

An assessment of the clinical utility of echocardiography criteria in a Tertiary Health Center

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ABSTRACT

Background: The rising prevalence of cardiovascular diseases in the population has increased the demand for cardiovascular imaging procedures (specifically echocardiography) in our center. **Aim:** To determine the percentage of appropriate indications for echocardiography. **Materials and Methods:** This was a prospective study conducted over a period of 1 year in the Department of Medicine of a Tertiary Health Care Center. The clinical diagnoses by the referring clinician and the indications (specific reasons for the study) for the echocardiography were consecutively recorded. The age and gender of the patients were also recorded. The indications were given a score of one to nine according to the revised appropriate use criteria of the American College of Cardiology Foundation and the American Society of Echocardiography (ASE). These indications were then classified into appropriate, inappropriate or uncertain based on the score. (1-3)-inappropriate use, (4-6) were derived. **Results:** There were 25 indications, 16 (64%) were appropriate, 6 (24%) were inappropriate and three (12%) were rated as uncertain. **Conclusion:** Sixty-four percent of the indications for echocardiography are appropriate for the procedure. This implies that the criteria for echocardiography are yet to be fully implemented resulting in overutilization of the procedure.

Key words: Echocardiography, criteria, utility

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INTRODUCTION

Echocardiography is a noninvasive, diagnostic cardiovascular imaging procedure. It is the most commonly utilized imaging technique in the evaluation of patients with suspected or known cardiovascular disease besides chest radiograph.¹

It is useful in determining structural and functional cardiac statuses. It is also of prognostic value and a research tool.²

Echocardiography was invented by Elder and Hertz in 1954, but it was introduced in Nigeria in the mid-seventies by Lawal *et al.*³ Since then the practice of echocardiography has grown phenomenally and it is now routinely performed in most tertiary health

institution across the country. It has a high degree of sensitivity and specificity when performed by experienced personnel.

Several professional bodies have published guidelines in an attempt to ensure its rational use. The American College of Cardiology Foundation (ACCF) and the American Society of Echocardiography (ASE) published the first appropriate use criteria (AUC) for transthoracic echocardiography in 2007 which was recently revised in 2011.⁴

In recent years, there has been a remarkable increase in the demand for all forms of cardiovascular imaging worldwide^{5,6} specifically echocardiography in our institution. This increase in utilization has the potential for misuse, which invariably increases the costs to the patients, health insurance companies, and the hospital.

Several studies on echocardiography have been conducted in the country, but none has appraised its use in terms of the appropriateness of the indications for the procedure. It is, therefore, expedient to assess the clinical implementation of the criteria for echocardiography.

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MATERIALS AND METHODS

This was a prospective study, and the protocol was approved by the hospitals research and ethics committee. All the echocardiography studies performed within 1-year were consecutively enrolled. The variables included the age, gender, and the clinical scenario (diagnosis by the referring clinician). The indications (specific reasons for ordering the procedure) were also recorded.

The studies were then categorized based on the clinical scenario. Each of the indications was scored on a scale of 1-9 according to the revised AUC of the ACCF/ASE. These scores were then used to rate the indications as appropriate, inappropriate, or uncertain.

These criteria were applied in this study because there are no indigenous criteria for echocardiography in our locale.

Score of 1-3 (inappropriate indication)

Echocardiography is not generally acceptable and not a reasonable approach for the indication.⁷

Score of 4-6 (uncertain indication)

Echocardiography may be generally acceptable and may be a reasonable approach for the indication. More research and/or patient information is needed to classify the test definitively.⁷

Score of 7-9 (appropriate indication)

Echocardiography is generally acceptable and is a reasonable approach for the indication. That is a study in which the expected incremental information, combined with clinical judgment, exceeds the expected negative consequence by a sufficiently wide margin for a specific indication.

The revised AUC criteria derived its indications from common clinical applications or anticipated uses, as well as from current practice guidelines and are regularly updated based on evidence from studies examining the implementation of the original AUC.

The criteria were based on five broad groups of indications regarding the possible use of echocardiography:

1. For initial diagnosis;
2. To guide therapy or management, regardless of symptom status;
3. To evaluate a change in clinical status or cardiac examination;
4. For early follow-up without change in clinical status; and
5. For late follow-up without change in clinical status.

In general, the indications were rated as appropriate when echocardiography was requested for initial evaluation of structure and function, a change in clinical status or when the results of the echocardiogram are anticipated to change patient management. Routine testing when there was no change in clinical status or when results of testing were unlikely to modify management were rated as inappropriate or uncertain.

Statistical analysis

Data were analyzed with SPSS version 16 (SPSS Inc, Chicago). The mean age of the patients was derived, and the frequency of the gender determined. The percentage of the appropriate indications was determined by the number of appropriate indications/total number of indications × 100. The percentages of the inappropriate and uncertain indications were also determined.

RESULTS

A total of 796 studies were recorded, 21 were excluded because of inadequate data while 775 were analyzed. The mean age of the patients was 43.28 ± 27.2 years. Echocardiography was requested for in the setting of 15 different clinical scenarios. There were 25 indications. 16 (64 %) of the indications were appropriate, 6 (24%) were inappropriate and 3 (12%) were rated as uncertain. Of the 775 studies 605 (78.1%) were appropriate studies, 146 (18.8%) were inappropriate while 24 (3.1%) were uncertain.

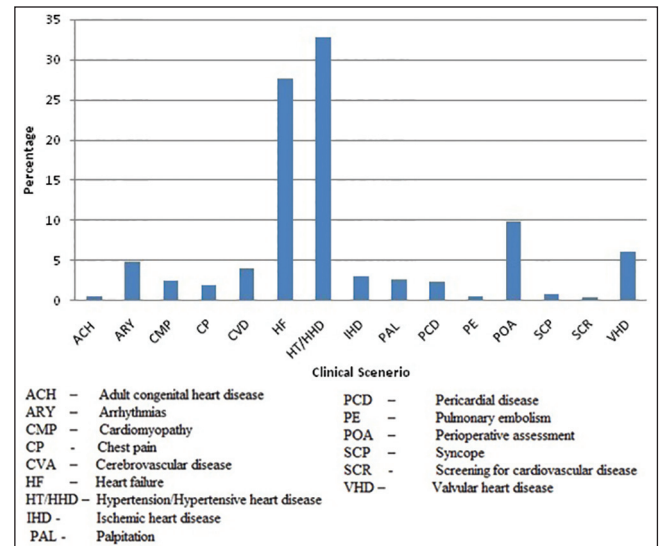


Figure 1: Frequency of clinical scenario. ACH – Adult congenital heart disease; ARY – Arrhythmias; CMP – Cardiomyopathy; CP – Chest pain; CVA – Cerebrovascular disease; HF – Heart failure; HT/HHD – Hypertension/hypertensive heart disease; IHD – Ischemic heart disease; PAL – Palpitation; PCD - Pericardial disease; PE – Pulmonary embolism; POA – Perioperative assessment; SCP – Syncope; SCR - Screening for cardiovascular disease; VHD – Valvular heart disease

Table 1: Rating and frequency of indications

Clinical scenario/reason for test (indications)	Score	n (%)
Heart failure		
Initial evaluation of heart failure	9 (A)	140 (18.1)
Acute deterioration of heart failure	8 (A)	74 (9.5)
Hypertension/hypertensive heart disease		
Routine evaluation of hypertension	3 (I)	91 (11.7)
Initial evaluation of hypertensive heart disease	8 (A)	150 (19.3)
Routine follow-up of known hypertensive heart disease	4 (U)	14 (1.8)
Perioperative assessment		
Preoperative evaluation of cardiac function with features of cardiovascular disease	9 (A)	50 (6.5)
Routine preoperative evaluation of cardiac function	2 (I)	26 (3.3)
Ischemic heart disease		
Evaluation of ventricular function after acute coronary syndrome	9 (A)	23 (3.0)
Valvular heart disease		
Initial evaluation of suspected valvular heart disease	9 (A)	40 (5.2)
Routine surveillance of valvular heart disease	6 (U)	7 (0.9)
Cerebrovascular disease		
Stroke with suspected cardiac etiology	9 (A)	31 (4.0)
Pericardial disease		
Suspected pericardial disease	9 (A)	18 (2.3)
Cardiomyopathy		
Initial evaluation of cardiomyopathy	9 (A)	16 (2.1)
Routine surveillance of known cardiomyopathy	5 (U)	3 (0.4)
Chest pain		
Clinical features suggestive of cardiac etiology	9 (A)	10 (1.3)
Routine evaluation of chest pain	2 (I)	5 (0.6)
Palpitation		
Clinical features suggestive of cardiac etiology	9 (A)	14 (1.8)
Routine evaluation of palpitations	2 (I)	7 (0.9)
Arrhythmia		
Atrial fibrillation	8 (A)	18 (2.3)
Infrequent atrial and ventricular premature complex	2 (I)	13 (1.7)
Frequent ventricular premature ectopic	8 (A)	7 (0.9)
Syncope		
Syncope with symptoms suggestive of cardiac disease	9 (A)	6 (0.8)
Adult congenital heart disease		
Initial evaluation of adult congenital heart disease	9 (A)	5 (0.6)
Screening		
Screening for cardiac disease in first degree relatives of patients with genetic cardiac conditions	9 (A)	3 (0.4)
Pulmonary embolism		
To establish diagnosis in suspected pulmonary embolism	2 (I)	4 (0.5)
Total		775 (100)

A – Appropriate; I – Inappropriate; U – Uncertain

DISCUSSION

The results show that sixty four percentage of the indications for echocardiography were appropriate for the procedure in our center. This is a modest result, for a tertiary hospital setting where the best medical practice should be the norm. The most likely explanation for this finding is that besides the specialist physician

(cardiologists), other clinicians also manage patients with cardiovascular diseases and as such request for echocardiography. This is due to the high prevalence of cardiovascular diseases in the population and the limited number of cardiologists. These noncardiologists are not conversant with the criteria for echocardiography and so more likely to misuse the procedure compared with the cardiac physician. The partial utility of the criteria for echocardiography invariably results in overutilization of the procedure.

In a study by Patil *et al.*,⁸ 82% of the indications were appropriate for echocardiography while Ballo *et al.*⁹ reported 80.3% in a study of 931 patients in a community hospital. These higher rates of appropriate indications can be attributed to better awareness and utility of the criteria for echocardiography. This is most probably due to the existence of indigenous criteria in their practice. Unfortunately, there are no similar local studies in the literature with which to compare our results.

The results also show that 24% of the indications were inappropriate this is lower than the appropriate indications but can be reduced further to ensure better use of echocardiography and management of patients and hospital's scarce resources. The inappropriate indications in the aforementioned studies were lower than that of this study because of their higher rate of appropriate indications.

Only 3 (12%) of the indications were rated as uncertain. The explanation is that the uncertain indications in the AUC criteria are primarily concerned about periodic surveillance or monitoring the progression of cardiac disease after the initial study. Patients usually do not show up for serial follow-up studies after the initial study except they have worsening symptoms. This may be due to financial constraint or lack of motivation.

The results show that echocardiography was most commonly requested for in the clinical setting of hypertension and heart failure [Figure 1]. This reflects the high prevalence of hypertension in the population. Heart failure is also common because most patients present to the hospital late in the course of the disease when the cardiac function has already been compromised. Ogah *et al.*¹⁰ reported a similar finding in their study of the use, problems, reproducibility, and potentials of echocardiography in Nigeria.

The two most common appropriate indications for echocardiography were an initial evaluation of hypertensive heart disease and heart failure (19.9% and 18.1%), respectively [Table 1]. Most of the inappropriate studies were due to the routine evaluation of hypertension and preoperative assessment of ventricular function even in the absence of evidence of cardiovascular disease

[Table 1]. Other inappropriate indications include clinically insignificant arrhythmias such as occasional atrial or ventricular premature complexes.

All the indications reviewed in this study were captured in the AUC. This is not surprising as the revised AUC is an improvement on previous editions and covers more clinical scenarios than the previous editions.^{11,12}

One of the limitations of this study is that the criteria applied were developed in a different locale so it may not be fully applicable in our practice. The results cannot also be generalized to other tiers of healthcare delivery as the results may differ if conducted in a private hospital or secondary health care facility.

Proposed recommendations to improve the clinical implementation or the use of echocardiography include education of health care providers concerned with the management of cardiovascular diseases about the criteria for echocardiography. This will significantly reduce the number of inappropriate indications and studies. All requests for echocardiography should be screened for appropriateness of indication prior to the procedure.

CONCLUSION

Sixty-four percent of the indications for echocardiography were appropriate, which implies that the criteria for echocardiography are being utilized although, it is yet to be fully implemented. This has resulted in overutilization of the procedure. Institution of the recommendations mentioned above will further improve the clinical utility of the criteria and the use of echocardiography.

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