



# 37. HEART RHYTHM SOCIETY-KONGRESS 2016

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Det er en lang reise til vestkysten, men årets Heart Rhythm Society-kongress i San Francisco var igjen verdt turen. Det ble ikke presentert revolusjonerende nyheter, men det er verdifullt i seg selv å få bekreftet at det man gjør er gjeldende standard. Som i fjor deltok ca. 10-15 norske arytmokardiologer .

Det var 6 norske bidrag, derav 1 paneldeltaker: Hans Henrik Odland fra Oslo universitetssykehus i sesjonen «Rapid Fire Cases

in Pediatrics and Congenital Heart Disease».

Som dessverre så mange ganger før: referat fra én deltaker, det er mangelfullt, men ...

Når det gjelder ventrikkeltakykardi-ablasjoner, som mange ser for seg som en enda større (spennende) del av arytmiologens fremtid, er det fortsatt mange forskjellige (overlappende) tilnærminger: lokal aktivering, kanaler, patologiske signaler, substrathomogenisering og så videre, uten at noe av dette fremtrer som den åpenbar beste løsningen. Vi kommer nok til å høre, lese og se mer om dette temaet i fremtiden.

Lungeveenisolasjon er og forblir hjørnesteinen i ablasjonsbehandlingen for (alle former for) atrieflimmer. Rollen av ganglion plexus-ablasjon (ved kirurgi) er blitt enda mer usikker enn det har vært før, og man må da spørre seg hvilken rolle disse spiller ved transvenøs ablasjon. Det samme gjelder rotorer, fraksjonerte signaler, linjer med mer. For «hverdags»-lungeveenisolering virker det som om cryoballoonen begynner å spise en større og større andel (med tross alt gode resultater) av prosedyrene.

NOAK-ene synes å være ganske veletablert før og etter radiofrekvensablasjon for atrieflimmer. Antidot for en av disse er tilgjengelig. Manglende mulighet for monitorering av behandlingen (etterlevelse) før radiofrekvensablasjon løser de fleste fortsatt med transøsofageal ekkokardiografi før prosedyren.

En interessant supplerende behandlingsmulighet ved fjerning av pacemakeranlegg er en vena cava-ballong for å kjøpe seg litt tid hvis det skulle oppstå akutt komplikasjon med ruptur (det hadde i alle fall ikke jeg hørt om før).

Denne gangen var det en egen «summit» om venstre aurikkelukking. Det vil si at interessen for dette har økt betraktelig, men da var jeg opptatt med andre foredrag ...

Jeg håper at fremtidige referater kan bli noe mer utfyllende, men da er stedlige redaktører avhengig av hjelp.

# NORSKE ABSTRAKTER

## PO02-214 / PO02-214 - Epsilon wave in the Nordic arrhythmogenic right ventricular cardiomyopathy registry: link to ventricular late potentials and contribution to diagnosis

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**Introduction:** Epsilon wave (EW) is a marker of ventricular depolarization abnormality in patients with arrhythmogenic right ventricular cardiomyopathy (ARVC), however high interobserver variability in assessment of EWs has been reported. Even though EW is considered a major diagnostic criterion of the disease, it is not clear to what extent it contributes to diagnosis or represent a manifestation of advanced ARVC phenotype. We aimed to (1) determine association between EW and operator-independent quantitative indices of ventricular depolarisation abnormality using signal-averaged ECG (SAECG) and (2) assess EW relationship to other diagnostic

criteria in patients with definite ARVC from the Nordic ARVC Registry.

**Methods:** Patients with definite ARVC by Task Force 2010 who underwent SAECG were included in the analysis: n=160, 62% male, 71% probands, mean age at diagnosis 42±16 years. EWs were adjudicated by ECG Core Lab. Filtered QRS duration (fQRS), duration of terminal QRS <40 uV (LAS) and root-mean-square voltage of terminal 40 ms (RMS40) were assessed in relation to the presence of EW using receiver-operator characteristics curve (ROC) analysis and area under the curve (AUC) measurement. Late potentials in the SAECG parameters were assessed by Task Force 2010 definitions.

**Results:** EW were documented in 10 patients (6%). All three SAECG parameters were strongly related to the presence of EW by AUC estimation: fQRS - 0.905, LAS - 0.910, RMS40 - 0.899 (p<0.001 for all). All three SAECG parameters were abnormal in 78 patients (49%) while 33 patients (21%) did not have late potentials by SAECG. All 10 patients with EW had late potentials in all three SAECG measures (p=0.011). All EW patients had other diagnostic criteria sufficient for ARVC diagnosis. All ten had either minor or major arrhythmia criterion vs 107 of 150 patients without EW (p=0.039), nine EW patients had major imaging criterion and eight had repolarisation abnormality.

**Conclusions:** EW represents an advanced ventricular depolarization abnormality, is strongly associated with ventricular late potentials by SAECG and arrhythmic manifestations of ARVC. EW is present only in patients with clear ARVC phenotype determined by other diagnostic criteria and has minimal contribution to ARVC diagnosis.



## AB10-04 / AB10-04 Impact of Acute Atrial Fibrillation Termination and Prolongation of AF Cycle Length on the Outcome of Ablation of Persistent AF: A sub-study of the STAR AF II trial

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**Introduction:** There is controversy about the impact of acute atrial fibrillation (AF) termination and prolongation of AF cycle length (AFCL) acutely during ablation on the long-term procedural outcome. We analyzed the influence of AF termination and AFCL-prolongation on freedom from AF in patients from the STAR-AF II trial.

**Methods:** STAR-AF II was a large, multicenter trial randomizing 589 patients with persistent AF to different ablation strategies. Acute changes in AFCL and AF termination were collected during the index procedure and both were compared to recurrence of AF at 18 months. Recurrence was defined as AF > 30 seconds based on ECG, Holters (3,6,9,12,18 months), and weekly transtelephonic monitor ECGs for 18 months. The impact of AF termination was also compared to other predictors of procedural outcome by Cox regression analysis.

**Results:** AF terminated in 8% of the pulmonary vein isolation (PVI) arm, 45% in the PVI+complex electrogram arm, and 22% of the PVI+linear ablation arm ( $p<0.001$ ) but the 18 month freedom from AF did not differ between the 3 groups ( $p=0.15$ ). Freedom from AF at 18 months was significantly higher in patients who presented to the lab in sinus rhythm compared to those who presented in AF but did not terminate during ablation (63% vs. 44%;  $p=0.007$ ). Those who presented in AF but terminated during ablation had an intermediate outcome (53% AF freedom at 18 months) but this was not significantly different from either those in sinus ( $p=0.84$ ) or those who did not terminate ( $p=0.08$ ). AF termination was a univariable predictor of success at 18 months ( $p=0.007$ ) but by multivariable analysis, performing PVI predominantly during sinus rhythm was the strongest predictor (HR 1.80,  $p<0.001$ ). Prolongation of the AFCL was not predictive of 18 month freedom from AF.

**Conclusions:** Acute AF termination and prolongation in AFCL did not predict 18 month freedom from AF. Performing PVI predominantly during sinus rhythm was the strongest predictor and could explain better outcome in patients with early AF termination during ablation.

## P003-52 / P003-52 - The force-frequency relationship of the failing and dyssynchronous heart is not changed with resynchronization therapy

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**Introduction:** Resynchronization therapy is an effective treatment of heart failure patients with left bundle branch block. Little is known about the myocardial force-frequency responses (FFR) in these patients. Dyssynchronous contraction may hamper the inotropic response resulting from changes in heart frequencies.

**Methods:** In 26 patients who underwent CRT with class I indications a left ven-

tricular pressure catheter was placed and pacing was performed first with the LV lead in a suboptimal anterior or apical position, then with the LV lead in an optimal lateral position. FFR was performed by sequential pacing in both positions with a pacing train of 8 beats (beat 1, paced cycle length, PCL,  $640 \pm 2$ ms) coupled to a pacing train (beat 3) with a longer PCL ( $810 \pm 7$ ms), still above the intrinsic rate. The first beat of the second pacing train is potentiated, termed beat 2. Response was measured as  $dP/dT_{max}$  (mmHg/s) and linear mixed models were used with all values presented as estimated marginal Mean  $\pm$  SEM (mmHg/s).

**Results:** Pacing resulted in a significant increase from beat 1 to 2 and a decrease to beat 3; A pacing  $795 \pm 35$  to  $903 \pm 35$  to  $765 \pm 34$ ; RV pacing  $834 \pm 40$  to  $932 \pm 40$  to  $758 \pm 39$ ; LV pacing  $900 \pm 50$  to  $1039 \pm 49$  to  $835 \pm 48$ ; BiVP  $845 \pm 41$  to  $987 \pm 41$  to  $765 \pm 39$ . A significant ( $p < 0.01$ ) impact on the intercept of the interaction between position and beat on  $dP/dT_{max}$  was found with BiV pacing (ant/apical  $840 \pm 40$  vs lateral  $947 \pm 40$ ) and LV pacing (ant/apical  $912 \pm 50$  vs lateral  $958 \pm 50$ ). No differences were found between pacing LV only or BiV in optimal and suboptimal positions with respect to beat 1, 2 and 3.

**Conclusions:** A force-frequency response with an increase in  $dP/dT_{max}$  and a subsequent decrease is seen with all pacing modalities in both optimal and suboptimal positions, however qualitatively different with pacing at optimal sites. This suggests that FFR is present, and may be modulated with resynchronization, even in dyssynchronous failing hearts.

### **PO04-99 / PO04-99 - Ablation index correlates with impedance drop during catheter ablation of atrial fibrillation**

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**Introduction:** The correlation between ablation index (Abl) and lesion depth has been proved in animal studies. However, the relationship between Abl and

ablation effectiveness has not been clearly elucidated in the human heart.

**Methods:** 416 ablation points were acquired from 19 patients with paroxysmal atrial fibrillation who underwent pulmonary vein isolation for the first time. A ThermoCool SmartTouch ablation catheter was used. Ablation time, power, contact force and impedance were recorded and used to calculate Ablation index (Abl) by a customized formula (Figure). Impedance drop (ID) was used to evaluate ablation effect.  $ID \geq 10 \Omega$  was regarded as an adequate lesion formation. The real-time ID under various Abl and total Abl after 60s ablation were calculated. Data were also grouped by different power applications (25W,  $n=115$ , 30W,  $n=166$ , and 35W,  $n=135$ ).

**Results:** ID rose  $3.7 \pm 2.8$ ,  $8.3 \pm 4.9$ ,  $10.8 \pm 6.9$ ,  $12.6 \pm 7.8$ ,  $16.1 \pm 8.6$ ,  $19.6 \pm 12.8 \Omega$  when Abl reached 100, 200, 300, 400, 500 and 600 W·g·s, respectively ( $P < 0.01$ ). Under power setting of 25W, ID was lower than that under 30W and 35W at the same Abl level. There was no significant difference of ID between 30W and 35W except Abl was at level of 300 W·g·s. Average Abl in the group that ID never crossed  $10 \Omega$  was lower than that in the group with  $ID \geq 10 \Omega$  (Table). To reach  $ID \geq 10 \Omega$ , minimum Abl of 400 W·g·s were needed at 25W, while only 300 W·g·s needed at 30W or 35W.

**Conclusions:** Abl correlated with the ID indicating ablation effect during atrial fibrillation ablation. A cutoff value of 400 W·g·s at 25w and 300 W·g·s at  $\geq 30$ W might be used for predicting an adequate lesion formation.

### **AB31-03 / AB31-03 - Cross Mapping Can Identify the Mechanisms of Atrial Tachycardia Post Atrial Fibrillation Ablation**

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**Introduction:** Fractionated potentials (FP), covering nearly half of tachycardia cycle length (TCL), are often observed in atrial tachycardia (AT) post atrial fibrillation

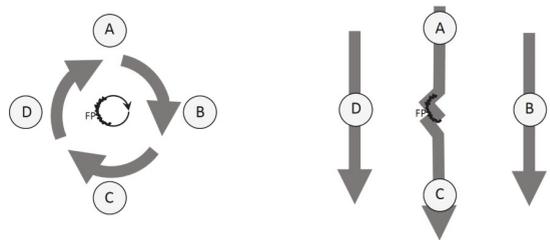
(AF). Some of these FPs present substrates for micro-reentrant AT (mAT), while others are bystander during AT. We investigated a method of cross mapping to identify the culprit FPs for mAT.

**Methods:** Mechanisms of ATs post AF were recognized by mapping. mAT was defined as a vortex-like conduction around a minuscule core (diameter<5mm) without any discernable obstacle. Cross mapping was performed: 1) Local activation times of 4 points (A, B, C and D, Figure) taken closely and evenly around a FP were measured. 2) The differences of local activation time between A and C, B and D were calculated. 3) Time difference ratios (TDR), the difference of local activation time divided by TCL (AC/TCL and BD/TCL), were calculated.

**Results:** Totally 19 patients (60.5±9.1 years, 15 men) with successful ablation of ATs post AF ablation were enrolled. After 3-dimesional mapping, 14 FPs (group I) were indicated as substrate for mAT, while 20 FPs (group II) were bystanders for mAT episode. After cross mapping, the mean of AC/TCL

and BD/TCL in group I was 54±23% and 41±25%, was 15±21% and 9±11%, respectively in group II. TDR ≥25% was used as the cut-off value for predicting mAT. The positive and negative predictive value was 71.4% and 100.0%, respectively, with sensitivity of 100.0% and specificity of 83.3%.

**Conclusions:** Cross mapping can differentiate culprit FPs from bystander FPs in mAT. Both cross over values of TDR ≥25% can be used as a key parameter.



Schematic diagram for the principle of cross mapping. Polyline represents an area with FP; Heavy arrow represents activation direction; A, B, C, and D represents a mapping point, respectively, FP: fractionated potential.

