

ment, and 11 had >35% (extensive) enhancement. AF recurrence analysis was carried out using a Cox regression model. Significant predictors of recurrence were category of enhancement (HR 3.11; $p=0.002$), left atrial volume (HR 1.01; $p<0.01$), and AF type (HR 0.46, $p=0.02$). A Kaplan Meier graph of recurrence of the various enhancement categories is shown.

Conclusions: DE-MRI evaluation of left atrial structural remodeling is a strong independent predictor of AF recurrence following catheter ablation. Based on our data AF ablation at early stage of left atrial remodeling is associated with a better outcome than later stages.

P4820 Side effects and success of antral isolation of pulmonary veins with cryoballoon technique in a large patient cohort with atrial fibrillation



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Purpose: In treatment of paroxysmal atrial fibrillation (af) circumferential substrate modification of the antrum of pulmonary veins (pv) with radiofrequency energy includes risks of pv stenoses and esophago – left atrial fistula. This study reports on success and side effects in antral isolation of pv with cryoballoon technique.

Methods: Pv isolation was performed with best fitting 28/23mm balloon (Arctic Front, Cryocath, Canada) occluding the venous antrum and freezing down to minus 35 – 75° C 6 minutes two times per vein with nitrous oxide. Lasso mapped rest potentials were eliminated with balloon freezes or due to touch up with a 9 french Freezer Max catheter. To avoid phrenic nerve palsy movement of right diaphragm or pacing of phrenic nerve were monitored. Patients (p) were followed three monthly with 7 day holter and symptoms.

Results: We treated 293 p (92 women, mean age 59±10 years, 273 with paroxysmal, 20 persistent af, left atrium 43±5 mm, 151 p with lone af, 102 hypertension, 40 mild structural heart disease). With a mean number of 2.4±1.1 impulses we isolated in 83% all pv with balloon only, in 17% with additional touchup. In the last 181 p all pv could be isolated with balloon only, in 44% combining two balloon sizes. Procedure time decreased to 169±38 min and x ray burden to 26±8 min. Phrenic nerve palsy in 9 p (3%, 8 with 23 mm balloon) recovered within 3 to 9 months. With pacing technique damage of phrenic nerve could be avoided completely. In 5 p we observed cough, reversible hemoptysis over 3 days and hematomas/edema around single pv's in ct scans due to freezing lung tissue. During a mean follow up of 8.5±6 months and 1.1 procedures per p (23 redos) of 168 p analyzed after blanking time of 3 months 81% (136 p) were free of af, with one procedure 72%, with left common ostia (11 of 13) 85%. No pv stenoses, no fistulas were observed. Other side effects were 1 stroke, 1 pericardial effusion, 4 groin hematomas, 2 additional substrate modifications and 7 late ablations of typical atrial flutter.

Conclusion: Antral cryoisolation of the pv with balloon technique is highly efficient. With pacing technique persistent phrenic nerve palsy can be minimized. Due to freezing too far inside of pv cough, hemoptysis and peri pv hematoma may occur. Balloon position inside of pv must be avoided. Cryoballoon therapy may be used as first line therapy.

P4821 Characteristics of atrial tachycardias after pulmonary vein isolation: comparison between cryoballoon and circumferential radiofrequency ablation



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Purpose: Left atrial tachycardias (LAT) after radiofrequency (RF) circumferential pulmonary vein isolation (PVI) are common and well documented. Cryoballoon ablation (CBA) is an alternative technique for PVI in patients with atrial fibrillation (AF). Theoretically, LAT are less common after CBA due to more homogeneous ablation lesions. The aim of our study was to compare the characteristics of LAT after CBA and RF PVI in patients with paroxysmal AF.

Methods: A total number of 302 patients were included into this study. CBA was carried out in 181 patients (131 males, mean age: 55±9.5 yrs, left atrial diameter: 42±5.9 mm). Circumferential RF PVI was performed in 121 patients (76 males, mean age: 56±14.6 yrs, left atrial diameter: 43±5.3 mm). Patients with structural heart disease were not included. Daily transtelephonic ECG monitoring, 24-hour Holter-ECG were used to document recurrences. Redo ablation for LAT was performed in patients with symptomatic sustained drug-refractory tachycardia not earlier than 3 months after the initial procedure.

Results: There were 16 (8.8%) patients after CBA and 13 (10.7%) patients after RF PVI with regular atrial tachycardias on at least one of the follow-up recordings during a mean follow-up period of 586±290 days ($p=NS$). In CBA group ECG tracings of two patients identified AF and were excluded from further analysis. Seven patients from CBA group and 8 from RF PVI group did not qualify for redo ablation. After CBA a redo procedure was performed in 7 (4.4%) patients and after RF PVI in 5 (4%) patients. Reconnection to the pulmonary veins was present in all patients, and PVI was completed in all. Cavotricuspid isthmus (CTI) ablation

was performed in 2 pts from CBA group because of CTI dependent flutter. In CBA group stable LAT was diagnosed and ablated in 2 (1.1%) patients. LAT had a focal origin in 2 patients (1.1%). No any patients had macroreentrant LAT's. In RF PVI group LAT's were ablated in 3 (2.5%) patients. Focal origin was diagnosed in 2 (1.6%) patients, macroreentrant mechanism in 1 (0.8%) patient.

Conclusions: Prevalence and characteristics of LAT's after CBA and RF PVI are not different.

P4823 Recurrence of atrial fibrillation after mini-Maze is associated with pulmonary vein reconnection



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Introduction: Thoracoscopic 'mini-Maze' procedure is a surgical alternative to catheter ablation for atrial ablation (AF). Although favourable success rates are reported, recurrences of AF are observed.

Methods: Since 2005, 210 patients underwent minimal invasive Maze surgery in our hospital, consisting of epicardial pulmonary vein (PV) isolation (bipolar RF clamp, Atricure Inc), epicardial ganglionated plexi ablation and left atrial appendage excision. Pts were followed with 24-hour Holter and ECG based on symptoms. In 8 pts with documented recurrent AF, electrophysiological study (EPS) was performed in a drug free state, with a decapolar lasso catheter, 4-polar CS and HRA catheter, and 4 mm tip RF catheter. PV potentials were assessed both during AF, SR, and during pacing from the CS. If PV reconnection was observed, wide area catheter ablation guided by 3-D mapping (NavX, St. Jude) with lasso verified isolation was performed. Immediate success and long term follow-up results were evaluated.

Results: In 8 pts, recurrent AF after mini-Maze warranted EPS. Lasso verified reconnection between the left atrium (LA) and PV(s) in 7/8 patients; in 1 PV in 1 patient, 2 PVs in 3 patients, 3 PVs in 1 patient and all PVs in 2 patients. Reconnection was equally frequent in left as in right-sided veins. The 3-D NavX reconstruction did not reveal a clear predilecting location for reconnection. All patients underwent a renewed wide area catheter ablation of the PVs that were not isolated. The segment requiring ablation ranged from 10-50% of the circumference of the antrum, which was performed with 5-71 RF applications. PV isolation could be established in 6/7 patients, while all patients had SR at the end of the procedure. Long term (mean 8 mo) follow up in 6 pts shows recurrences of paroxysmal AF in 2, and persistent AF in 1 pt, while only 2 pts are free of drugs.

Conclusions: Recurrent AF after mini-Maze is associated with LA-PV reconnection. Additional catheter ablation may eliminate AF in only 50% of pts. Persistent recurrences of AF are likely due to arrhythmogenic triggers outside PVs, or the inability to achieve transmural RF lesions by both epicardial and endocardial approach.

P4824 Comparison of a new circular ablation catheter with conventional approach for pulmonary vein isolation



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Introduction: We compared the new pulmonary vein ablation catheter (PVAC) (Ablation Frontiers, Carlsbad, California) with our conventional ablation approach to pulmonary vein isolation (PVI).

Methods: Data was analysed from consecutive patients undergoing PVI for PAF at our centre. "Conventional" ablation for was carried out point-by-point using a roving irrigated tip catheter and a circular pulmonary vein (PV) mapping catheter, combined with 3D navigation (Ensite NavX, St Jude Medical). "PVAC" cases used only the PVAC to map and isolate PVs under fluoroscopy.

Results: Twenty PVAC cases were compared with a matched group of 20 Conventional cases. See table for baseline characteristics. Time to start of ablation was shorter (45±2 vs 75±6 min, $p<0.001$) as was total time taken to complete PVI (127±5 vs 157±7 min, $p=0.002$) with PVAC compared to Conventional. There was no difference in radiofrequency delivery time (1852±84 vs 1772±120 s, $p=0.59$) or fluoroscopy time (56±3 vs 57±3 min, $p=0.86$). 10 of 15 patients (67%) in sinus rhythm (SR) at the start developed sustained AF with catheter manipulation or during ablation in the PVAC group, compared to 4 of 15 (27%) in the Conventional group ($p=0.07$); AF termination to SR occurred by ablation in 8 (53%) and 3 (33%) patients respectively ($p=0.42$). One patient (5%) in the PVAC group had documented AF recurrence, compared to 2 (10%) patients in the Conventional group ($p=1.00$), at mean follow-up of 3.5±1.6 months and 4.2±1.2 months respectively.

	PVAC (n=20)	Conventional Ablation (n=20)	P Value
Age	58±3	54±3	0.25
Male	12 (60%)	14 (70%)	0.74
PAF	20 (100%)	20 (100%)	NA
Mean history of AF (months)	50±10	53±8	0.82
Hypertension	11 (55%)	8 (40%)	0.53
Mean left atrial size (mm)	41±1	42±1	0.75
In SR at start of procedure	15 (75%)	15 (75%)	NA
In AF at start of procedure	5 (25%)	5 (25%)	NA

Conclusions: PVI is faster using PVAC alone, compared to conventional approach. This is achieved mainly by reducing time to ablation with no difference seen in ablation delivery time. Early outcomes appear comparable to conventional approach.

P4825 Three-terminal impedance analysis to assess catheter tip-to-tissue contact during radiofrequency ablation of atrial fibrillation



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Background: The quality of the catheter tip-to-tissue contact is critical for safety and efficacy of ablation lesion formation. In this study a new method of contact assessment based on the measurement of the local electrical properties at the catheter tip-to-tissue interface was validated in a blinded fashion in the clinical setting of AF catheter ablation.

Methods: Using a 3-terminal circuit model local resistance and reactance between catheter tip and tissue surface were measured and combined in an electrical coupling index (ECI). Twelve patients undergoing AF catheter ablation were included in this study. During the ablation procedure, the catheter was placed in the left atrium at various levels of contact. Blinded to the physician, measurements of electrogram amplitudes, pacing thresholds, and impedances at the catheter tip-to-tissue interface were performed.

Results: As the catheter went from a non-contact location to a contact location, ECI increased from 118 ± 15 to 145 ± 24 ($p < 0.0001$). Similarly electrogram amplitudes increased from 0.14 ± 0.16 to 2.0 ± 1.9 mV ($p < 0.0001$), and pacing thresholds decreased from 13.9 ± 3.1 to 3.1 ± 2.0 mA ($p < 0.0001$). ECI was significantly higher in vascular tissue as compared to trabeculated and smooth myocardium. Patch orientation, operator, body-mass index, or type of atrial fibrillation had no influence on ECI values. On multivariate analysis, ECI improved the clinician's ability to predict "true contact".

Conclusion: Measurement of local impedances between catheter tip and tissue is feasible to reproducibly predict electrical catheter contact in human radiofrequency ablation.

P4826 Efficacy of synchronized paroxysmal supraventricular tachycardia ablation in patients referred for pulmonary veins ablation of atrial fibrillation



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Introduction: Catheter ablation strategies for treatment of atrial fibrillation (AF) have been focused on the role of patho-physiological mechanism (trigger, initiator and perpetuator). Although the pulmonary veins represent the most common sites of atrial fibrillation (AF) triggers, also synchronized paroxysmal supraventricular tachycardia (PSVT) can be associated to AF. It has been observed that ablation of PSVT in adjunction to PV ablation, can be an ideal treatment in patients (pts) with both arrhythmias. The effects of ablation focused only on the triggering PSVT suppression in patients with AF are still not well known.

Aim of the study: to evaluate the prevalence of PSVT in patients referred for ablation of AF; to evaluate the effects of PSVT ablation on AF recurrences.

Methods: one hundred-fifty pts referred for ablation of AF were studied. Fifty pts (33%; mean age 44.5 ± 15.4 years; 38 males) had inducible PSVT during electrophysiologic study. Every patient underwent an ablation procedure targeted only on the PSVT.

Results: Ablation procedure was successful in all patients. No complication occurred. Twenty-five pts underwent slow pathway ablation for atrio-ventricular nodal re-entrant tachycardia (AVNRT); eighteen pts were ablated for a concealed accessory pathway; seven patients underwent ablation for focal atrial ectopic tachycardia (FAT). After a follow-up of 18 ± 11 months no recurrences of PSVT were observed. Four patients (8%; 3 with left-sided accessory pathway, 3 with AVNRT and 2 with FAT) showed a recurrence of at least one episode of paroxysmal AF. Pts with inducible PSVT had less structural heart disease, and were younger than pts without inducible PSVT (interventricular septum thickness: 9.2 ± 1.4 vs 11 ± 1.4 mm, $p < 0.05$; left atrial AP diameter: 35 ± 3.4 vs 44 ± 2.2 mm $p < 0.05$; age 44.5 ± 15.4 vs 57.3 ± 11.2 years, $p < 0.05$). Prevalence of paroxysmal AF was higher in pts with inducible PSVT compared to those without inducible PSVT (91.6% vs 27.4%, $p < 0.05$).

Conclusions: PSVT ablation in young pts with structurally normal heart, showed a preventive effect on the recurrences of AF. Those patients should be selected for more simple ablation procedures tailored on the triggering arrhythmia suppression.

P4827 Acute efficacy and safety of a novel circular multielectrode radiofrequency ablation catheter for pulmonary vein isolation in paroxysmal atrial fibrillation



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Purpose: Pulmonary vein isolation (PVI) is the standard ablation strategy in paroxysmal atrial fibrillation (AF). In order to reduce procedure and fluoroscopy times, novel ablation tools have recently been introduced. Aim of the study was to assess the acute efficacy and safety in achieving PVI using a low energy phased radiofrequency circular multielectrode ablation catheter (Pulmonary Vein Ablation Catheter™ [PVAC], Ablation Frontiers, Carlsbad, CA, USA) in patients (pts) with paroxysmal AF.

Methods: Consecutive patients with paroxysmal AF referred for catheter ablation were included in the study. PVI was performed using the PVAC system. PVs were considered isolated by demonstration of entry and exit block during pacing and after adenosine challenge. In case of failure in isolating the vein with the PVAC, a 4 mm irrigated tip catheter was used to complete the isolation.

Results: A total of 119 pts (59% males, mean age 60.5 ± 9.9 yrs, NYHA class 1.3 ± 0.6 , CHADS2 score 1.3 ± 1.2 , LVEF $58.6 \pm 7.2\%$, LA diameter 38.8 ± 5.9 mm) were included in the analysis. Isolation of the pulmonary veins was achieved in all pts at the end of the procedure. Mean fluoroscopy time was 36.5 ± 13.9 min. In the whole population, PVI was achieved in 78 pts (66%) with PVAC alone. By analyzing the time course of the success rates, a learning curve was evident: variable success rates were recorded in the first 69 pts (overall 55%), whereas the rate of PVI with PVAC alone was higher in the last 50 pts (80%). Only two complications related to the use of the PVAC occurred in our population: 1 self-limiting hemoptysis due to the guidewire wedging into a small PV branch, and 1 PV-stenosis that remained asymptomatic after > 6 months.

Conclusions: In our experience PVI using PVAC: 1) is safe, and 2) is acutely effective to achieve PVI once a learning curve phase has been completed.

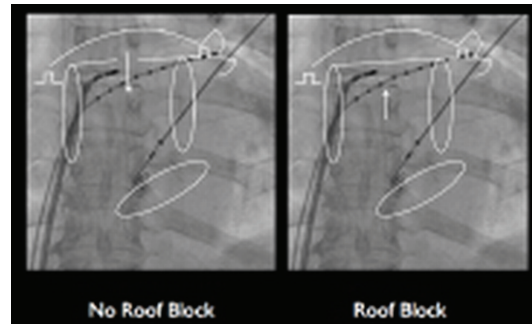
P4828 Assessment of the left atrial roof line in sinus rhythm



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Introduction: Confirmation of electrical block of the cavotricuspid isthmus line and mitral isthmus lines requires pacing manoeuvres next to the line. The left atrial roof line (LARL) (left superior pulmonary vein to the right superior pulmonary vein) occupies a privileged position in that activation of the left atrium preferentially occurs via "Bachmann's Bundle", which just anterior to the line. The present study assessed whether block of the LARL can be assessed in sinus rhythm, avoiding the use of left atrial appendage (LAA) pacing (Figure).

Methods: In 43 patients we mapped the wavefront of activation of the posterior left atrial wall mapped in both sinus rhythm and with pacing from the LAA, and confirmed using the Electroview® mapping system (Bard Electrophysiology). A LARL was performed in 32 patients. Block of the LARL was defined during LAA pacing, with normal activation of the posterior wall going in a high to low direction, and with block of the LARL occurring in a low to high direction. Results In all patients without a roof line activation of the posterior wall was from high to low in both pacing ($109 \text{ms} \pm 48 \text{ms}$ and $126 \text{ms} \pm 59 \text{ms}$, respectively) and sinus rhythm ($87 \text{ms} \pm 46 \text{ms}$ and $107 \pm 44 \text{ms}$ respectively, $p < 0.001$). In patients with confirmed roof line block, activation was low to high in LAA pacing ($145 \pm 49 \text{ms}$ and $185 \text{ms} \pm 54 \text{ms}$ respectively, $p < 0.0001$), and sinus rhythm ($120 \text{ms} \pm 43 \text{ms}$ and $152 \text{ms} \pm 50 \text{ms}$ respectively, $p < 0.0001$).



Assessment of The Left Atrial Roof Line

Conclusions: The left atrial roof line is unique amongst linear lesions in that block can be tested in sinus rhythm, in the presence of normal right atrial conduction and an intact Bachmann's Bundle.