command “metan” [7]. Aiming to assess the impact of the type of procedural access (retrograde aortic vs transseptal), subgroup meta-analysis was performed for both primary and secondary outcomes and a Q test for heterogeneity between subgroups was computed. In addition, aiming to reduce the impact of potential biases derived from patients’ characteristics or year of publication, using the primary outcomes as dependent variables, pre-specified meta-regression analysis was performed through STATA command “metareg” [8] to test whether interactions with (i) year when the study was published and (ii) mean age of study participants were present.

Continuous variables were reported as mean (standard deviation) and categorical variables as counts (percentage). Statistical analysis was performed using STATA version 12.0 (StataCorp, College Station, TX, USA), considering *p* values < 0.05 statistically significant.

3. Results

3.1. Search results

The search identified 269 abstracts referring to transcatheter ablation of left sided APs; among this group, 233 were excluded following application of the inclusion and exclusion criteria; 36 of them were selected and full text was read by two Authors; 7 were excluded because reporting repeated data. Twenty-nine studies were finally included meeting all the pre-specified inclusion criteria. All included articles were single-Centre studies; overall 28 observational studies and one randomized trial were included. Complete details of the study flow-chart are described in the Supplementary Material, Supplementary Fig. 1.

First Author, study design, publication date and complete main characteristics of each included study are reported in the Supplementary Material, Supplementary Table 1 [9–37].

Overall, 2030 patients have been included in the analysis, 1013 approached by retrograde transaortic access and 1017 by transseptal puncture. Baseline characteristics of the included population in both groups are described in Table 1. Briefly, population included mainly young adults, two thirds of whom were males. The most common location for left sided AP was left lateral, followed by left posterior.

3.2. Efficacy and safety endpoints

As shown in Fig. 1, patients approached by transseptal puncture presented a significantly higher acute success of the ablation (98% vs. 94%, *p* = 0.040) compared to transaortic retrograde approach. Conversely, the incidence of late recurrences of cardiac pre-excitation did not differ significantly among the two groups (3% vs. 2%, *p* = 0.381; Fig. 2). Concerning safety, the incidence of overall complications was equally low in both groups (0.4% vs. 1.2%, *p* = 0.301; Fig. 2). Of note, complications pattern was different: vascular complications (hematoma, pseudoaneurysm, aortic regurgitation and coronary damage) were more frequent with transaortic retrograde approach (*p* = 0.03), while cardiac tamponade was the main complication of transseptal approach. Detailed complications are reported in the Table 2.

Additionally, procedural duration and fluoroscopy time were investigated, and no difference was noted between the two groups (*p* = 0.230 and *p* = 0.980, respectively; Fig. 2).

Aiming to assess the impact of the currently available knowledge and technologies employed for transcatheter ablation on the outcome and complications of the procedure, a meta-regression analysis was performed to assess the impact of year of publication, showing no relation between year of publication and acute success (*p* = 0.325) or incidence of complications (*p* = 0.795). Detailed meta-regression analysis is represented in Supplementary Fig. 2, in the Online Supplement. Additionally, due to the wide age range of the included patients, varying from children to middle age, a meta-regression analysis was performed to assess the impact of age (Supplementary Fig. 2), showing no direct relation with acute success (*p* = 0.256) or complications (*p* = 0.863).

Table 1
Pooled clinical features of included studies (2030 patients, 29 studies).

	Transseptal approach (1017 patients)	Transaortic approach (1013 patients)	<i>p</i> -Value
Age, years (CI)	27.8 (17.9–37.6)	34.5 (30.1–39.0)	0.10
Males, % (CI)	67 (62–72)	67 (59–65)	0.90
Concealed accessory pathways, % (CI)	34 (20–48)	31 (8–59)	0.76
Site of accessory pathway, % (CI):			
- Left anterolateral (%)	7 (0.0–15)	7 (2–11)	0.68
- Left lateral (%)	54 (36–70)	67 (57–76)	0.08
- Left posterior (%)	32 (20–44)	12 (4–21)	0.02
- Left posteroseptal (%)	7 (3–12)	14 (7–21)	0.60
Symptoms, % (CI):			
- AVRT (%)	82 (38–100)	86 (76–95)	0.81
- AF (%)	13 (8–20)	31 (15–51)	0.05
Acute success, % (CI)	98 (96–100)	94 (90–97)	0.02
Number of RF/Cryo applications, n (CI)	6.7 (4.6–8.6)	6.1 (4.2–8.0)	0.63
Procedural duration, min (CI)	179.0 (139.7–218.3)	145.5 (109.2–181.8)	0.23
Fluoroscopy time, min (CI)	32.2 (19.0–45.3)	32.9 (22.7–43.1)	0.98
Complications, % (CI)	0.4 (0.0–1.2)	1.2 (0.3–2.6)	0.30
Follow-up duration, months (CI)	14.5 (10.8–18.1)	12.75 (9.4–16.1)	0.62
Recurrences, % (CI)	3.2 (1.6–6.1)	2.3 (0.5–4.6)	0.31

AVRT: atrioventricular re-entrant tachycardia; AF: atrial fibrillation; RF: radiofrequency; Cryo: cryoablation; CI: 95% confidence interval.

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