Phonocardiography-based mitral valve prolapse detection using an artificial neural network

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References:


Abstract:

Mitral valve prolapse (MVP) is the most common valve anomaly and the most frequent cause of isolated mitral insufficiency. MVP has a mostly benign course and prognosis in childhood; however, complications, such as severe mitral regurgitation, infectious endocarditis, pulmonary embolism, arrhythmia and sudden death, occur more often in elderly people, demonstrating the need for prompt diagnostics and prevention. Due to its frequent occurrence, failures in diagnosing MVP and the clinical importance of early MVP detection, the aim of this study was to develop an original, non-invasive and easily applicable diagnostic method for MVP detection in children and adolescents by using an artificial neural network (ANN). Cardiac sounds were recorded by auscultation using electronic stethoscope in 48 children with MVP, 49 healthy children and 38 children with a pathological heart murmur from atrial septal defect (ASD), ventricular septal defect (VSD), ductus arteriosus persistence (DAP), aortic stenosis (AS), pulmonic stenosis (PS), aortic coarctation (ACo), mitral regurgitation (MR), mitral insufficiency (MI) and tricuspid insufficiency (TI). In electronic stethoscopes, the sound is archived in the internal memory of the stethoscope and then transmitted to a computer by a transmitter. Basic software for the check-up and sound analysis is provided along with the electronic stethoscopes and provides a phonocardiograph and spectral presentation of auscultative findings. For further qualitative analysis, the digital form (format *.e4k) of the phonocardiogram is transformed into standard *.wav format, which is the first step in the processing of the digital signal for studying and testing with an ANN. The obtained precision of MVP classification category was 71.2%. These results may be interesting for the phonocardiograph diagnosis of MVP in children and adolescents.

Keywords:

phonocardiography, mitral valve prolapse, neural network