

Evaluation of a Shock Advisory System with Non-Shockable Pediatric Rhythms

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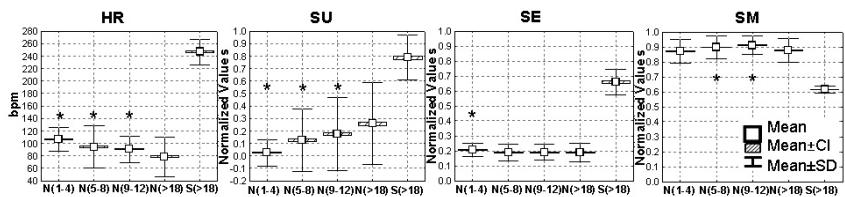
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There are evidences for significant differences between pediatric vs. adult electrocardiogram (ECG). A supplementary validation of the shock advisory system (SAS) in automatic external defibrillators (AED) with pediatric ECGs is required. This study aims to assess the influence of non-shockable pediatric ECG on particular SAS criteria and to validate the SAS specificity (Sp).

The study uses an own pediatric ECG database from lead II holter recordings of 46 children - healthy and cardiac patients. A number of 10301 ten-second strips of non-shockable (N) rhythms are adopted for analysis. Adult ECG database (MIT-vfdb) is applied for derivation of reference SAS criteria values for N and shockable (S) rhythms.

Specific ECG analysis criteria of an AED SAS are evaluated: heart rate (HR), slope uniformity of positive vs. negative peaks (SU), deflections from signal extrema (SE) and signal mean (SM) in a narrow frequency band for QRS complexes enhancement.

The SAS criteria are estimated in the following groups: (i) N(1-4) for N rhythms in children from 1 to 4 years; (ii) N(5-8); (iii) N(9-12); (iv) N(>18) for N rhythms in adults; (v) S(>18) for S rhythms in adults (see figure). Pediatric vs. adult N rhythms show significant differences in all criteria for groups N(1-4), N(5-8), N(9-12) compared to N(>18), $p < 0.05$. Exceptions are: SE in N(5-8), N(9-12) vs. N(>18), $p > 0.2$; SM in N(1-4) vs. N(>18), $p = 0.12$. Comparisons in Mahalanobis space of HR, SU, SE, SM for S(>18) vs. N(1-4), N(5-8), N(9-12), N(>18) show that pediatric N rhythms are further away from S(>18) than adult N rhythms from S(>18). This is beneficial for correct recognition of pediatric N rhythms. The SAS validation for N(1-4), N(5-8), N(9-12) respectively present $Sp = 100\%$ (1796/1796), 99.8% (4557/4568), 100% (3937/3937), higher than N(>18) with $Sp = 99.6\%$ (2439/2448).



Box-Plot distribution of 4 SAS criteria for pediatric and adult rhythms.

* $p < 0.05$: comparison of pediatric N(1-4), N(5-8), N(9-12) vs. N(>18)