



Journal of Medical Sciences

ISSN 1682-4474

science
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Short Communication

JMS (ISSN 1682-4474) is an International, peer-reviewed scientific journal that publishes original article in experimental & clinical medicine and related disciplines such as molecular biology, biochemistry, genetics, biophysics, bio-and medical technology. JMS is issued eight times per year on paper and in electronic format.

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J. Med. Sci., 7 (4): 704-706
15th May, 2007

Power of Portable and Digital Phonostethoscope Designed in Iran in Diagnosis of Valvular Heart Diseases

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The objective of present study determine the sensitivity, specificity, positive predictive value, negative predictive value, likelihood ratio of negative and positive tests and accuracy of portable and digital phonostethoscope designed in Iran in diagnosis of valvular heart diseases. One hundred patients who were admitted to electrocardiographic ward underwent simultaneous physical exam with conventional stethoscope, electronic stethoscope and phonocardiographic study. Transthoracic echocardiography was performed in all patients after these studies. The sensitivity, specificity and accuracy of Phonostethoscope in diagnosis of Valvular heart disease was 79, 80 and 80%, respectively. Portable digital phonostethoscope has acceptable accuracy in detecting valvular heart diseases.

Key words: Phonocardiogram, electronic stethoscope, valvular heart disease, specificity, sensitivity

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INTRODUCTION

Valvular heart diseases are in common cardiologic problems (Schoen, 2005). Physical exam with stethoscope in many cases missed the diagnosis of valvular heart Diseases even among experienced cardiologists (Petty *et al.*, 2005).

Phonocardiogram is a promising, noninvasive diagnostic tool for the assessment of valvular heart diseases (Surawicz *et al.*, 1998). It is also helpful for identifying patients with nonvalvular heart diseases (Xiao *et al.*, 2002).

The purpose of this study was to design a quick, simple, cost ratio and noninvasive Portable-Digital phonostethoscope with small size that assembles on traditional stethoscope for such evaluations at the bedside (for in-patients), in the clinic (for outpatients) or even at home. The most benefit of this device is that it converts the traditional stethoscope to phonocardiogram and electronic stethoscope.

MATERIALS AND METHODS

Patients: The population of this Diagnostic study consisted of a series of 100 consecutive Patients (38 male and 62 female aged between 84-35) admitted to echocardiographic ward of loghman hospital during 2005 to 2006. For sensitivity and specificity of 10±85% with confidence level of 95% we needed 50 subjects with valvular heart disease and 50 subjects without valvular heart disease. When the number of each non valvular heart disease and valvular heart disease reached to 50, the sampling was stopped.

The patients underwent simultaneous examining with electronic stethoscope and phonocardiogram before transthoracic electrocardiography (gold standard). Data analysis were performed by 3 investigators who were blinded from each other. In step one, patients were examined with electronic stethoscope by senior resident of heart disease and documented his findings on questionnaire No.1. Then patients were examined with phonocardiography by senior resident of Internal medicine (Designer of Device) and the second questionnaire was completed. At last transthoracic echocardiography (ESAOI CHALLENGE) was done by cardiologist and the last questionnaire was completed.

All patients gave informed consent and the study was approved by the Ethical Committee of Shaheed Beheshti University of Medical Science.

Statistical methods: Sensitivity, specificity, positive predictive value, negative predictive value, likelihood ratio of positive and negative tests and accuracy of device were obtained according to standard definitions.

RESULTS

To detect the power of portable digital phonostethoscope we compare the device with the gold standard echocardiogram in order to determine the sensitivity, specificity, accuracy, positive predictive value, negative predictive value, likelihood ratio of a positive test and Likelihood ratio of a negative test for both components of device (electronic stethoscope and phonocardiogram) which is shown in Table 1.

DISCUSSION

The present study has evaluated the power of portable digital phonostethoscope in detecting valvular heart diseases and according to the results of the study, this device has acceptable sensitivity, specificity and accuracy in screening valvular heart diseases.

Many studies have shown that phonocardiogram is a promising, non invasive tool for the diagnosis of different heart diseases.

One of the benefits of phonocardiogram is recording the heart sounds and its accessibility in future. Time interval between opening snap and A2 or time interval between P2 and A2 are helpful in assaying the severity of mitral stenosis and pulmonary stenosis respectively (Surawicz *et al.*, 1998). It is also a good tool for screening classification of Aortic stenosis before any methods are used Sun *et al.* (2005). Phonocardiogram can screen pulmonary stenosis and Atrial septal defect (Debbal and Bereksi-Reguig, 2005). This device can also screen the patients with pulmonary hypertension and eliminate the need for invasive catheterization (Gamboa *et al.*, 1999). With measuring left ventricular ejection time and preejection time and the ratio of them, the power of heart contractility is estimated and therefore screening of muscular heart diseases is possible (Singh, 2004). Because

Table 1: Comparison between electronic stethoscope and phonocardiogram with echocardiography

	Number	Specificity (%)	Sensitivity (%)	PPV (%)	NPV (%)	LR negative	LR positive	Accuracy (%)
Pho-VHD	50	80	79	87	70	0.26	3.95	80
Es-VHD	50	94	68	95	64	0.34	11.33	78

Es = Electronic stethoscope, VHD = Valvular Heart Disease, Pho = Phonocardiogram, PPV = Positive Predictive Value, NPV = Negative Predictive Value, LR = Likelihood Ratio

phonocardiogram can detect S3 and S4, has capability to screen ischemic heart diseases (Arnow *et al.*, 1997).

The benefit of our device in addition to being a phonocardiogram, is its converting the traditional stethoscope to electronic stethoscope. Also it is a portable and cost effective device at the bedside (for in-patients), in the clinic (for outpatients) or even at home.

Because most patients visit a general physician, screening of heart diseases with this device can prevent the complications. The device can record the findings and Email it for consultation.

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