CONCLUSION: In this large patient cohort with MAC, progression to severe MAC is common and frequently results in CMVD. Female sex was associated with higher progression rates and an association between MAC and AS progression was observed. MAC and CMVD are expected to dramatically increase as the population ages and there is an urgent need to better understand the pathophysiology of MAC in order to develop effective preventative medical therapies.

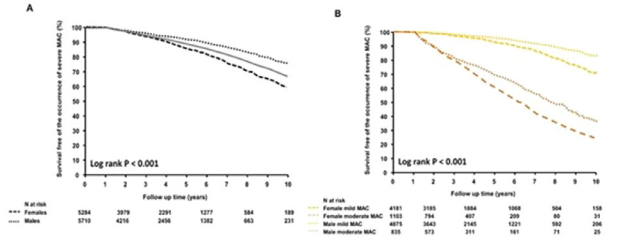

Figure 1. Progression to mitral annular calcifcation (MAC) according to (A) sex and (B) sex and degree of mitral annular calcification (MAC). (A). At 10 years, 41% of female patients compared to 24% of male patients progressed to severe MAC. (B). Sex increased the risk of progression to severe MAC independent of MAC severity.

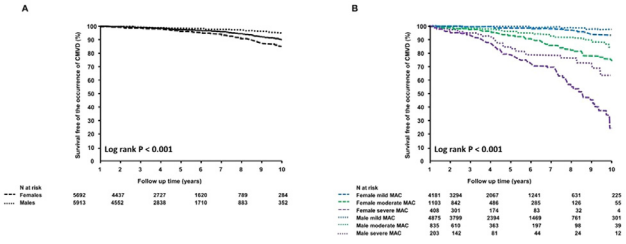

Figure 5. Progression to calcific mitral valve disease (CMVD) according to (A) sex and (B) sex and degree of mitral annular calcification (MAC). (A). At 10 years, 15% of female patients developed CMVD compared to only 5% of male patients. (B). Sex increased the risk of developing CMVD independent of MAC severity.

CSE Travel Bursary Research Award

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COVID-19 DIAGNOSIS BY POINT OF CARE LUNG ULTRASOUND: A NOVEL DEEP LEARNING ARTIFICIAL INTELLIGENCE METHOD

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BACKGROUND: Point of care lung ultrasound (POCUS-L) and the interpretation of lung artifacts has recently emerged as key assessment for patients with acute respiratory illnesses. In the era of COVID-19, POCUS-L can be used to risk stratify, and diagnose COVID-19 pneumonia preceding a formal diagnosis by polymerase chain reaction (PCR). There has been recent development of artificial intelligence (AI) software to automate analysis of ultrasound images for clinicians without formal training. Given the magnitude of COVID-19, AI-assisted POCUS-L has the potential to change the diagnostic landscape empowering frontline clinicians from tertiary care centres to rural communities. While there have been published deep learning models for the interpretation of POCUS-L, images can be challenging for AI networks for 2 reasons: 1. large datasets are not currently available and 2. the presence of lung artifacts can be sparse within the numerous frames of a video. To overcome these limitations, we propose a knowledge transfer approach for the former, and an attention-based model for the latter. Using an attention-based model allows the network to narrow focus on relevant frames improving diagnostic precision and accuracy.

METHODS AND RESULTS: In our design we modify the current open-source state-of-the-art model (POCOVID-NET). A convolutional neural network (CNN) extracts spatially encoded features from POCUS-L images, which are fed to a novel attention-based transformer encoder to capture temporal information across frames, which then narrows focus to key frames. We guide the network learn relevant features (A and B lines) by training it on a pulmonary biomarker detection task from our own private dataset of lung images (Fig 2, step 1). We then transferred the knowledge learned and apply this novel attention-based model to a publicly available POCUS-L image dataset set consisting of patients with 1. healthy lungs 2. bacterial lobar pneumonia, and 3. COVID-19 viral pneumonia. We performed a performance study comparing diagnostic precision and recall compared to the POCOVID-Net model. Our novel attention-based model achieves 85% precision and 90% recall for COVID-19, an improvement of 4 % and 10% respectively over the previous model (Table 1).

CONCLUSION: In this study, our novel attention-based machine learning model outperformed the state-of-the-art model for COVID-19 diagnosis by POCUS-L. By integrating an attention mechanism across video frames, our models leverages both spatial and temporal information highlighting key frames used to make the prediction. To our knowledge, this is the highest performing model on this POCUS-L dataset diagnosing COVID-19.

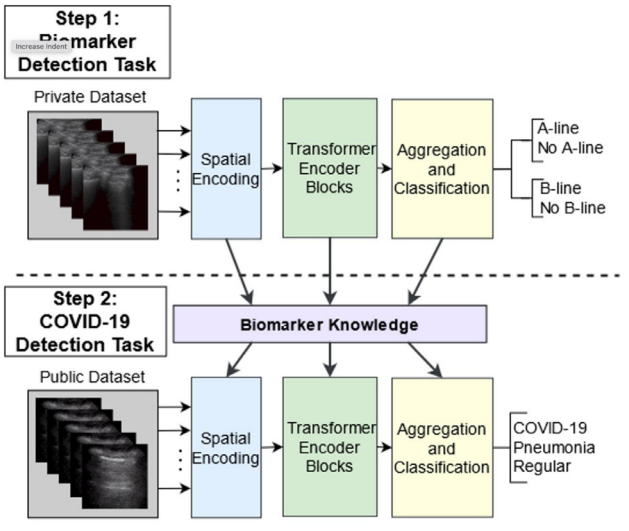

Figure 1: Study design entailing an attention-based video model that is first trained on a pulmonary biomarker detection task (step 1), followed by knowledge transfer to a COVID-19 detection task (step 2).

	Class	Precision	Recall	F1-score
Original State-of-the-art model (POCOVID-NET)	COVID-19	**81%**	**80%**	**80%**
	Bacterial Pneumonia	65%	79%	71%
	Healthy Lung	92%	84%	88%
Novel attention-based model	COVID-19	**85%**	**90%**	**88%**
	Bacterial Pneumonia	89%	91%	90%
	Healthy Lung	92%	87%	90%

Table 1: Performance of the original State-of-the-art Model and the Novel attention-based model for precision and recall of healthy lungs, bacterial pneumonia, and COVID-19 pneumonia

non-invasive method to quantify cardiac sympathetic activity in-vivo. This new imaging method may be helpful in the future to identify cardiac regions associated with elevated arrhythmogenic risk.

Canadian Cardiovascular Society (CCS) Abstracts — Policy

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ACCELERATED TRACER WASHOUT IN REGIONS OF SYMPATHETIC DENERVATION IN HEART FAILURE PATIENTS WITH ISCHEMIC CARDIOMYOPATHY USING FLUBROBENGUANE POSITRON EMISSION TOMOGRAPHY IMAGING

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BACKGROUND: Sympathetic denervation has been shown to predict the risk of sudden cardiac death in ischemic cardiomyopathy (ICM) heart failure patients with implanted cardiac defibrillators. The previous PAREPET trial (JACC 2014;63 (2):141) used the PET tracer hydroxyephedrine (HED) which is a false neurotransmitter analog of norepinephrine. This established tracer is labeled with the short-lived isotope C-11, which limits its widespread utility for risk stratification in clinical practice. The purpose of this study was to evaluate the ability of a new F-18-labeled PET tracer LMI-1195 (flubrobenguane) to measure regional denervation (tracer uptake) as well as sympathetic tone (washout rate) in ICM patients with heart failure.

METHODS AND RESULTS: A subset of patients (N=7) in the LMI-1195 vs HED validation trial underwent early (30 min) and late (4 hours) PET-CT imaging following injection of 3 MBq/kg of flubrobenguane. Five subjects were ICM patients and 2 were healthy normal controls. Regional tracer distribution was quantified on the early and late uptake images using the clinical 4DM-PET analysis program (Ann Arbor, MI). Percent washout rate was measured as (early-late) / early uptake (x100%) using a 9-segment model of left ventricle. In normal controls, there was minimal washout over the 4-hour interval between early and late images (4 +/- 4%). Tracer washout was significantly accelerated ($P < 0.0001$) in both ischemic regions and in remote (perfused) regions in the ICM patients (21 +/- 10% and 17% +/- 9% respectively), suggesting increased sympathetic tone in the whole-LV of these heart failure patients, with regionally higher tone in the ischemic zone.

CONCLUSION: Initial pilot studies evaluating the novel PET tracer [18F]flubrobenguane as a marker of presynaptic neuronal function in humans with and without HF was performed, showing accelerated washout in regions of sympathetic denervation in patients with ischemic cardiomyopathy. If confirmed in larger studies, this would represent a novel and

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EXAMINING THE ASSOCIATION BETWEEN DOMAINS OF FRAILTY AND 6-MONTH CHANGES IN HEALTH-RELATED QUALITY OF LIFE, LIVING STATUS, AND TREATMENT DECISIONAL REGRET AMONG OLDER PATIENTS REFERRED FOR CARDIAC SURGERY

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BACKGROUND: Both age and frailty function as key preoperative risk factors for cardiac surgery. Age alone is usually a poor marker for predicting older patients' health status, most likely due to failure to reflect functional status in the measurement. Frailty status, which takes function into account, may be a better measure for older patients' health status.

METHODS AND RESULTS: The overall goal of this research was to determine the impact of varying degrees of frailty on the functional recovery of patients who undergo cardiac surgery. Specific objectives were as follows: (1) Determine the association between domains of frailty and change in HRQoL at baseline and 6 months post-surgery, (2) Determine the association between domains of frailty and dependent living status at 6 months post-surgery (3), determine the association between domains of frailty and treatment decisional regret at 6 months post-surgery. A prospective cohort pre-post design was used to evaluate the exposure (frailty)and resulting outcomes (change in HRQoL; dependent living status; treatment decisional regret). The primary outcome was HRQoL, measured preoperatively and at 6 months using EQ-5D-3L/EQ-VAS. Secondary outcomes were, dependent living status and treatment decisional regret, measured using the Functional Independence questionnaire. Worse ADL function was positively associated with higher levels of impairment in mobility and usual function HRQoL from baseline to 6 months. As well, worse ADL function was negatively associated with greater HRQoL improvement in men as measured by index scores and across all procedure types as measured by EQ-VAS. Worse mobility function was negatively associated with higher levels of improvement in HRQoL in isolated AVR patients. Lastly, those with worse ADL function had higher odds of experiencing a dependent living status 6 months after surgery (aOR = 2.06 (1.42, 3.00)), and worse ADL (aOR = 1.89 (1.35, 2.65) and cognitive (aOR = 1.77 (1.26, 2.47) function had higher odds of regretting their decision to have surgery.