Background: Telerobotic surgery could improve access to specialized procedures such as cardiac catheter ablation in rural and underserved regions in the US and worldwide. Advancements in telecommunication, internet infrastructure, and surgical robotics are lowering the technical hurdles for this future healthcare delivery paradigm. Nonetheless, important questions remain regarding the safe implementation of telerobotic surgery in rural community hospital settings.

Objective: The purpose of this study was to pilot test a system and methods to explore remote surgery in a rural community hospital setting using a novel telerobotic catheter ablation platform.

Methods: Telerobotic System: We assembled a portable pre-clinical telerobotic catheter ablation system from commercial-grade components using 3rd party vendors. A Plexiglas case housed a 3-dimensionally printed cardiac model and simulated vasculature to represent the patient. Finally, we used a proprietary telerobotic cloud service and an off-the-shelf VR headset to allow a remote operator to perform the simulated telerobotic operations. Simulations: We carried out eight simulations with an experienced operator in Chicago, IL, and the Operating room (OR) team at Ocean Beach Hospital, a rural community hospital in Ilwaco, WA. OR team members were assigned to one of two simulation scenarios: loss of network connection or cardiac perforation with subsequent life-threatening tamponade physiology. Ethnographic Study: Two ethnographers observed and recorded each simulation via two stationary cameras in the rural hospital OR. The ethnographers also conducted semi-structured and focus group interviews.

Results: Interviews and observations suggested that rural OR teams could readily adapt to the telesurgery context. However, team perceptions of communication and emergency management were significantly impacted during simulated network failure with loss of contact with the remote operator. Most participants believed the team would have been more responsive to the challenges had they received formal training or had prior experience with the procedure.

Conclusion: We demonstrate feasibility of a system and methods for the study of specialty telerobotic surgery in a rural hospital OR setting.

PO-631-02

RIGHT PRECORDIAL U WAVES IN SEVERE AORTIC STENOSIS: PREVALENCE IN A "REAL WORLD" COHORT AND DIMINUTION BY TAVR

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Background: Using a convolutional neural network (CNN), artificial intelligence has identified patients with moderate or severe aortic stenosis (AS) based solely on the 12-lead ECG. Saliency mapping (which elucidates feature importance used by CNNs employing deep learning algorithms in model prediction) identified right precordial U waves as a key ECG feature to identify AS.

Objective: To assess both the real-world prevalence of U waves in severe AS and any effect of TAVR on dynamic U wave changes.

Methods: In a retrospective analysis of patients with severe AS undergoing TAVR, the right precordial U wave was defined as a positive deflection in leads V1-V3 - after the T wave within a distinct TP segment not due to artifact. U wave diminution was defined as a reduction in amplitude of visible U waves in leads V1-V3 (if present pre-TAVR).

Results: From August to November 2021, a total of 16 consecutive patients were analyzed. The cohort was 50% male and 50% female (8 patients each). The mean age was 80.6 yrs (95% CI 75.9-85.3) and the mean baseline LVEF was 61% (95% CI 56-67%). TAVR decreased the peak velocity (by ECHO) from 4.7m/s (95% CI 4.4-4.9) to 2.3m/s (95% CI 2.0-2.6, p < 0.0001), mean gradient from 55mmHg (95% CI 48-62) to 12mmHg (95% CI 9-16, p < 0.0001) and increased the valve area from 0.67 cm² (95% CI 0.61 to 0.73) to 1.6 cm² (95% CI 1.4-1.9, p < 0.0001). U waves were present in 13 pts (81%; mean amplitude 0.79 mm) prior to TAVR. After TAVR, U waves disappeared in 8 pts (62%), reduced in amplitude in 4 pts (30.8%; mean 40% reduction), and were unchanged in 1 patient.

Conclusion: Right precordial U waves are present in ~80% of pts with severe AS, and reduce or disappear in ~90% of pts post-TAVR. Further studies should assess clinical outcomes, diagnosis and treatment. This is one of the first examples of clinical translation of machine learning-derived feature importance in the real world.

Figure 1. Electrocardiographic Right Precordial U Wave Diminution After TAVR

PO-631-03

DEEP LEARNING FOR THE IDENTIFICATION OF PATIENTS WITH A HIGH RISK FOR IDIOPATHIC VENTRICULAR FIBRILLATION

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Background: A DPP6 gene risk haplotype, putatively enhancing Purkinje fiber transient outward current Ito, associates with familial idiopathic ventricular fibrillation (IVF). Outside this genetic disposition, no clinical risk factors nor ECG features for IVF have so far been identified to recognize those at risk for IVF.

Objective: We aimed to develop deep learning (DL) models to predict the DPP6 risk haplotype on ECG and use explainable DL to uncover the ECG specificities recognized by DL.

Methods: Raw 12 lead ECG data of DPP6 risk haplotype carriers (n = 156) and genotype negative family members (n = 156) were analyzed by multiple Convolutional Neural Networks (CNNs) with various data preprocessing strategies, using 5-fold cross-validation for testing. For each patient, the first recorded outpatient clinic ECG was used. Gradient weighted Class Activation Mapping (GradCAM) visualized the ECG specificities most important for a 2-Dimensional (2D) CNN.
**Results:** The Area Under the Curve Receiver Operating Characteristic (AUC) of the different models to differentiate DPP6 positive from negative family members, was 0.69-0.85. The best performing DL models were a 1D CNN (AUC 0.85) using raw waveform data and a 2D CNN (AUC 0.82) using an image of the mean P-QRS-T complex of each lead. 2D CNN GradCAM showed the QRS complexes of leads I and V5, among other activated ECG regions, to be most important (Figure 1).

**Conclusion:** In contrast to previous standard ECG analyses, DL models can detect the DPP6 IVF risk haplotype with good accuracy. In addition, GradCAM uncovered that lateral lead QRS complexes were of most importance, matching with the inferred pathophysiological mechanism of increased Ito in Purkinje. It is important to take into consideration that the saliency of heat-map patterns in I and V5 is not the consequence of a targeted optimization, but the emergent result of training the model to perform the binary decision task, highlighting the most relevant information for this task. However, ultimately, DL models might be able to identify pre-symptomatic IVF patients in and outside the DPP6 risk haplotype, enabling patient tailored pre-symptomatic treatment.

**PO-631-04**

**ACCURACY OF A SMARTWATCH ECG TO DIAGNOSE ATRIAL FIBRILLATION AND NORMAL SINUS RHYTHM**

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**Background:** Select smartwatches offer the ability to record a single-lead ECG with automated detection of atrial fibrillation (AF). The growing use of these devices by consumers is accompanied by mass screening of AF. However, the accuracy of the smartwatch automatic diagnosis (SWAD) of AF has only been validated in limited number of patients, often excluding patients with comorbidities or low/high heart rates.

**Objective:** We assessed the ability of SWAD to correctly detect AF or normal sinus rhythm (NSR) with a 12-lead ECG expert diagnosis in a large cohort of patients with various ECG anomalies.

**Methods:** 734 consecutive hospitalized patients (without exclusion criteria) underwent a 30-seconds Apple Watch recording and a simultaneous 12-lead ECG. The SWAD (“normal”, “AF” or “inconclusive”) was compared with the smartwatch ECG and 12-lead ECGs as interpreted by two cardiologists.

**Results:** Of the 734 patients, 547 were in NSR (75%) and 187 were in supraventricular tachycardia (SVT, 25%) including AF, atrial flutter (AFL) or atrial tachycardia (AT). Overall, the SWAD was NSR in 455 (62%), AF in 137 (19%) and inconclusive (IC) in 142 patients (19%). For the whole cohort, sensitivity and specificity for AF and AFL/AT was respectively 70% and 81%. For patients in NSR, 105 were classified as AF or IC. Of these false positives, 27 (26%) had sinus node dysfunction, 19 (18%) had second or third degree AV block, 18 (17%) had premature ventricular contractions (PVCs), 18 (17%) had an intraventricular conduction delay (IVCD) and 9 (9%) had a ventricular paced rhythm. For patients in SVT, 58 were classified as NSR or IC. Among these false negatives, 21 (36%) had an IVCD, 7 (12%) had a ventricular paced rhythm, and 5 (9%) had PVCs. Moreover, for patients in AFL/AT the SWAD identified “AF” in only 1/22 patients. When excluding patients with IVCD, PVCs and paced rhythm, sensitivity and specificity for AF was 77% and 83%.

**Conclusion:** In 734 patients with various ECG anomalies, the SWAD failed to identify patients with AF and AFL/AT in a significant proportion of patients. The clinician needs to take these limitations into consideration when using smartwatch automatic diagnosis for the detection of AF.

**PO-631-05**

**A MOBILE APP FOR IMPROVING THE COMPLIANCE TO REMOTE MONITORING OF PATIENTS WITH CARDIAC IMPLANTABLE DEVICES: A MULTICENTER EVALUATION IN CLINICAL PRACTICE**

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**Background:** The use of remote patient monitoring (RPM) is recommended for patients with cardiac implantable electronic devices (CIEDs). The continuity of monitoring is crucial, indeed patients who consistently transmit data using RPM were shown to be at substantially lower risk of death and readmission. The MyLATITUDE Patient App (Boston Scientific) has been developed to encourage patient compliance to RPM by providing him with information about communicator setup and troubleshooting, connection status of the communicator, scheduled transmissions, status of the implanted device battery.