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Utilizing Artificial Intelligence to Predict Post Operative Atrial Fibrillation in Non-Cardiac Transplant

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Abstract : Background: Postoperative atrial fibrillation (POAF) is associated with adverse health consequences, higher costs, and longer hospital stays. Utilizing existing predictive models that rely on clinical variables and circulating biomarkers, multiple societies have published recommendations on the treatment and prevention of POAF. Although reasonably practical, there is room for improvement and automation to help individualize treatment strategies and reduce associated complications. Methods and Results: In this retrospective cohort study of solid organ transplant recipients, we evaluated the diagnostic utility of a previously developed AI-based ECG prediction for silent AF on the development of POAF within 30 days of transplant. A total of 2261 non-cardiac transplant patients without a preexisting diagnosis of AF were found to have a 5.8% (133/2261) incidence of POAF. While there were no apparent sex differences in POAF incidence (5.8% males vs. 6.0% females, p=.80), there were differences by race and ethnicity (p<0.001 and 0.035, respectively). The incidence in white transplanted patients was 7.2% (117/1628), whereas the incidence in black patients was 1.4% (6/430). Lung transplant recipients had the highest incidence of postoperative AF (17.4%, 37/213), followed by liver (5.6%, 56/1002) and kidney (3.6%, 32/895) recipients. The AUROC in the sample was 0.62 (95% CI: 0.58-0.67). The relatively low discrimination may result from undiagnosed AF in the sample. In particular, 1,177 patients had at least 1 AI-ECG screen for AF pre-transplant above .10, a value slightly higher than the published threshold of 0.08. The incidence of POAF in the 1104 patients without an elevated prediction pre-transplant was lower (3.7% vs. 8.0%; p<0.001). While this supported the hypothesis that potentially undiagnosed AF may have contributed to the diagnosis of POAF, the utility of the existing AI-ECG screening algorithm remained modest. When the prediction for POAF was made using the first postoperative ECG in the sample without an elevated screen pre-transplant (n=1084 on account of n=20 missing postoperative ECG), the AUROC was 0.66 (95% CI: 0.57-0.75). While this discrimination is relatively low, at a threshold of 0.08, the AI-ECG algorithm had a 98% (95% CI: 97 – 99%) negative predictive value at a sensitivity of 66% (95% CI: 49-80%). Conclusions: This study's principal finding is that the incidence of POAF is rare, and a considerable fraction of the POAF cases may be latent and undiagnosed. The high negative predictive value of AI-ECG screening suggests utility for prioritizing monitoring and evaluation on transplant patients with a positive AI-ECG screening. Further development and refinement of a post-transplant-specific algorithm may be warranted further to enhance the diagnostic yield of the ECG-based screening.

Keywords : artificial intelligence, atrial fibrillation, cardiology, transplant, medicine, ECG, machine learning
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