

## Pediatric Cardiology 2017: Heart sounds auscultation, past, present and future - Amir A Sepehri - CAPIS Biomedical R&D Department

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Heart sound auscultation is also known as Cardiac Auscultation has been used as a screening technique for investigating cardiac condition over several years. The earliest notice of the heart sounds comes from William Harvey's *De Motu Cordis* in 1628, in which he likened the heart sounds to "two clacks of a water bellows to raise water". There are evidences demonstrating that this technique was utilized during Old Persian and Egyptian civilization to check heart condition but, the biggest breakthrough came on 1816, when the French physician, Ren Laennec, invented the first stethoscope by curving a wooden cylinder. After the invention of stethoscope, numerous diagnostic features of this technique were understood by the doctors and later, the phonocardiography turned into a significant instrument for cardiac diagnosis within 1950s. With advances in technology, there has been wide development of traditional stethoscope and this has allowed us to beat a number of the previous acoustic limitations once victimization traditional stethoscopes. Electronic stethoscopes have the power to amplify the center sounds, filter sound frequency and eliminate ground noise. Moreover, a key to reinforcing teaching by the side, newer generation models are capable of storage and playback of heart sounds far away from the patient through an external supply or laptop. The concept of mixing such a medical instrument with laptop package that would visualize the murmur and heart sounds as a way of facilitating college boy teaching was projected many years past. This tool provides a plot of heart audio recording on a rolling paper.

In any case, after the creation of cardiovascular ultrasound imaging in Lund, Sweden, phonocardiography turned out to be less valued by the cardiologists on account of the enlightening graphical portrayal, provided by echocardiography, which is still suggested by the pertinent associations as the tool with central role in diagnosis. In Doppler echocardiography, disease diagnosis depends on the direct and indirect measurement and calculation of the operator. This attributes subjectivity to the approach, even though it has been objectively accepted by the cardiology community, which is considered as a drawback of the approach that limits its application to the expert clinicians, and access to such expert clinicians is not easy especially in the rural places. Heart sound auscultation is therefore, employed altogether the medical settings because the first screening approach, which is by far a less costly method.

Due to progresses in signal processing and AI, many studies aimed to associate intelligence with the guts sound auscultation technique to enhance screening accuracy in cardiac auscultation specially, in children, where the accuracy is substantially impaired by innocent murmurs. An examination in Johns

Hopkins University, USA, demonstrated that the screening precision in pediatrics cases is as low as 40% in family specialists, which can be somewhat improved by utilizing computer-assisted auscultation.

An automated tool for screening congenital heart condition in infants and in children is achievable by using our unique processing method, named Arash-Band that has been internationally patented. Such a handling strategy was fused into proper graphical UI and installed on a portable processing unit, to be utilized by the practitioners or nurses in primary healthcare centers places for an improved screening. This computerized framework, which we call it Pouya-Heart, has incredible consistence with echocardiography for identifying CHD and CCHD. Our proposed advanced phonocardiograph is currently accessible available. One of the interesting capabilities of the system is its discrimination power in separating innocent murmurs from the pathological ones. Further endeavors are made to lift applicability of the digital phonocardiograph from the screening to diagnosis by adding intelligent algorithms for the disease detection. The Arash-Band method might be implemented on smartphones and web technology, which can end in a homecare system for pediatric heart condition screening. It is implied that the digital phonocardiograph tends to supply rather diagnostic information within the future and avails echocardiography to those of need, where decision for an appropriate therapeutic is critical. Whereas technological advancements, like diagnostic procedure, may perhaps have contributed to the ending of internal organ listening, technology within the variety of integrated electronic listening may perhaps revive its place in clinical medication. Many factors have conspired to limit adequate teaching and maintenance of internal organ listening skills. So the necessities and expectations of junior doctors, with relation to listening, are much lower currently than in previous generations.