





Localization of Accessory Pathway in Patients with Wolff-Parkinson-White Syndrome Using Cross-Recurrence Plot of Precordial Leads

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Abstract

The non-invasive localization of accessory pathway (AP) in patients with Wolff-Parkinson-White (WPW) syndrome is typically performed upon physicians' diagnoses based on observing their electrocardiogram (ECG) signals, which are not always the same. Therefore, a high-accuracy automatic method can help minimize this gap regarding AP localization. This study was to develop a novel semi-automatic localization of AP in patients with WPW syndrome, using features selected from the cross-recurrence plot (CRP) of consecutive precordial leads on ECG. The study participants comprised of 31 patients with WPW syndrome (aged 8-69, with the mean age of 31.19 ± 14.69 , 32.3% female), receiving successful ablation therapy during the first session. The features extracted from the CRP, including laminarity (LAM), trapping time (TT), determinism (DET), and mean length of diagonal line (L) were then analyzed. Altogether, 20 features were obtained for each segment of ECG, from the start of the P wave to the end of the T one. The feature reduction, The classification and the cross-validation (CV) methods were sequential forward selection (SFS), the k-nearest neighbors (KNN) and the leave-one-out (LOO) respectively. The proposed method could differentiate the right and left APs in the patients with WPW syndrome with the accuracy value of 87% (sensitivity: 93.33%, specificity: 81.25%). These results were achieved by the LAM and L features from the CRP of (V1, V2) and (V3, V4), respectively. The data indicated that the features extracted from the CRP of the precordial leads on ECG could semi-automatic.

Keywords: Wolff-Parkinson-White syndrome, Localization, Accessory pathway, Cross-recurrence plot.

Highlights

- The localization of APs with a semi-automatic approach using ECG signal was achieved non-invasively.
- The feature LAM yielded from the CRP of leads V1 and V2 was effective in the localization of APs.

- The feature L yielded from the CRP of leads V3 and V4 was effective in the localization of APs.
 - The localization of right- and left-sided APs with LAM and L had an accuracy of 87%.
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