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Real-Time Prospective Validation of a High-Accuracy Wearable System for Atrial Fibrillation Detection in Hemodialysis

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Objectives : Atrial fibrillation is a prevalent and potentially life-threatening arrhythmia among patients undergoing hemodialysis and is strongly associated with increased risks of stroke, heart failure, and sudden cardiac death. Rapid electrolyte fluctuations during dialysis sessions may provoke transient arrhythmias that frequently remain undetected by intermittent electrocardiographic monitoring. Continuous wearable monitoring with real-time analytical capabilities may help bridge this critical gap in clinical surveillance and facilitate earlier identification of clinically significant arrhythmic events during dialysis treatment.
Methods : Atrial fibrillation is a prevalent and potentially life-threatening arrhythmia among patients undergoing hemodialysis and is strongly associated with increased risks of stroke, heart failure, and sudden cardiac death. Rapid electrolyte fluctuations during dialysis sessions may provoke transient arrhythmias that frequently remain undetected by intermittent electrocardiographic monitoring. Continuous wearable monitoring with real-time analytical capabilities may help bridge this critical gap in clinical surveillance and facilitate earlier identification of clinically significant arrhythmic events during dialysis treatment.
Results : A total of 32 patients were enrolled. The mean age was 67.3 ± 15.0 years, 65.6% were male, and the mean dialysis vintage was 6.16 ± 4.94 years. The mean body mass index was 22.71 ± 3.37 kg/m², and the mean cardiothoracic ratio was 51.8 ± 6.4%. Hypertension, diabetes mellitus, and heart failure were present in 84.4%, 46.9%, and 18.8% of participants, respectively. Ten atrial fibrillation alerts were generated, comprising six true-positive and four false-positive detections, with no false negatives observed. The algorithm demonstrated a sensitivity of 100%, specificity of 84.6%, overall accuracy of 87.5%, an area under the receiver operating characteristic curve of 0.923, and a Cohen's kappa coefficient of 0.67.
Conclusions : The wearable system demonstrated high sensitivity and strong diagnostic performance for real-time atrial fibrillation detection during hemodialysis, supporting its clinical potential to enhance arrhythmia recognition and dialysis safety.