# Abstract sessies NVVC Najaarscongres
Donderdag 4 november 2021
16:30 – 18:00 uur

## Sessie 4 Electrophysiology

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spreker 1:</strong></td>
<td><strong>A Deep Learning Approach to Identify New Electrocardiographic Features in Congenital Long QT Syndrome</strong>&lt;br&gt;H. Bleijendaal (Amsterdam UMC locatie AMC, Amsterdam)</td>
</tr>
<tr>
<td><strong>Spreker 2:</strong></td>
<td><strong>Ventricular Arrhythmia Substrate, Fibrosis and Sympathetic Innervation Patterns in Non-Ischemic Cardiomyopathy Patients</strong>&lt;br&gt;H.S. Chen (Leids Universitair Medisch Centrum, Leiden)</td>
</tr>
<tr>
<td><strong>Spreker 3:</strong></td>
<td><strong>Performance of HeartLogic Algorithm in a Real World Ambulant Heart Failure Population in the LUMC</strong>&lt;br&gt;M. Feijen (LUMC, Leiden)</td>
</tr>
<tr>
<td><strong>Spreker 4:</strong></td>
<td><strong>Reduction in QRS Area Correlates with Acute Hemodynamic Response during CRT-device Implantation</strong>&lt;br&gt;M.A.G. Ghossein (Maastricht University, Maastricht)</td>
</tr>
<tr>
<td><strong>Spreker 5:</strong></td>
<td><strong>Automated Localization of Accessory Pathways in Wolff-Parkinson-White Syndrome Based on 12-lead ECG using Deep Neural Networks</strong>&lt;br&gt;J. Hennecken (UMCU, Utrecht)</td>
</tr>
<tr>
<td><strong>Spreker 6:</strong></td>
<td><strong>Experience with Nanostim Leadless Pacemakers during Medium Term Follow-up: Troubleshooting and Management</strong>&lt;br&gt;F.J. Oosterwerff (Isala, Zwolle)</td>
</tr>
<tr>
<td><strong>Spreker 7:</strong></td>
<td><strong>Gender Differences in ICD-related Complications in the PRAETORIAN Trial</strong>&lt;br&gt;W. van der Stuijt (Amsterdam UMC location AMC, Amsterdam)</td>
</tr>
<tr>
<td><strong>Spreker 8:</strong></td>
<td><strong>Childbirth with an Activated ICD: Is it Safe?</strong>&lt;br&gt;J.A. de Veld (AMC, Amsterdam)</td>
</tr>
</tbody>
</table>
A DEEP LEARNING APPROACH TO IDENTIFY NEW ELECTROCARDIOGRAPHIC FEATURES IN CONGENITAL LONG QT SYNDROME

Presenting author: H. Bleijendaal
Department: Cardiology

S. Aufiero (Amsterdam UMC locatie AMC, Amsterdam); H. Bleijendaal (Amsterdam UMC locatie AMC, Amsterdam); T. Robyns (UZ Leuven, Leuven); B. Vandenberk (UZ Leuven, Leuven); C. Krijger (Amsterdam UMC locatie AMC, Amsterdam); M.M. Winter (Amsterdam UMC locatie AMC, Amsterdam); C. Bezzina (Amsterdam UMC locatie AMC, Amsterdam); A.H. Zwinderman (Amsterdam UMC locatie AMC, Amsterdam); A.A.M. Wilde (Amsterdam UMC locatie AMC, Amsterdam); Y.M. Pinto (Amsterdam UMC locatie AMC, Amsterdam)

Purpose:
Congenital Long QT syndrome (LQTS) is a rare heart disease caused by various underlying mutations. Most general cardiologists do not routinely see patients with congenital LQTS and consequently may not always recognize the accompanying ECG features. In addition, a proportion of disease carriers do not display obvious abnormalities on their ECG. Combined, this can cause underdiagnosing of this potentially life-threatening disease. Deep learning (DL) based algorithms have shown promising results, also for ECG analysis. By training a model to detect LQTS on the ECG, we hypothesized that DL models can improve diagnosis of LQTS.

Methods:
A 1-Dimensional Convolutional Neural Network was trained with a dataset of 12-lead ECGs provided by Amsterdam UMC and was validated with an external dataset provided by University Hospital Leuven. As a control group, a dataset consisting of normal labelled ECGs was used. The development dataset included ECGs from 10000 controls, 172 LQTS type 1, 214 LQTS type 2 and 71 LQTS type 3 patients. For interval validation of model performance, 5-fold cross-validation was performed. The external validation dataset included ECGs from 2200 controls, 33 LQTS type 1 and 81 LQTS type 2 patients. Unfortunately, no LQTS type 3 data was available for external validation. The performance of the DL models was compared with QTc measurement and with the assessment of an experienced LQTS expert. Lastly, a technique for feature visualization was used for model interpretation, in order to visualize what ECG region the models used for classifying LQTS type 1, 2 and 3.

Results:
In the internal test set of the Amsterdam Data, the best models achieved an average sensitivity for LQTS type 1, 2 and 3 of 84%, 90% and 87%, a specificity of 96%, 95% and 92% and an Area Under the Receiver Operator Curve of 0.90, 0.92 and 0.89, respectively. The DL models performed better than measuring the QTc. The performances held up when the DL algorithm was validated on the external validation set from Leuven and outperformed the expert cardiologist in terms of specificity while in terms of sensitivity, the model and the expert cardiologist in LQTS performed comparable (see Table 1). Finally, the feature visualization technique identified the onset of the QRS complex as the most informative region for the DL algorithm to classify the ECGs.

Conclusion:
This study showed that a DL algorithm performs as well as an international expert in detecting LQTS mutation carriers on the ECG. Surprisingly, the DL algorithm uses different ECG features than the expert suggesting the common ECG still harbors added information
that human experts do not commonly use. Therefore, DL models could be implemented in clinical care in the form of a clinical decision tools to aid general cardiologists in diagnosing LQTS on the ECG and potentially unmask concealed LQTS patients.

**Keywords:**
Long QT syndrome, Deep Learning, Electrocardiogram

**Figure:**
Table 1: Performance comparison DL model vs. cardiologist on LQTS 1, 2. A subset of 30 LQTS1, 30 LQTS2 and 300 controls (150 X 2) from the Leuven dataset were selected and used to validate our models which were trained on the Amsterdam data using all available 12-lead ECGs per patients (top). The values reported in the table is the average of 5-fold cross-validation. The same subset was evaluated by an expert cardiologist in LQTS (bottom). Unfortunately, no LQTS3 patients were available for external validation. Sen.: Sensitivity, Spe.: Specificity, F1-score, AUC: Area Under the Curve, Acc.: Accuracy, SD: standard deviation, LQTS1: LQTS type 1, LQTS2: LQTS type 2.

<table>
<thead>
<tr>
<th>Training</th>
<th>Type</th>
<th>External validation (Leuven data)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Sen. ± SD</td>
</tr>
<tr>
<td>All available</td>
<td>LQTS1</td>
<td>89%±0.04</td>
</tr>
<tr>
<td>12-lead ECGs per patient</td>
<td>LQTS2</td>
<td>91%±0.03</td>
</tr>
<tr>
<td>Expert cardiologist in LQTS</td>
<td>LQTS1</td>
<td>93%</td>
</tr>
<tr>
<td></td>
<td>LQTS2</td>
<td>90%</td>
</tr>
</tbody>
</table>
VENTRICULAR ARRHYTHMIA SUBSTRATE, FIBROSIS AND SYMPATHETIC INNERVATION PATTERNS IN NON-ISCHEMIC CARDIOMYOPATHY PATIENTS

Presenting author: H.S. Chen
Department: Cardiology

H.S. Chen (Leids Universitair Medisch Centrum, Leiden); C. Jungen (Leids Universitair Medisch Centrum, Leiden); Y. Kimura (Leids Universitair Medisch Centrum, Leiden); P. Dibbets-Schneider (Leids Universitair Medisch Centrum, Leiden); S.R.D. Piers (Leids Universitair Medisch Centrum, Leiden); A.F.A. Androulakis (Leids Universitair Medisch Centrum, Leiden); R.J. van der Geest (Leids Universitair Medisch Centrum, Leiden); L.F. de Geus-Oei (Leids Universitair Medisch Centrum, Leiden); A.J.H.A. Scholte (Leids Universitair Medisch Centrum, Leiden); M.J. Lamb (Leids Universitair Medisch Centrum, Leiden); M.R.M. Jongbloed (Leids Universitair Medisch Centrum, Leiden); K. Zeppenfeld (Leids Universitair Medisch Centrum, Leiden)

Purpose:
In patients with non-ischemic cardiomyopathy (NICM) with ventricular arrhythmias (VA), two dominant substrate locations, namely antero-septal and infero-lateral exist. A deep intramural location may account for the poor outcome after radiofrequency catheter ablation (RFCA) of antero-septal substrates (ASS) compared to infero-lateral substrates (ILS). However, additional characteristics such as fibrosis and sympathetic innervation are important determinants of arrhythmogenicity and may also contribute to the discrepancy in outcome. The aim of this study was to evaluate the relation between VA substrate location, myocardial fibrosis and sympathetic denervation.

Methods:
29 NICM patients with VA (including ventricular tachycardia and premature ventricular contractions) from the ‘Leiden Non-ischemic Cardiomyopathy Study’, who underwent electroanatomical voltage mapping, late gadolinium enhanced (LGE) cardiac magnetic resonance and 123I-MIBG imaging between 2011-2018 were included. Patients were categorized in ASS or ILS according to VA substrate location. Endocardial low unipolar voltage (UV)<25th percentile), sympathetic denervation and LGE scar where analyzed according to the 17-segment model and these findings were compared between ASS and ILS patients.

Results:
VA substrate segments show relatively lower UV for both ASS and ILS. In all patients with ILS, VA substrate segments showed regional fibrosis, as identified by LGE, and segmental denervation. In patients with ASS, only 63% (p=0.2) of VA related antero-septal segments showed regional fibrosis and only 27% (p=0.0002) showed segmental denervation.

Conclusion:
Despite low endocardial UV for AS and IL segments harboring VA substrates, regional sympathetic denervation matched with fibrosis only in ILS patients. The mismatch between regional fibrosis and preserved sympathetic innervation in patients with ASS may contribute to a VA substrate difficult to control by RFCA.

Keywords:
Non-ischemic cardiomyopathy, Ventricular arrhythmia, Sympathetic innervation
PERFORMANCE OF HEARTLOGIC ALGORITHM IN A REAL WORLD AMBULANT HEART FAILURE POPULATION IN THE LUMC

Presenting author: M. Feijen
Department: Cardiology

M. Feijen (LUMC, Leiden); A.D. Egorova (LUMC, Leiden); R.W. Treskes (LUMC, Leiden); M.J. Schalij (LUMC, Leiden); S.L.M.A. Beeres (LUMC, Leiden)

Purpose:
Heart failure related hospitalizations are a marker for poor prognosis, pose a burden on patients, healthcare givers and healthcare budgets. The mainstay in preventing these hospitalizations is early detection congestion. HeartLogic (HL), a novel multisensory cardiac implantable electronic device (CIED) based algorithm, aims to timely alert clinicians of impending fluid retention. This study investigates the performance of the HL algorithm in chronic HF patients.

Methods:
Chronic HF patients with a CIED and activated HL algorithm were included. Patients were followed up according to the HL-care path from 01-01-2018 until 01-03-2021 (Figure 1). The HL index is generated based on S3/S1, thoracic impedance, respiratory- and night heart rate. In case of surpassing the pre-set threshold of 16, an alert was issued. An alert was true positive (≥2 signs/symptoms of fluid retention) or false positive (≤1 signs/symptoms). Without an alert a patient was true negative (≤1 signs/symptoms) or false negative (≥2 signs/symptoms).

Results:
Data of 102 patients was available for analysis, median age 70[IQR 60-77], 78% male, 48% ischemic etiology and 68% had a CRT-D. Total follow-up (FU) consists of 128 patient-years (PY), median FU 13 months[IQR 6-23]. Six alert episodes were excluded because of inadequate adherence to the care path. During FU, 120 alerts in 54 patients, were included. Mean alert rate was 0.94 per PY. The sensitivity to detect fluid retention was 93% and the specificity 97%. The unexplained alert rate was 0.24 per PY.

Conclusion:
The HL algorithm can accurately detect an upcoming episode of decompensated HF, with a low unexplained alert rate.

Keywords:
Heart failure, HeartLogic, Telemonitoring
Figure:
Overview of the Heart Failure care path

- Continuous home monitoring
- Index ≥ 16
- Device technician receives alert
- Digital CIED evaluation
- HF caregiver receives information
- HF caregiver contacts patient
- No signs and symptoms: Follow up in 2 weeks
- Signs and symptoms: Lifestyle modification and/or adjustment HF medication
- Re-evaluate
REDUCTION IN QRS AREA CORRELATES WITH ACUTE HEMODYNAMIC RESPONSE DURING CRT-DEVICE IMPLANTATION

Presenting author: M.A.G. Ghossein
Department: Cardiology

M.A.G. Ghossein (Maastricht University, Maastricht); M.A. Ghossein (Maastricht University, Maastricht); A.M.W. van Stipdonk (Maastricht University Medical Center+, Maastricht); F.C.W.M. Salden (Maastricht University Medical Center+, Maastricht); E.B. Engels (Yale New Haven Hospital, New Haven); F. Zanon (Santa Maria della Misericordia General Hospital, Rovigo); J.G.L.M. Luermans (Maastricht University Medical Center+, Maastricht); S. Westra (Radboud University Medical Center, Nijmegen); F.W. Prinzen (Maastricht University, Maastricht); K. Vernooy (Maastricht University Medical Center+, Maastricht).

Purpose:
Inter-patient comparisons have shown that reduction in QRS area after cardiac resynchronization therapy (CRT) is associated with improved long-term clinical outcome. The aim of this study was to investigate whether the within-patient variation in QRS area reduction is associated with hemodynamic improvement at different LV lead positions and pacing configurations.

Methods:
A total of 52 patients with a CRT-indication were prospectively included in 3 hospitals. QRS area was calculated from vectorcardiograms that were synthesized from 12-lead ECG’s. Acute hemodynamic response was assessed invasively as the change in maximum rate of rise of left ventricular (LV) pressure (%LVdP/dtmax) rise. QRS area reduction was studied in relation to LV lead position and proximal versus distal pacing configuration.

Results:
There was a significant correlation between the largest QRS area reduction per patient and %LV dP/dtmax rise (R=0.46, p<0.0001, panel A). In 84% of patients, their largest QRS area reduction was associated with the largest %LV dP/dtmax rise. In 21 patients in which at least three lead positions were available, a significant correlation was also found between QRS area reduction and %LVdP/dtmax rise intra-individually (average R=0.69, p<0.0001, panel B).

Conclusion:
Within patients, QRS area reduction is associated with %LVdP/dtmax rise with various LV lead positions and pacing configuration. Therefore, QRS area, which is an easily obtainable and objective parameter, might be a promising tool for optimization of LV lead position and pacing configuration in CRT.

Keywords:
Cardiac Resynchronization Therapy, Heart Failure, QRS area
Abstract sessies NVVC Najaarscongres
Donderdag 4 november 2021
16:30 – 18:00 uur

Figure:
AUTOMATED LOCALIZATION OF ACCESSORY PATHWAYS IN WOLFF-PARKINSON-WHITE SYNDROME BASED ON 12-LEAD ECG USING DEEP NEURAL NETWORKS

Presenting author: J. Hennecken
Department: Cardiology

J. Hennecken (UMCU, Utrecht); R.R. van de Leur (UMCU, Utrecht); P.A. Doevendans (UMCU, Utrecht); R.J. Hassink (UMCU, Utrecht); P. Loh (UMCU, Utrecht); R. van Es (UMCU, Utrecht)

Purpose:
Wolff-Parkinson-White (WPW) syndrome is characterized by accessory atroventricular pathways which predisposes patients to tachycardias. Treatment primarily consists of radiofrequency (RF) catheter ablation. As pre-procedural localization is favourable, several algorithms were developed based on polarity of delta waves on a 12-lead electrocardiogram (ECG). Nonetheless, these algorithms are time consuming, prone to inter-observer variability and do not use delta waves as a continuous variable. To overcome these challenges, we propose an automated algorithm using a deep neural network (DNN).

Methods:
Patients that underwent RF-ablation for an accessory pathway in the University Medical Centre Utrecht between 2004 and 2020 were included. Patients with concealed pathways, multiple antegrade pathways or ECGs with arrhythmias were excluded. The ground truth location was determined based on treatment location during the ablation procedure and categorized into left, right or septal.

An exponentially dilated convolutional DNN was pre-trained on 21504 ECGs of which 1024 with pre-excitation. Finetuning was performed on 450 ECGs of 238 patients with 148 left, 74 septal or 16 right pathways. The DNN was internally validated using 5-fold cross-validation. Performance of the DNN was compared to two conventional algorithms: Milstein and Arruda.

Results:
The DNN outperformed both the Milstein and Arruda algorithms with an area under the receiver operating curve of 0.89 ± 0.05, compared to 0.76 and 0.74, respectively.

Conclusion:
Our algorithm showed excellent discriminatory performance in predicting the location of an accessory pathway while outperforming conventional techniques. Clinically, this tool can improve pre-planning and risk stratification thus optimizing RF-ablation.

Keywords:
Wolff-Parkinson-White, Deep Learning, ECG
Figure:
Figure 1: Performance of the algorithm and its corresponding anatomical locations
Red: Left sided pathways (65%)
Black: Septal pathways (27% of which 57% paraseptal pathways)
Green: Right sided pathways (8%)
Abbreviations:
AUC: Area Under the receiver operating curve
EXPERIENCE WITH NANOSTIM LEADLESS PACEMAKERS DURING MEDIUM TERM FOLLOW-UP: TROUBLESHOOTING AND MANAGEMENT

Presenting author: F.J. Oosterwerff
Department: Cardiology

F.J. Oosterwerff (Isala, Zwolle); A. Salavati (Isala Ziekenhuis, Zwolle); M. Lenssen (Isala Ziekenhuis, Zwolle); P. Delnoy (Isala Ziekenhuis, Zwolle); A. Adiyaman (Isala Ziekenhuis, Zwolle); A. Elvan (Isala Ziekenhuis, Zwolle)

Purpose:
The Nanostim leadless pacemaker (LP) was launched in 2012. However, the use of Nanostim LP was suspended due to safety. The aim of this study was to report our experience with the management of malfunctioning Nanostim LPs, including premature battery depletion.

Methods:
Fifty-one consecutive patients (age 83 ± 10, 65% male) who underwent Nanostim LP implantation between 2014 and 2016 at Isala Hospitals were identified. Two patients were excluded from analysis due to incomplete follow-up. Mean follow-up duration was 1114 ± 560 days.

Results:
Nanostim LP malfunction occurred in 20/49 (40.8%) patients. Premature LP battery failure was observed in 18/20 (90%) of the affected patients. Furthermore, malpacing/malsensing was observed in 1 patient and mechanical dislocation of the Nanostim LP occurred in 1 patient. Of note, 17/18 (94%) Nanostim LPs with premature battery depletion showed normal device parameters three months prior to the diagnosis of (impending) premature battery failure. In 12 patients Nanostim LPs with a mean device age at the time of extraction of 1040 ± 467 days was successfully extracted without complications. Implantation of another LP or a transvenous device was successfully performed in all 20 patients with Nanostim LP malfunction. All known cases of early-life battery failure were identified during the three monthly follow-up consultations.

Conclusion:
The incidence of Nanostim LP early-life battery failure was higher than previously reported. Nanostim LP extraction in an older population seems to be safe and effective. Three monthly follow-up seems to be effective at preventing in-between Nanostim LP related hospitalization.

Keywords:
Nanostim, Early-life battery failure, Nanostim LP extraction
Figure 1. Management of Nanostim LPs at risk of early-life battery failure under the Nanostim advisory
GENDER DIFFERENCES IN ICD-RELATED COMPLICATIONS IN THE PRAETORIAN TRIAL

Presenting author: W. van der Stuijt
Department: Cardiologie

R.E. Knops (Amsterdam UMC location AMC, Amsterdam); L.R.A. Olde Nordkamp (Amsterdam UMC location AMC, Amsterdam); P.P.H.M. Delnoy (Isala Hospital, Zwolle); L.V.A. Boersma (St. Antonius Hospital, Nieuwegein); J. Kuschyk (University Medical Centre of Mannheim, Mannheim); M.F. El-Chami (Emory University Hospital, Atlanta); S. Mittal (The Valley Hospital, Ridgewood); L. Smeding (Amsterdam UMC location AMC, Amsterdam); W. van der Stuijt (Amsterdam UMC location AMC, Amsterdam); A. de Weger (Amsterdam UMC location AMC, Amsterdam); M.A. Brouwer (Radboud University Medical Center, Nijmegen); K. Vernooy (Maastricht University Medical Centre (MUMC) Maastricht); T. Betts (Oxford University Hospitals NHS Foundation Trust, Oxford); D.J. Wright (Liverpool Heart and Chest Hospital, Liverpool); A.A.M. Wilde (Amsterdam UMC location AMC, Amsterdam)

Purpose:
The PRAETORIAN trial has investigated the difference in complications between the subcutaneous implantable cardioverter-defibrillator (S-ICD) and the transvenous ICD (TV-ICD). Retrospective studies suggest that women experience more ICD-related complications, specifically related to the lead, than men. We aimed to evaluate this gender difference as a subanalysis of the PRAETORIAN trial.

Methods:
The PRAETORIAN trial (NCT01296022) is an international multicenter randomized trial. Patients with a class I or IIa ICD indication with no need for pacing therapy were randomized 1:1 to receive either an S-ICD or a TV-ICD and followed for a median of 49.1 months.

Results:
A total of 849 patients were included, of whom 167 (19.7%) were female. ICD-related complications occurred in 6/89 women in the S-ICD group and 11/78 women in the TV-ICD group (HR 0.46, 95%CI 0.17-1.25). In men, 25/337 in the S-ICD group and 33/345 in the TV-ICD group had a ICD-related complication (HR 0.77, 95%CI 0.46-1.29). Kaplan Meier curves of both genders are shown in the figure. In Cox regression analysis, women had a higher risk of lead-related complications (HR 2.1, 95%CI 1.04-4.16, p = 0.04).

Conclusion:
Our prospective data show a more prominent trend in women to experience more ICD-related complications with the TV-ICD. This difference may be due to a significantly higher risk of lead-related complications in women. However, numbers are low and more research is needed to gain more insight into the gender-specific risks and benefits of ICD therapy.

Keywords:
ICD therapy, Complications, Gender
Abstract sessies NVVC Najaarscongres
Donderdag 4 november 2021
16:30 – 18:00 uur

**Figure:**
Percentages are 4-year cumulative incidences based on Kaplan–Meier estimates in time-to-first-event analyses.

![Graph showing ICD-related complications for female and male patients with hazard ratios and cumulative incidence over years of follow-up.](image-url)
CHILDBIRTH WITH AN ACTIVATED ICD: IS IT SAFE?

Presenting author: J.A. de Veld
Department: Cardiology

J.A. de Veld (AMC, Amsterdam); W. van der Stuijt (AMC, Amsterdam); K.M. Kooiman (AMC, Amsterdam); L. Smeding (AMC, Amsterdam); L.R.A. Olde Nordkamp (AMC, Amsterdam); R.E. Knops (AMC, Amsterdam)

Purpose:
The number of young patients living with an implantable cardioverter defibrillator (ICD) is increasing, due to increased recognition of genetic arrhythmic syndromes. ICDs are often deactivated during childbirth to prevent inappropriate shocks (IAS) caused by oversensing of myopotentials. To date, no IAS during childbirth are reported. This study hypothesized that childbirth with an activated ICD is safe.

Methods:
This retrospective analysis included patients from a tertiary hospital who underwent childbirth with an ICD in situ. Data on cardiac disease, childbirth, and ICD settings were collected. Primary outcomes were IAS during childbirths with an activated ICD, and external defibrillation or medication for ventricular arrhythmias during childbirths with a deactivated ICD. In addition, patients were given a questionnaire about childbirth perception and treatment preferences.

Results:
We included 26 patients who underwent 41 childbirths. Both the activated and deactivated ICD group consisted of 13 patients. There were no episodes of IAS and no external defibrillations or cardiac medications administered. Compared to the activated ICD group, significantly more patients in the deactivated ICD group would prefer the opposite (activated) ICD treatment during future childbirths. In the activated ICD group, everyone was content with their ICD status (p=0.002, figure 1).

Conclusion:
In patients giving birth with an activated ICD, there were no IAS. Although the sample size is small, this study suggests it is safe to give birth with an activated ICD. Moreover, most patients preferred their ICD activated during childbirth. Patient preference regarding ICD status during childbirth should be discussed prenatally.

Keywords:
Implantable cardioverter defibrillator, Childbirth, Inappropriate shock
Figure:
Figure 1. Patient preferences regarding ICD status during childbirth