Augmented Two-channel Arrhythmia Detection

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It has been estimated that up to 40% of all electrical shocks delivered by implantable cardioverter-defibrillators (ICDs) result from false positive detection of ventricular arrhythmias. To prevent false diagnosis of such tachyarrhythmias in ICDs, detection methods complementary to rate analysis must be combined in an algorithm suitable for implementation in next generation ICDs.

Materials and Methods

The augmented two-channel arrhythmia detection (A2CAD) method, an on-line algorithm that employs information from both the atrial and ventricular channels, has been designed for arrhythmia diagnosis for implantable devices. The scheme utilizes rate analysis of atrial and ventricular activation as a preliminary analysis.[1] This is sufficient to recognize most arrhythmias in which atrial activation predominates or in cases in which ventricular activation predominates. In cases where atrial and ventricular activation are equal, that is, a 1:1 relationship, morphological analysis of each channel is invoked to further characterize the arrhythmia.[2] Morphology is classified as normal or abnormal by computing a cross correlation between the waveform under analysis and a stored template.

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Results

A2CAD was tested on recordings of bipolar intraatrial and intraventricular electrograms (1 cm, 1–500 Hz) acquired during electrophysiology studies. The 40 patient cases (10–50 s) analyzed included 6 atrial flutters, 4 atrial fibrillations, 6 supraventricular tachycardias, 2 sinus tachycardias, 12 ventricular tachycardias, 7 ventricular flutters, and 3 ventricular fibrillations. A2CAD successfully diagnosed 40 of 40 cases for an overall success rate of 100%.

Conclusion

An innovative method (A2CAD), which uses rate augmented by morphologic analysis of both atrial and ventricular channels to derive accurate diagnosis of complex arrhythmias, has been shown to be effective and efficient. Incorporation of fast morphological algorithms[3] is planned for future versions, which may be feasible for use in implantable devices.

References

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