Automatic computerized evaluation of resting ECG in preparticipation screening of young athletes: validation study

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Introduction:
There is ongoing debate on inclusion of resting ECG as part of pre-participation examination of asymptomatic competitive athletes. The aim of this study was to test newly designed computer algorithm for detection of ECG abnormalities according to the Seattle criteria for pre-participation examination of adolescent and young adult athletes.

Methods:
Seattle criteria were split into 16 binary items and final binary statement was added. Computerized standard 12-lead ECGs were obtained using a device compatible with AHA standards (BTL 08-LC, BTL Industries, UK) from consecutive examinations of athletes and from selected patients with cardiac disease of comparable age. Reference evaluation of all items in all records was obtained by agreement of two skilled physicians. Prototype of computer algorithm was developed as extension of marketed software (BTL CardioPoint 2.23) developed by Medical Technologies CZ, a.s. Items were classified (highest priority first) as abnormal, borderline or normal. Borderline ranges of measured parameters (e.g. PR interval, QRS duration) were extension of abnormal range depending on mean error of automatic measurement. Both abnormal and borderline findings were regarded to reflect pathology. If automatic algorithm failed to evaluate the item was classified unknown. Final statement was based on one or more items with the highest priority.

Results:
Comparison of computer algorithm with reference was performed on 316 records (258 athletes, 58 patients). Sensitivity/specificity varied considerably in particular items between 22-100/56-100 % with lowest values for pre-excitation/ST segment depression. Negative predictive value was high (98-100 %). Unknown classifications occurred in 3/16 items: left atrial enlargement (11 % of records), intra-ventricular conduction delay (2 %) and pre-excitation (1 %). Sensitivity/specificity/negative predictive value of the final statement was 100/23/100 %.

Conclusions:
The study demonstrates that automatic computerized evaluation may be suitable as the initial step of the pre-participation ECG screening process because it has a high negative predictive value and successfully eliminates part of normal records. Low sensitivity for some criteria (pre-excitation) and low specificity limits, however, its current use. (Supported by MH CZ – DRO, University Hospital Motol, Prague, Czech Republic 00064203 and TA2-1258 Technology Agency of the Czech Republic)