Original Article

A single-centre audit of request forms and the 2011 appropriate use criteria for transthoracic echocardiography

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Abstract

Background: Transthoracic echocardiography (TTE) is a useful diagnostic tool in cardiology practice. The information provided by the requesting physician is a helpful guide in the interpretation of findings. This study aimed to audit echocardiography request forms (ECFs).

Methods: A 3-year retrospective audit of echocardiography request forms (ERFs) received at a community-based echocardiography centre in Delta State, Nigeria. Delta State University Teaching Hospital Health Research Ethics Committee granted ethical approval to conduct this study. Data extracted from the ERFs were patients' name, age, sex, address and indication/background clinical information, the name and signature of requesting physician, name of referring hospital and date of the request. Evaluation of the appropriateness of the indications for echocardiography was done using 2011 Revised American College of Cardiology Foundation's appropriate use criteria (AUC). The corresponding echocardiograms were coded as normal or abnormal reports. Data were anonymised and analysed using the SPSS software version 23.

Results: All the 412 ERFs audited had the names of the patients. The patients' age, sex and address were missing in 22.6%, 11.4% and 92.5% of the ERFs, respectively. A total of 119 (28.9%) ERFs lacked indication/clinical information and thus unclassifiable using the 2011 AUC. Of the remaining ERFs, the AUC was appropriate, inappropriate and uncertain in 259 (88.4%), 26 (8.9%) and 8 (2.7%), respectively. Majority of the ERFs with uncertain indications had normal echocardiograms. The echocardiograms of 78% (93/119) of the patients whose ERFs lacked indication/clinical information were abnormal.

Conclusion: In this study, ERFs were inadequately filled. However, majority of the stated indications/clinical information for TTE were classified as appropriate.

Keywords: Appropriate use criteria, Nigeria, open access echocardiography, request forms, transthoracic echocardiography

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INTRODUCTION

Globally, the burden of heart disease is enormous and rising.[1] Echocardiography is presently a mainstay, perhaps a baseline, investigative modality for diagnosing the presence and extent of structural and functional damage to the heart. Transthoracic echocardiography (TTE) is a noninvasive diagnostic tool. It is also a useful guide for pericardiocentesis. It competes favourably with other noninvasive cardiac imaging modalities such as computerised tomographic (CT) scan and magnetic resonance imaging (MRI).[2] It is relatively less time-consuming and more cost-effective compared to a

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CT scan and MRI. However, its use is operator dependent, and the information provided by the requesting doctor may be a useful guide in the interpretation of findings.[3]

TTE is a widely used investigative tool in developed countries. However, TTE is not readily available in most hospitals in Nigeria, especially at the primary and secondary levels of care. The demand for TTE modality is increasing. Consequently, requests for TTE come from within and outside the centres where the facility is domiciled. Indeed, this pattern is not peculiar to Nigeria.[4,5] Across the globe, requests for echocardiography are received from cardiologists and non-cardiology specialists as well as general medical practitioners. To forestall the under-use and over-use of TTE, the European Association of Cardiovascular Imaging and the American College of Cardiology Foundation (ACCF) have independently developed appropriate use criteria (AUC) for TTE.[6,7] The ACCF defined TTE requests as appropriate for initial diagnosis when there is a change in patient's clinical status or when the outcome of the echocardiography is likely to influence a change in the management. On the other hand, the request for TTE was termed inappropriate for routine testing in which there is no change in patient's clinical status or when the echocardiogram result is not likely to influence change in the management. The ACCF considered over two hundred clinical scenarios for which TTE could be requested and scored them on an arbitrary scale of 1–9. The median score for appropriate, uncertain and inappropriate use of TTE was 7–9, 4–6 and 1–3, respectively. Of the 202 clinical scenarios considered, 97 (48.0%) were appropriate, 71 (35.1%) were inappropriate, while 34 (16.8%) were uncertain.[7]

The 2011 ACCF AUC as a guide for requesting TTE is useful and applicable both in North America and other places around the world.[8-10]

However, only a few studies have evaluated the AUC for TTE in Nigeria. This study aimed to audit a cardiac diagnostic centre in Nigeria to ascertain the adequacy of basic information on the TTE request forms and the appropriateness of the request.

METHODS

This was a retrospective, descriptive study. The study site was a private community-based non-invasive cardiac diagnostic centre in Delta State, Nigeria. Requests for echocardiography were received from private and public medical practitioners around the study site. A certified consultant cardiologist performed all the transthoracic echocardiograms using the standard image acquisition techniques with a GE Logiq™ Pro echocardiography machine. Reports were generated from the interpretations of the two-dimensional and motion mode (M-mode) imaging as well as color flow and spectral Doppler imaging.

Due permission of the Centre's management was obtained before accessing their echocardiography records. The Delta State University Teaching Hospital Health Research Ethics Committee provided ethical approval for the study.

All the echocardiography request forms (ERFs) and their corresponding reports from September 2016 to August 2019 were retrieved from the Centre's archive. Requests generated from the Centre's intramural practice were excluded from the study.

The ERFs were free-form text styled. The information sought from the request forms presented for TTE were the name, sex, age, address of the patient as well as the indication/background clinical information for the investigation. Other information obtained from the ERFs was the name, signature and telephone number of the referring physician as well as the name of the referring hospital and the date of the request.

The ten items extracted from the ERFs were used as the benchmark information to determine the adequacy of the completion of ECFs. Each of the ten items was equally weighted and scored one point, equivalent to 10%. An ERF with all ten items filled was 100% completed while the forms with none of the ten items were 0% completed.

The data obtained from the ERFs were anonymized, coded and documented as present or missing from the request form. Furthermore, the provided indication/clinical scenario for TTE were classified as appropriate, uncertain and inappropriate using the ACCF 2011 AUC as a guide.[7] Based on the guide above, the indications for TTE were defined as.

Appropriate indication

This refers to stated clinical scenarios for which TTE is generally acceptable and considered reasonable.

Inappropriate indication

This refers to stated clinical scenarios for which TTE is generally not acceptable and considered unreasonable.

Uncertain indication

This refers to stated clinical scenarios for which further research is needed to determine the appropriateness or otherwise of TTE.

Request forms without clinical scenarios (background clinical information/indication) for the test were tagged as unclassified.

The accessed echocardiogram reports were coded as normal or abnormal based on the presence or absence of structural and functional abnormality of the heart.

All retrieved and coded data were inputted into a Microsoft Excel spreadsheet before exporting to the International Business Machine Statistical Package for Scientific Solutions (IBM SPSS) Statistics for Windows, version 23 software (IBM Corp., Armonk, New York, USA) for the statistical analysis. The obtained data were summarised as frequencies and percentages presented as charts and tables.

RESULTS

A total of four hundred and twelve ERFs were accessed in the period under the study. Overall, using the 10-item benchmark information sought from the ERFs, only one (0.2%) was 100% completed. The rate of completeness of the ERFs is as shown in Figure 1.

Demographic characteristics of clients

All (100.0%) the ERFs had the client's name written on them. Information on the age, sex, and address of the client were missing in 22.6%, 11.4% and 92.5% of the ERFs [Table 1]. Of the 319 ERFs with information on age, 219 (68.7%) had the age of clients stated. In contrast, 100 (31.3%) had age expressed as 'Ad,' which was assumed to represent adults. Among the 365 ERFs that indicated sex, 191 (52.3%) were females.

Details of referring physician and hospital

A little over half of the ERFs had the name of the referring hospital documented. The name and the signature of the referring physician were missing in over 40% of the ERFs [Table 1]. At the same time, only 4% of the ERFs had the phone numbers of the referring physician. All the ERFs with documented phone numbers also had the names of the referring physician. Of the 412 ERFs, only 174 (42.2%) had dates.

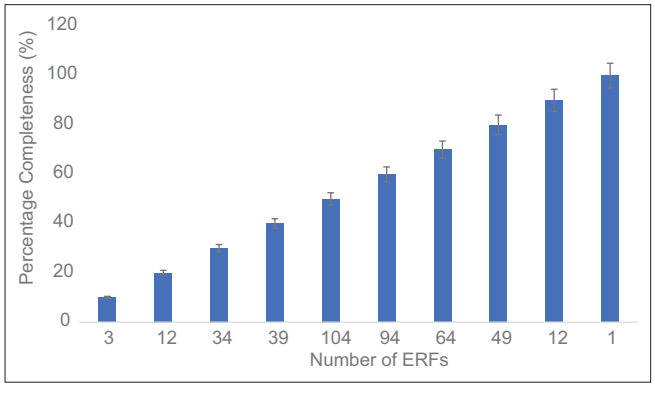

Figure 1: Percentage completeness of echocardiography request forms using the ten-item benchmark information

A total of 119 (28.9%) of the ERFs did not have any background clinical information and indication for the requested investigation and were tagged unclassified [Table 1]. Of the remaining 293 ERFs with clinical scenarios for echocardiography, 54 (18.4%) had multiple indications. For example, out of the 30 ERFs with pre-operative assessment for non-cardiac surgery, eight also indicated the patient had hypertension. Overall, hypertension and heart failure were the most frequent clinical background information provided [Table 2].

Using the ACCF 2011 Revised AUC for echocardiography, most of the indications were appropriate [Figure 2].

Normal echocardiograms were reported in 69 (16.7%) of the cases reviewed. Among the ERFs with missing indication for echocardiography, 26 (21.8%) had normal

Table 1: Proportion of missing information on the echocardiography request forms

Information sought for on each ERF	Missing, *n* (%)
Demographic characteristics of patient	
Name	0
Age	93 (22.6)
Sex	47 (11.4)
Address	381 (92.5)
Details of referring physician and hospital	
Name of referring doctor	175 (42.5)
Signature of referring doctor	190 (46.1)
Telephone number of referring doctor	395 (95.9)
Name of referring hospital	219 (53.2)
Date of request	238 (57.8)
Clinical scenario	119 (28.9)

ERF: Echocardiography request form

Table 2: Spectrum of clinical scenarios indicated on the echocardiography request forms

Clinical scenarios*	Frequency (%)
Hypertension/hypertensive heart disease	130 (44.4)
Heart failure	50 (17.1)
Preoperative evaluation for noncardiac surgery	30 (10.2)
Congenital heart disease	24 (8.2)
Cardiomyopathy	16 (5.5)
Cardiomegaly	14 (4.8)
Valvular heart disease	13 (4.4)
Chest pain	11 (3.8)
Pericardial effusion	4 (1.4)
Dyspnoea	4 (1.4)
Chronic obstructive airway disease	4 (1.4)
Stroke	4 (1.4)
Syncope	3 (1.0)
Diabetes mellitus	3 (1.0)
Routine medical check-up	1 (0.3)

*Multiple clinical scenarios apply

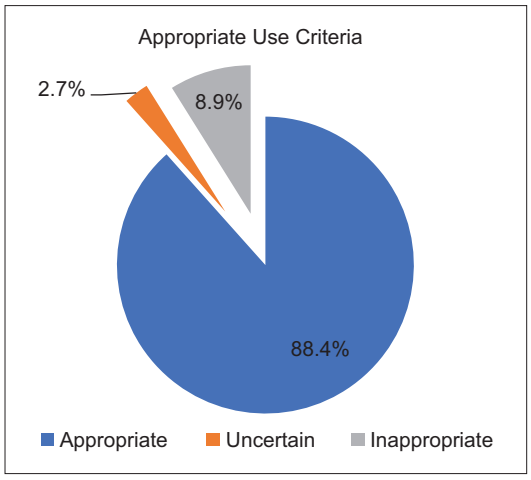

Figure 2: Distribution of the appropriateness of the indication for echocardiography

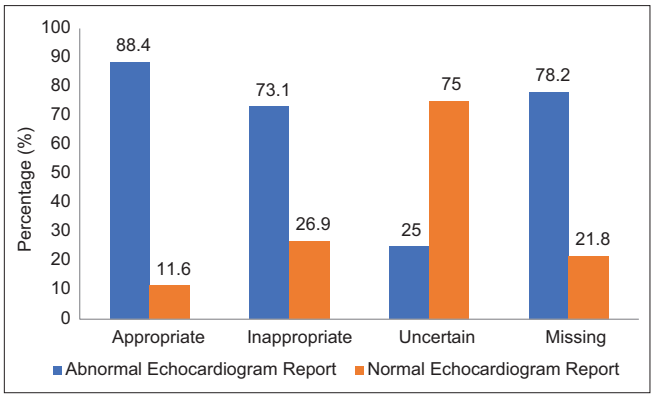

Figure 3: Association between the echocardiogram reports and the appropriateness of the request

echocardiogram reports. The proportion of normal echocardiograms for matching ERFs with appropriate, inappropriate and uncertain indications for TTE was 11.6%, 26.9% and 75.0%, respectively [Figure 3]. The association between the echocardiogram reports and the appropriateness of the request was statistically significant ($\chi^2 = 28.577$, df = 3, $P < 0.001$).

DISCUSSION

TTE is an indispensable investigative tool in cardiology. In open-access echocardiography centres, the ERFs are an essential link between the requesting clinician and the echocardiographer. Inadequately filled request forms and inappropriate/uncertain indications for echocardiography may lead to a fritter of already limited resources.

The findings from this study show that ERFs were inadequately filled. About a fifth (21.4%) of the ERFs had less than half of the information sought for in this audit, and only one ERF had all ten items. The demographic information of the patient provided on the ERFs serves to identify the patient correctly. In this study, all the ERFs had the names of the patients written on them. However, approximately one, two, and nine out of every ten ERFs lacked the patient's sex, age and address, respectively. Although there is no report on the adequacy of completion of ECFs in Nigeria for comparison, Caruana *et al.* reported similar inadequately filled ERFs for TTE performed in a single centre in Malta.[11] In their report, name, age, and address were missing in 0.0%, 32.4% and 30.0%, respectively.[11] One can infer from the work by Caruana *et al.* and the index study that the referring physicians acknowledge patients' names as a principal identifier.

This study also shows that many ERFs lacked information on the referring physician. The name of the referring physician was missing in 42.5% of the ERFs. This was 30 times more than the 1.4% reported by Caruana *et al.* Worse still, only 4% of the ERFs in this study had the telephone numbers of the referring physician. The implication is that direct communication with the referring physician to seek clarifications or provide urgent feedbacks is not feasible.

In this study, more than one-quarter of the ERFs lacked any form of background clinical information and indication for echocardiography. The application of the AUC to these ERFs was practically impossible. The use of free-form text ERFs, as was the case in this study, may, in part, contribute to the observed gaps. Of the remaining ERFs, hypertension/hypertensive heart disease was the most frequently encountered background clinical information and indication for echocardiography. Reports from other cardiac laboratories in Nigeria also show hypertension/hypertensive heart disease as the most frequent indication for echocardiography.[12-17] Akin to this study, other reports have also shown heart failure to be the second most come indication for requesting echocardiography.[11-14]

In open access echocardiography centres, such as the one audited in this study, abuse of TTE is not unlikely. The AUC was developed and revised by different stakeholder associations to check the over-and under-use of TTE.[6,7] Majority of the indications for echocardiography in this study were appropriate using the criteria developed by the ACCF.[7] This pattern is consistent with other reports from Nigeria and around the world.[4,11,17,18] Although in the minority, approximately one-in-ten echocardiography requests were either inappropriate or of uncertain indication and could contribute to over-subscription of the test. This is buttressed by the much higher frequency of

normal echocardiograms obtained for uncertain indications compared with the appropriate requests. It is noteworthy that the majority (78%) of the ERFs without indications did not have a normal echocardiogram. This implies that the request for the echocardiograms was justifiable in many of the cases.

The reasons for missing information from the ERFs in this study are beyond the scope of this study being a retrospective one. The use of free-form text styled ERFs, as observed in this study, may presumably be one of the reasons for the inadequately completed forms. However, this study is limited in making inferences in this regard, as there was no comparative audit of structured ERFs.

CONCLUSION

The ECFs audited in this study were inadequately completed. The majority of the TTE request was appropriate. However, one-in-ten of the AUC classifiable ERFs suggest the test could have been avoided. This study will, therefore, recommend further research to develop and validate a standard template for ECFs for use in Nigeria. This will help to improve the request and appropriate utilisation of echocardiography in the country.

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Conflicts of interest
There are no conflicts of interest.

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