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A 3-Year Audit of Pre-Operative Transthoracic Echocardiographic Features Of Patients Undergoing Elective Non-Cardiac Surgery In A Tertiary Hospital In South-South Nigeria

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Abstract

Background: Echocardiography is one of the most common imaging modalities routinely used in the field of interventional cardiology and cardiothoracic surgery because it can simultaneously evaluate cardiac structures and the function in real time. However, its clinical utility has recently increased in pre-operative cardiovascular evaluation of patients undergoing elective non-cardiac surgery (NCS).

Objective: To assess the echocardiographic features of adult patients undergoing elective NCS who were referred for preoperative cardiac evaluation and echocardiography, with a view to understanding its utility.

Methods: Medical and echocardiographic records of the patients from January 2021 to April 2024 were obtained from the archives of Delta State University Teaching Hospital Medical records Department. The patients' biodata and other relevant clinical information relating to the echocardiographic study, and cardiovascular risk profile were obtained and analyzed using IBM SPSS version 23.

Results: A total of 101 patients' records were retrieved with a mean age of 54.8 ± 16.5 years and females constituting 54%. The main surgical cases were breast cancers (34.7%), thyroid diseases (10.9 %), benign prostate hyperplasia/cancers (10.9%), abdominal masses (18.8%) and bone fracture (24.8 %). The main co-morbidities found in approximately half of the patients (48.5%) were hypertension, diabetes mellitus, dyslipidemia and chronic kidney diseases. The echocardiographic findings were normal in most patients but 26.0% of the cohort had atrial enlargement (3.0%), mild left ventricular hypertrophy (4.0%), diastolic dysfunction (7.0%), mild mitral regurgitations (4.0%), pulmonary regurgitations (4.0%), pulmonary hypertension (2.0%) and aortic sclerosis (2.0%). No patient had a finding that could be described as a contraindication to surgery or anesthesia.

Conclusion: Most of the patients being prepared for elective non-cardiac surgery in our center have normal echocardiograms. However, it is advised that request for echocardiography should adhere to guideline recommendations to optimize care.

Keywords: Echocardiographic features, Elective non-cardiac surgery

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Introduction

Transthoracic Echocardiographic **(**TTE) is an imaging modality that is routinely deployed in studying the structure and function of the heart and great vessels. It is one of the most common imaging modalities routinely used in pre-operative cardiac risk stratification because it can simultaneously evaluate cardiac structures and function[1]. It also has the added advantage of relatively low operation cost, good safety profile, reproducibility of results and relatively easy to learn.[2] Its application in pre-operative and perioperative evaluation of cardiac surgery patients is a well-established standard practice.[3] However, its clinical utility has recently increased in pre-operative cardiovascular evaluation of elective Non-Cardiac Surgery (NCS) patients. The British Society of Echocardiography, and American College of Cardiology/American Heart Association guidelines have published guidelines for deploying this tool yet there is lack of uniformity in the observance of these guidelines.[4,5]

Non-Cardiac Surgery is associated with varying degrees of cardiovascular (CV) risk and incidence of CV morbidity and mortality.[6] The aim of the CV pre-operative evaluation is to assess for the presence of current CV abnormalities as well as risk stratification of patients before NCS. Elective NCS may be deferred on account of some underlying active CV disease conditions such as ischemic heart disease, unstable cardiac failure as well as severe valvular disease.[7] Transthoracic echocardiography has also been found very useful in perioperative conditions where it has been used to investigate causes of hemodynamic instability; correctly diagnosing typical causes of hemodynamic instability like ventricular dysfunction, cardiac tamponade, rupture of myocardium, and obstruction of the left ventricular outflow tract.[8]

Cardiac Risk Stratification for non-cardiac Surgical Procedures.

Patients at significant risk for major adverse cardiac events before non-cardiac surgery still need to be identified and risk-stratified even if they do not have an active cardiac condition. To stratify cardiac risk, there is need to evaluate for presence of CV risk including factors such as age, prior history of heart disease, chronic heart failure, stroke, hypertension, smoking history, dyslipidemia, abnormalities of glucose metabolism and kidney disease. Other factors to be considered during preoperative assessment include patient's functional status and history of previous surgeries. Surgery-related factors would include type of surgery, urgency status, duration of surgery, possibility of blood loss and fluid shifts (Table 1).[2,5] These factors and others need to be comprehensively assessed for the patient to be optimally evaluated preoperatively for NCS.

Echocardiography may be performed as part of cardiac risk stratification and the findings incorporated. Some findings on echocardiography like severe valvular disease may need to be corrected before elective NCS. Moreover, the presence of some abnormalities e.g. left atrial dilatation has been linked to increased risk of atrial fibrillation.[2] The information obtained from echocardiography

Table 1. Cardiac Risk Stratification for Non-cardiac Surgical Procedures.[5]

Risk Stratification	Procedure Examples
Vascular (reported cardiac risk often more than 5%)	Aortic and other major vascular surgery Peripheral vascular surgery
Intermediate (reported cardiac risk generally 1%–5%)	Intraperitoneal and intrathoracic surgery Carotid endarterectomy Head and neck surgery Orthopedic surgery Prostate surgery
Low (reported cardiac risk generally less than 1%)	Endoscopic procedures Superficial procedure Cataract surgery Breast surgery Ambulatory surgery

can influence the management plan of patient's condition. It may lead to a step-up of treatment e.g. more intensive intra-operative hemodynamic management changes and provision for intensive care unit (ICU) care post-surgery. In some clinical settings, request for preoperative CV evaluation and echocardiography is usually initiated by the anesthetic team. Some workers have reported that pre-operative echocardiography led to significant delay before surgery.[9] In most centers, request for echocardiography service is usually overbooked and delay in response to the elective surgical patient inevitably occurs. It is unclear if the echocardiography findings justify the delay in obtaining the result.

This article thus evaluates echocardiographic findings in NCS patients sent for CV evaluation, as part of pre-operative evaluation in Delta State University Teaching Hospital (DELSUTH), Oghara. There is need for this information in this cohort of patient to audit and guide local practice especially as it relates to request for pre-operative echocardiography.

Materials and Methods

Study population and design: This was a descriptive retrospective cross-sectional study. The study population was derived from a retrospective cohort of adult patients who had echocardiography done as pre-operative evaluation for NCS at DELSUTH, Oghara, from January 2021 to January 2024. The history of cardiovascular risk factors such as hypertension, diabetes mellitus, renal dysfunction, stroke, dyslipidemia, and heart failure were documented.

Inclusion criteria: All adult patients of the hospital that had pre-operative CV evaluation including echocardiography in the referenced time frame with complete medical record.

Exclusion criteria: Children, patients undergoing cardiac surgery and patients with incomplete records were excluded.

Data collection

The patients' biodata and details of medical history were obtained from the hospital record. Data from transthoracic echocardiography performed as part of preoperative evaluation were retrieved from the archive. Specific echocardiographic parameters were obtained for each subject, viz: Left ventricular (LV) internal diameter in diastole and systole, interventricular septal diameter in diastole and systole and the derived ejection fraction (for assessment of left ventricular systolic function). For assessment of LV diastolic function, the ratio of mitral inflow velocity of the early phase (E) to the late phase (A) during diastole and left atrial size were obtained. Details of cardiac wall motion abnormalities, pulmonary artery acceleration time, right ventricle systolic function (surrogate-tricuspid annular plane systolic excursion, TAPSE) were also retrieved. Abnormal echocardiographic findings included significant biventricular systolic or diastolic dysfunction, wall motion abnormality, cardiac chamber dilatation, reduced pulmonary artery acceleration time, or significant valvular heart disease. Significant valvular heart disease was described as moderate/severe stenosis or regurgitation of the cardiac valves.

Data Analysis

The data were entered into an Excel spreadsheet and exported to IBM® SPSS 23 for analysis. Quantitative variables were summarized using mean, while categorical variables were summarized using frequencies and percentages. Descriptive statistics were conducted to analyze information related to the characteristics of patients, medical and surgical histories and echocardiologic findings.

Results

The total number of patients enrolled was 101. Their age ranged between 18 to 80 years, with a mean age of 54.8 ± 16.5years and the majority (53.5%) were females (male: female 1:1.2). Most of the respondents (69.3%) were married (Table 2).

Table 2: Sociodemographic characteristics of the Patients

Variables	Frequency n= 101	Percentage
Age group (years)		
<40	10	9.9
40-49	23	22.8
50-59	21	20.8
60-69	22	21.8
≥70	25	24.7
Mean age; 54.8 ± 16.5 years		
Gender		
Female	54	53.5
Male	47	46.5
Marital status		
Single	4	4.0
Married	70	69.3
Widowed	27	26.7

Majority of the patients did not have any co-morbid condition (51.5%). Some patients had hypertension, diabetes mellitus and dyslipidemia (Table 3).

Table 3: Disease profile of patients.

Variable	Frequency (n=101)	Percent (%)
Medical		
Hypertension	20	19.8
Diabetes mellitus	8	7.9
Dyslipidemia	18	17.8
Chronic kidney disease	3	3.0
None	52	51.5
Surgical		
Bone fracture	25	24.8
Thyroid	11	10.9
Breast cancer	35	34.7
Abdominal mass	19	18.8
Prostate Abnormality	11	10.9

A good number of the patients had no significant abnormal echocardiographic findings. However, twenty-six patients (26.0%) had echogenic features notably, atrial enlargement, left ventricular (LV) hypertrophy, LV diastolic dysfunction, mild mitral or pulmonary regurgitation, and mild aortic valve sclerosis (Table 4).

Table 4: Echocardiographic features of patients

Variable	Frequency	Percentage (%)
Atrial enlargement	3	3
Diastolic dysfunction	7	7
LV hypertrophy	4	4
Regional wall motion abnormality	0	0
Systolic dysfunction	0	0
Valvular regurgitation	0	0
Pulmonary (Mild)	4	4
Mitral (Mild)	4	4
Aortic sclerosis	2	2
Prosthetic valve	0	0
Pericardial effusion	0	0
Pulmonary hypertension	2	2

Discussion

Sociodemographic characteristics of the subjects

The sociodemographic distribution of the patients reflected the heterogeneity of the surgical disease presentation in the community with the average age of the patients approaching the 6th decade when age-related CV complication may necessitate increased referral for pre-operative CV evaluation. The gender distribution also reflected the sex-related characteristics of conditions requiring surgery — with breast cancers and thyroid

conditions more prominent in the female; prostate and orthopedic conditions commoner among the males.

Surgical and co-morbid medical conditions

For most of the patients requiring surgery, the concurrent co-morbid medical condition often underlines the need for exhaustive pre-operative CV evaluation. As the co-morbid medical condition can often affect the outcome of the surgical intervention, there is usually a need to concurrently prioritize evaluation and management of such co-morbidity.[10,11] Chronic medical conditions like systemic hypertension, type 2 diabetes mellitus, dyslipidemia and chronic kidney diseases needing pre-operative CV evaluation are common among the subjects perhaps reflecting the prevalence in the community.[12,13] Malignancies affecting the breast, prostate and abdominal organs are quite common in our environment; orthopedic cases especially trauma-related are also very common causes of surgical cases requiring pre-operative evaluation CV. [14]

Echocardiographic findings

Majority of the patients have normal echocardiographic parameters especially when the parameters interrogated were the basic ones needed in risk-profiling the surgical patients. This finding probably reflects the bias of request for echograms in pre-operative patients; as a study in USA revealed that 25% of patients undergoing elective NCS had resting echograms that on review were considered inappropriate.[15] Indeed some workers have reported that their data did not support the use of routine transthoracic echocardiography for the assessment of cardiac risk before NCS; and that echocardiographic measurements had limited prognostic value and suboptimal operating characteristics.[16] However, other workers found that pre-operative echocardiography evaluation for NCS can provide independent information about the risk of postoperative cardiac complications in selected patients.[17] It is also worth noting that some studies have documented increase in mortality in association with echocardiographic LV systolic dysfunction in patients undergoing NCS [18,19]

In this index review, 26% of the patients had abnormal echocardiography findings. These findings were mainly LV diastolic dysfunctions, mild left ventricular hypertrophy, mild mitral, pulmonary and aortic valve diseases. Other abnormal echocardiography findings were mild pulmonary hypertension and left atrial enlargement. A similar study revealed significant echocardiographic abnormality such as moderate to severe LV hypertrophy, moderate to severe mitral regurgitation, and increased aortic valve gradient in their cohort.[17]

With reference to the index study, it would appear that most of these findings are indicative of hypertensive heart disease and age-related CV changes as majority of the patients are in their 6th decade and are also hypertensive. None of the findings in this review was a contraindication to anesthesia or surgery. This is probably due to the fact that most of these patients were otherwise medically stable before their scheduled elective surgeries. It is well established that patient selection and medical stabilization does improve surgical outcome.[20] However, some abnormalities like LV diastolic dysfunction may lead to modification of therapy to improve LV diastolic function e.g. addition of calcium

channel blockers medication to patients' drug regimen; while valvular regurgitation may engender stricter fluid management during the perioperative period.

Conclusion

A substantial number of the patients referred for echocardiography undergoing NCS have normal echocardiograms. The abnormal findings noted were not contra-indications to anesthesia or surgery but require optimal perioperative management to ensure a favorable outcome. It is thus advised that request for echocardiography should adhere to guideline recommendations to optimize available resources.

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