Background: Telerobotic surgery could improve access to specialty 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 preclinical 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 emergency surgery. OR team members were told that the simulation would proceed to the challenges had they received formal training or had prior experience with the procedure.

Results: Interviews and observations suggested that rural OR teams could readily adapt to the telesurgery context. However, teamwork 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 presence 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.