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Original Article

Utility of physical examination and comparison to echocardiography for cardiac diagnosis

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ABSTRACT

Objective: To find out the accuracy of cardiac auscultation using non-digital stethoscope in physical diagnosis of cardiac diseases.
Methods: We enrolled 104 consecutive patients with abnormal cardiac auscultatory findings attending cardiology clinic and not previously evaluated by echocardiography. One time detailed cardiac physical examination followed by echocardiography within 1 month was undertaken. Agreement between two methods was calculated using mean pair percentage agreement, kappa statistics (κ) and calculation of 95% confidence interval (CI) for kappa statistics.
Results: Using kappa statistics, there was almost perfect agreement between cardiac auscultation and echocardiography for the detection of mitral stenosis ($\kappa = 0.865$; CI 0.76–0.97) and ventricular septal defect ($\kappa = 0.872$; CI = 0.73–1.01). Substantial agreement was noted for aortic stenosis ($\kappa = 0.752$; CI = 0.56–0.94), pulmonary stenosis ($\kappa = 0.647$; CI = 0.33–0.97) and atrial septal defect ($\kappa = 0.646$; CI = 0.32–0.97), while moderate agreement was found for mitral regurgitation ($\kappa = 0.470$; CI = 0.30–0.64), aortic regurgitation ($\kappa = 0.456$; CI = 0.25–0.66) and tricuspid regurgitation ($\kappa = 0.575$; CI = 0.38–0.77).

For combined mitral stenosis and mitral regurgitation lesions, almost perfect agreement was found for mitral stenosis ($\kappa = 0.842$; CI = 0.691–0.993) while fair agreement noted for mitral regurgitation ($\kappa = 0.255$; CI = −0.008 to 0.518).
Conclusion: Careful clinical auscultation using a stethoscope remains a valuable tool for cardiac diagnosis. Decision on initial diagnosis and management of valvular and congenital heart diseases should be based on clinical examination and integrating such information with echocardiography as required.

What is already known?

Physical examination is a sensitive tool for diagnosis of cardiac diseases.
Echocardiography is rapidly supplanting and often used as an alternative to physical examination diagnoses at first patient encounter.

What this study adds:

Physical examination is still a valid tool for diagnosis of cardiac diseases. Structured training in physical methods including cardiac auscultation should be part of undergraduate and postgraduate teaching curriculum in India.

1. Introduction

Despite the glorious past of cardiac auscultation and thrill of making bedside diagnoses, proficiency in this clinical skill has been deteriorating over past many decades.[1–5] Further, some North American medical schools are providing medical students with hand held pocket ultrasound equipments to make a cardiac diagnosis with the ultrasound equipment on first patient encounter rather than using stethoscope.[6,7] Should stethoscope be discarded as a cardiac diagnostic tool on the pretext of its limited diagnostic yield? In the resource poor settings, cardiac auscultation should continue to serve as a useful tool to

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physicians for taking immediate clinical decisions on encountering patients.

There are many situations, in which clinical examination provide important insight into disease condition, which may not be provided by echocardiography in a given context. Recent editorial in the Journal of the American College of Cardiology has clearly identified few of such situations.[8]

We planned this study to find out the accuracy of cardiac auscultation using non-digital stethoscope in physical diagnosis of cardiac diseases compared to gold standard echocardiography to know its utility in current times to avoid over utilization of echocardiography resources in initial cardiac diagnosis.

2. Methods

2.1. Selection of patients

We enrolled all consecutive patients with cardiovascular diseases attending cardiology clinic at M.Y. Hospital, Indore with abnormal cardiac auscultatory findings from February 2015 to September 2015. Patients who had echocardiography evaluation earlier at any time were not included. The study protocol was approved by institutional Ethics and Scientific review board and a valid informed consent was obtained from all patients prior to inclusion in the study. Additionally children above 7 years gave assent for participation.

2.2. Study design

This is a cross-sectional, observational study with one time clinical examination and echocardiography of patients enrolled in the study.

First, the patients were selected on outpatient basis, based on having some abnormal cardiac auscultatory findings. They were physically examined by senior most cardiologist using non-digital Littmann Master Cardiology stethoscope and detailed findings on inspection, palpation, percussion and auscultation were recorded. The examining cardiologist had an experience of 30 years in cardiology practice. It was assumed that physical examination by a senior faculty would provide best possible accuracy in physical examination. Murmurs were characterized in terms of location, grading and timings in cardiac cycle. Characteristics of heart sounds, extra sounds and abnormal sounds were also noted. The examining cardiologist was allowed to have sufficient time for performing clinical examination but not allowed to have access to history and other investigations of the patients before committing and recording physical examination in a standardized format. The intra-observer variability for assessment of lesion severity was less than 5%.

Most of the patients underwent echocardiographic evaluation on the day of examination but some within 1 month of auscultation. This included M-Mode, 2-D, Colour Flow Mapping, pulse wave and continuous wave Doppler using adult and pediatric transducers (GE Logic-3 Expert Machine, GE medical system, Phoenix, AZ, USA). The echocardiographer had no knowledge of clinical findings and was allowed to have sufficient time as may be required for performing echocardiography.

2.3. Outcome measures and statistical analysis

Echocardiography was considered as a gold standard diagnostic test. Agreements between echocardiographic diagnoses were compared with auscultatory diagnoses using kappa statistics.[9–11] Since kappa statistics requires number of categories of observation to be same between the two observers, lesions diagnosed as trivial on the echocardiographic basis were recorded as equivalent to no lesion for the purpose of calculation of kappa statistics. Kappa statistics was calculated both for agreement on presence or absence of disease as well as for agreement on the severity of disease in question. Table 1 shows interpretation of calculated kappa statistics.[10] Mean pair agreement index (observed percentage agreement) for each diagnosis was also calculated.[12] Calculation of 95% confidence interval (CI) was done to further characterize agreement based on the kappa statistics.

Table 1
Interpretation of kappa.[9,10]

Kappa	Agreement
<0	Less than chance agreement
0.01–0.20	Slight agreement
0.21–0.40	Fair agreement
0.41–0.60	Moderate agreement
0.61–0.80	Substantial agreement
0.81–0.99	Almost perfect agreement

SPSS version 20.0 was used for analyzing the data. In situations, where it did not provide direct output like 95% confidence interval for kappa statistics, manual calculations were performed.

3. Results

A total of 104 patients were included in the study with age ranging from 2 to 85 years. Most of the patients were of 21–50 years age group (56%).

A total of 210 diagnoses were sorted out based on echocardiographic findings. Majority of cases had valvular disease of rheumatic etiology with many of them having multivalvular involvement, others had congenital heart diseases. Most common diagnoses in decreasing order of frequency were mitral regurgitation (MR, 37.5%), mitral stenosis (MS, 31.7%), aortic regurgitation (AR, 24%), tricuspid regurgitation (TR, 23.1%), aortic stenosis (AS, 30.5%), ventricular septal defect (VSD, 12.5%), pulmonary stenosis (PS, 6.7%) and atrial septal defect (ASD, 5.8%) (Table 3). Single cases of patent ductus arteriosus (PDA), cor triatriatum, ruptured sinus of valsalva into right ventricle (RSOV) and aortic valve prolapse (AVP) were also noted.

Among patient with rheumatic heart diseases, mitral valve was most often involved, both clinically and by echocardiography. Mixed lesions were frequent, with combined MS + MR being most common (16.34%), followed by combined MR + AR (11.53%), MS + AR (6.73%), MR + AS (3.84%), MS + AS (1.92%) and MS + MR + AS + AR (1.92%). Five patients were found to have occult MS. Atrial fibrillation was found in 16 patients, of which 9 were having underlying mitral stenosis.

3.1. Valvular heart diseases

In general, agreement between clinical auscultation and echocardiography was better for detection of stenotic lesions as compared to regurgitant lesions (Table 2). Almost perfect agreement was noted for detection of MS ($\kappa = 0.865$; CI 0.76–0.97) while substantial agreement was found for AS ($\kappa = 0.752$; CI = 0.56–0.94).

Moderate agreement was noted for TR ($\kappa = 0.575$; CI = 0.38–0.77); MR ($\kappa = 0.470$; CI = 0.30–0.64) and AR ($\kappa = 0.456$; CI = 0.25–0.66).

In general, agreement on disease severity was inferior to that of disease detection only (Tables 3 and 4). Taken isolated and mixed lesions together, there was substantial agreement for assessment of severity of disease for MS ($\kappa = 0.704$; CI = 0.58–0.83) and moderate agreement for AS ($\kappa = 0.569$; CI = 0.38–0.76), and TR ($\kappa = 0.454$; CI = 0.29–0.62). Fair agreement was noted for severity assessment of MR ($\kappa = 0.326$; CI = 0.18–0.47). Only slight agreement was found for severity assessment of AR ($\kappa = 0.018$; CI = −0.01 to 0.04).

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