Conclusion: Our modeling work suggests that modifications to the S-ICD coil design could lead to marked reductions in DFT. This could allow for the creation of S-ICDs with lower energy requirements and correspondingly smaller generators compared to current devices and might obviate the need for VF conversion testing with S-ICDs.

PO-618-04
LONGEVITY OF MODEL-3501 SUBCUTANEOUS IMPLANTABLE DEFIBRILLATOR LEAD IN CLINICAL PRACTICE
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Background: In December 2020, the subcutaneous implantable cardioverter-defibrillator (S-ICD) lead model-3501 was subject to a safety notification because of increased risk of fracture at a location just distal to the proximal sense ring. The manufacturer’s product performance report currently reports a lead survival probability of 98.8% at 45 months. However, no multicenter long-term performance information exists for this lead.

Objective: To assess the longevity of model-3501 leads and to compare it with that of the previous model-3401.

Methods: This analysis included consecutive patients who received an S-ICD with a model-3501 or a model-3401 lead at 66 Italian centers of the Rhythm Detect registry. A lead failed if it required extraction/replacement because of abnormalities suggestive of a structural defect, e.g. out-of-range impedance, nonphysiological electrical noise or ineffective therapy.

Results: From January 2013 to July 2021, 2403 patients were implanted and followed up (78% male, age 49±15 years). A 3501-model lead was used in 1697 patients and a 3401-model in 706 patients. During a median follow-up of 38 months [25th-75th percentile: 24-55], we detected 4 malfunctioning model-3501 leads and 2 model-3401 leads. After analysis of the returned leads by the manufacturer’s technical services, a single model-3501 lead failure was a fracture distal to the proximal ring electrode, as described in the manufacturer’s advisory letter. No deaths or permanent injuries occurred as a result of lead failures. The survival of 3501-model leads at 4 years was 99.5% (95% C.I. 99.0 to 99.9) compared with 99.9% (95% C.I., 99.6 to 100.0) of 3401-model leads (P = 0.110). The cumulative occurrence rate of the 3501-model safety notification fracture was 0.1% (95% C.I., 0.0 to 0.3).

Conclusion: In this large multicenter analysis, the survival probability of model-3501 S-ICD leads was in line with that reported by the manufacturer, was not significantly lower than that of 3401-model leads (not affected by a safety notification), and still higher than that reported with transvenous leads. Although an enhanced electrode is now available, which addresses the potential for electrode body fracture, the present findings are reassuring and may have significant implications for the management of patients who have affected leads.

PO-618-05
DEEP LEARNING ALGORITHMS FOR SCREENING OF LEAD NOISE IN ELECTROCARDIOGRAMS TRANSMITTED BY CARDIAC IMPLANTABLE ELECTRONIC DEVICES
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Background: Electrograms (EGM) remotely transmitted by cardiac implantable electronic devices (CIEDs) may show signs of lead noise.

Objective: We tested different deep neural architectures for detection of noise amongst episodes labeled as non-sustained ventricular tachycardia (NSVT).

Methods: A total of 10,471 NSVT episodes from 805 patients implanted with a Boston Scientific CIED were used, each composed of a right ventricular near-field signal and possibly a right atrial and/or a far field signal, depending on the device model. The highly unbalanced dataset (6% of positive events corresponding to noise versus 94% of NSVT) was divided into 3 datasets: training (4,998 episodes), validation (2,621 episodes), and test (2,843 episodes). Five deep learning approaches, including state-of-the-art architectures based on convolutional neural networks (CNN) and ResNet, were trained and optimized to tested. Results were evaluated using a clinically relevant F2 score, prioritizing noise detection over precision.

Results: A CNN-based network (2DTFCNN) that used 2D time/frequency (TF) maps of the ventricular bipolar signal as input gave the best results on the test set (F2 = 0.914), outperforming a ResNet pre-trained with electrocardiogram data and with transfer learning (2DTF-ResNet) (F2 = 0.863). However, a CNN network based on a naive ResNet architecture trained on 2D images of the ventricular signal time traces (2D-ResNet) also performed very well (F2 = 0.906).

Conclusion: Artificial intelligence can adequately detect lead noise, optimizing remote monitoring and decreasing work burden.

PO-618-06
REMOTE PROGRAMMING OF CARDIAC IMPLANTABLE ELECTRONIC DEVICES: MULTI-CENTRIC EVALUATION OF A CUSTOM MULTIVENDOR SOLUTION
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Background: Until now, remote programming of cardiac implantable electronic devices (CIEDs) has been ruled out due to technical issues and safety concerns. However remote programming would be of high value particularly in settings of emergency, limited resources, enforced physical distancing, and quarantines.
Objective: We aim to investigate the feasibility and safety of a custom made system for remote programming of CIEDs in clinically relevant situations.

Methods: Our remote programming solution consists in remote controlling CIEDs programmer through screen capture and remote cursor control. This approach has the advantages to preclude unauthorized access to the CIED, to prevent alteration of the programmer and to be multivendor compatible. In this multicenter feasibility study the primary outcome was the percentage of successful remote interrogation and programming of patients requiring a device check-up or programming intervention.

Results: Device cardiologists performed in-hospital (Bordeaux University Medical Center; N=49), medium-range (100 km at non-academic center; N=10), and intercontinental programming (>5000 km; N=6) of 65 patients (56% pacing dependent). Implanted devices were pacemakers (74%) and ICDs (26%) from Biotronik™ (N=42), Microport™ (N=18), and Abbott™ (N=5). The patients were located in the outpatient clinic, device clinic, operating room (per-implantation), emergency department and MRI preparation room. Device cardiologists worked from home in 14 cases. Full CIED interrogations succeeded in 100% of cases with programming changes effectuated in 62%. The mean time lag for programmer screen interaction was 0.6±0.7 seconds. No clinical or technical complications occurred.

Conclusion: Remote programming is feasible and enables safe interrogation and reprogramming of CIEDs in various conditions and distances. This strategy may enhance health care access and facilitate medical training, tele-expertise and tele-work.

PO-618-07

PREDICTORS AND OUTCOMES OF LEAD PERFORATION IN A UNITED KINGDOM MULTICENTRE SERIES - THE DIAGNOSTIC VALUE OF HIGH-RESOLUTION COMPUTED TOMOGRAPHY

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Background: Iatrogenic cardiac perforation due to pacemaker (PM) & implantable cardioverter-defibrillator (ICD) leads is a rare but serious complication. Clinical features vary widely at times causing diagnostic delay. Management strategies and are non-guideline based due to paucity of data.

Objective: To review the incidence, clinical features, management, and outcomes of PM/ICD lead cardiac perforation in a contemporary multi-centre study.

Methods: This study is a multicentre retrospective series including 3 United Kingdom cardiac tertiary centres from 2016-2020. Patient, device & lead characteristics were obtained including outcomes at 6 months.

Results: Seventy cases of perforation were identified from 10,631 procedures; perforation rate was 0.50% for local implants. 39 (56%) patients were female, mean age 74 (±13.8) years. Mean left ventricular ejection fraction 51(±13.2) %.

Conclusion: Perforation was rare (0.50%) within this cohort and managed successfully by a percutaneous strategy. Cardiac CT was highly sensitive for a perforation diagnosis. The presence of tamponade was associated increased risk of 30-day mortality and major complications. Case complexity is highly variable and requires both skilled operators and multi-disciplinary management to achieve good outcomes.

Computed tomography post contrast displaying lead tip perforation localization with review in three orthogonal views: A + B: coronal planes, C: axial plane and D: sagittal plane. All demonstrating the lead tip (denoted by *) traversing beyond the visceral pericardium and likely abutting the parietal pericardium, visible even with some motion artefact.