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Research Article

Prediction of morbidity and mortality in middle and old aged surgical patients-comparison of standard scoring system and addition of echocardiography with hemodynamic indices

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ABSTRACT

Background: A prospective study was carried out in our hospital to predict morbidity and mortality in middle and old aged surgical patients by adding echocardiography to standard scoring system with hemodynamic studies.
Methods: A total of 50 patients of either sex ranging from 40-70 years of ASA grade 1 & 2 scheduled for various types of noncardiac surgeries were enrolled for the study in our hospital. Patients were divided in two groups according to echocardiographic examinations. The patients with normal echocardiographic values were kept in control group and the patients with abnormal values were kept under study group. The patients in study group were further divided in three groups according to LVEF. Group1-LEVF≥60%, Group2-LVEF≥50-59%, Gr3≥40-49% Tab lorazepam was given to all the patients' orally prior night of surgery. All the patients were induced with same type inducing agents according to body weight. All the patients were maintained on IPPV by anaesthesia machine with supplemental fentanyl, N2O, O2 and muscle relaxant. SPO2, electrocardiograph (ECG), Non-invasive/invasive blood pressure (BP), Spirometry, Capnography and temperature were monitored. At the end of the research project data's were compiled systematically and were subjected to statistical analysis using odd's ratio(OR),95% confidence interval (CI), z value and p value, two statistical software programme were used.
Results: Significant difference in the results seen between the three study groups (Gr1, Gr2, Gr3) for perioperative ischemic changes, CHF and arrhythmias.
Conclusions: In conclusion preoperative TTE before non-cardiac surgery can predict the risk of perioperative cardiac complications in known or suspected cases of cardiac disease patients.

Keywords: Standard scoring system, Preoperative trans thoracic echocardiography (TTE), Hemodynamic indices

INTRODUCTION

The risk of perioperative cardiac complications in an individual patient can be initially assessed by presence or absence of clinical predictors of increased perioperative cardiovascular risk, the patient's level of cardiac functional status and the underlying risk of surgical procedure. Many individuals have contributed to our knowledge of cardiac events in perioperative periods. One of the outstanding contributors is Lee Goldman, who first designed a cardiac risk index, known as Goldman cardiac risk index, for prediction of perioperative cardiac events. The original description of M-mode echocardiography in 1953 by Inge Idler and his physicist friend Hellmuth Hertz marked the beginning of a new diagnostic non-invasive technique. For his landmark discovery, Edler is recognized as the father of the echocardiography. The commonest reason for undertaking an echo is to assess left ventricular function. Although clinical information and basic investigations

will often identify patient with significant left ventricular systolic dysfunction, echocardiography can quantify the severity and determine the underlying cause and also valuable in patients with known coronary heart disease, even those without overt heart failure. Transthoracic echocardiography (TTE) should be considered when extended perioperative haemodynamic monitoring is needed. Don Poldermans et al concluded that dobutamine stress echo is a feasible, safe and useful method for identifying patients at high or low risk of perioperative cardiac events.[1] The test yields additional information, beyond that provided by clinical variables, in patients who are scheduled for major non-cardiac surgery. Canty DJ et al concluded that focussed transthoracic echocardiography in preoperative clinic is feasible and frequently alters management in patients with suspected cardiac disease.[2] Rohde LE et al stated that preoperative TTE before non-cardiac surgery can provide independent information about the risk of post-operative cardiac complications in selected patients.[3] ACC/AHA guidelines (2007) recommended dobutamine stress echocardiography for supplemental preoperative evaluation in cardiac patients undergoing noncardiac surgery. Sharir et al did preoperative echocardiography in known case of CAD patients undergoing non-cardiac surgery, to determine the LVEF and found that most powerful predictor of cardiac death was post stress LVEF, whereas the best predictor of MI was the degree of ischemia. Recent practice guidelines suggest that a TTE is often sufficient to exclude major cardiac pathology in patients scheduled for procedures with low cardiac risk. Sudhakar Subramani and Anurag Tewari found that appropriate utilization of the preoperative echocardiography to improve overall perioperative outcomes is a challenging task, encountered by every perioperative physician during preoperative assessment.[5] With recent increase in echocardiography training amongst anaesthesiologists, we envisage increased integration with conventional anaesthetic assessment. TTE performed by an anaesthesiologist trained and experienced in the use of TTE significantly facilitated the patients perioperative management in a time efficient manner to quickly exclude major cardiac pathology and guide perioperative care. Wijeysundera DN et al in his study found that preoperative echocardiography was not associated with improved survival or shorter hospital stay after major non-cardiac surgery.[6] These findings highlight the need for further research to guide better use of this common preoperative test.

METHODS

This is a prospective study. After taking permission from ethical committee 50 patients of either sex ranging from 40-70 years with ASA grade 1 & 2 were taken for our study and they were divided into two groups by doing preoperative echocardiographic examination. Group A called control group and Group B called study group. Group B further subdivided into Group 1, Group 2 and Group 3 depending on Left Ventricle Ejection Fraction (LVEF) done by preoperative echocardiography.

Group A - Control group,

Group B - Study group,

1. Group 1 (LVEF≥60%)
2. Group 2 (LVEF≥ 50-59%)
3. Group 3 (LVEF≥ 40-49%)

Table 1: Showing sex distribution and total number of cases in each group.

Group	Male		Female		Total	
	No	%	No	%	No	%
Control	18	36 %	07	14%	25	50%
Group 1	04	08 %	-	-	04	08%
Group 2	07	14 %	02	04%	09	18%
Group 3	09	18 %	03	06%	12	24%
Total	38	76 %	12	24%	50	100%

Male : Female ratio was found to be 3.16:1

Table 2: Showing clinical characteristics of patients.

Characteristic	Control		Study	
	No	%	No	%
Cardiac History				
Previous MI	-	-	02	08%
Angina	04	16%	05	20%
Palpitation	03	12%	03	12%
Claudication	01	04%	01	04%
CHF	03	12%	04	16%
Dyspnoea	05	20%	05	20%
Cardiac Risk Factors				
Smoking	15	60%	18	72%
HTN	02	08%	04	16%
DM	04	16%	05	20%
Age≥65 yrs.	06	24%	10	40%
Serum Cholesterol (>250 mg %)	04	16%	06	24%
Goldman Cardiac Risk Index				
Class 1	21	84%	18	72%
Class 2	04	16%	07	28%
Class 3	-	-	-	-
Class 4	-	-	-	-
Preoperative Medication				
Antihypertensive	02%	08%	05	20%
Digoxin	-	-	01	04%
Others	06%	24%	10	40%
Mean Age(Yrs.) ± SD	58±4		62±8	

Informed and written consent was obtained after explaining the procedure to the patients. Preoperative clinical assessment was done in all the patients. Routine preoperative investigations of blood/urine, electrocardiograph (ECG), X-ray chest etc. were done in all the cases. The Goldman cardiac risk index class was determined for each patient. Standard 2-dimensional and M-mode echocardiography was done in each patient before surgery.

Table 3: Showing various numbers of patients having various pathology and clinical features in different groups.

Pathology	Control		Group 1		Group 2		Group 3	
	No	%	No	%	No	%	No	%
Coronary heart disease	02	08%	01	25%	01	11.1%	03	25%
HCD	02	08%	01	25%	01	11.1%	02	16.6%
Pulmonary heart disease	02	08%	-	-	01	11.1%	01	8.3%
Others	06	24%	01	25%	03	33.3%	07	58.3%
Clinical Features								
Angina Pectoris	04	16%	01	25%	01	11.1%	03	25%
Dyspnoea	05	20%	01	25%	01	11.1%	03	25%
Palpitation	03	12%	-	-	01	11.1%	02	16.6%
Syncope	02	08%	-	-	01	11.1%	01	8.3%
X-Ray Chest Findings	02	08%	01	25%	-	-	02	16.6%
Others	02	08%	-	-	02	22.2%	-	-

Echocardiographic variables of interest were left ventricular systolic ejection fraction, regional wall motion abnormality, left ventricle diastolic dysfunction (LVDD) and left ventricle hypertrophy. All patients were given tab. lorazepam orally prior night to surgery. In the OT intravenous line was secured and monitoring devices were attached which involved ECG, SPO2, invasive/non-invasive blood pressure, spirometry, capnography and temperature probe. In all the patients depending on the weight, midazolam 2-5 mg, fentanyl 50-100µg and glycopyrolate 0.2 mg given slow IV. All patients were preoxygenated and induced by adequate dose of thiopentone sodium followed by intubating dose of muscle relaxant, endotracheal intubation was done. All the patients were maintained on intermittent positive pressure ventilation (IPPV) with supplemental fentanyl, oxygen, N2O and muscle relaxant. At the end of surgery all the patients were given inj. neostigmine and inj. glycopyrolate for reversal. Throughout the anaesthesia & immediate postoperative period all the patients were monitored for HR (heart rate), BP (blood pressure), SPO2, ETCO2, ECG etc. IV fluids were given as per body weight & operative loss requirements. Intraoperative and postoperative complications like ischemic changes, CHF, arrhythmias were recorded. At the end of surgery all the data's were compiled systematically & analysed by chi-square test. For mean standard deviation, 95% Confidence Interval (CI), Z-value and P-value, two statistical software programs were used. 1). Decision analyst. Inc. 2). OPENSTAT@msn.com by W.G.Miller. P-value<0.05 considered as significant.

RESULTS

A total of 50 patients of either sex with known or suspected case of heart diseases were enrolled for the study. Table 1 shows the sex distribution of cases in different groups. Out of these 50 patients studied, 38 were males and 12 were females. The male and female ratio is 3.16:1. The youngest patient was 40 years old and oldest was 68 years old, maximum cases were between 45-65 years of age, comprising 36% i.e.18 patients.

Table 4: Shows echocardiographic abnormalities detected preoperatively in the study group.

Abnormality	Group 1		Group 2		Group 3	
	No	%	No	%	No	%
WMA	01	25%	02	22.2%	04	33.3 %
DD	03	75%	03	33.3%	06	50%
LVH	-	-	-	-	01	8.3%
Others	-	-	01	22.2%	02	16.6 %

WMA=Wall motion abnormality, DD = Diastolic dysfunction, LVH = Left ventricular hypertrophy.

Table 2 shows clinical characteristics of patients, The patients who show no echocardiographic abnormalities besides the history and clinical features of CAD were kept in control group 84% and 16% patients of control group were respectively in class1&2 category of Goldman cardiac risk index (GCRI).Similarly 72% and

28% patients of study group were in class 1 & 2 category of GCRI.

Table 3 shows patients having various clinical features and cardiovascular diseases and their incidence. CAD was the most common pathology found in the patients constitutes 14%, Hypertension in 12% and pulmonary heart diseases 8% were also present. Pathologies other than cardiopulmonary and surgical illness included DM, Thyroid diseases, renal diseases etc. Patients were having various cardiac symptoms, dyspnoea and angina pectoris were most common i.e.20% and 18% respectively.12% and 8% of total cases had H/O palpitation and syncope respectively. X-ray findings shows pleural effusion and cardiomegaly in 2 patients of grade 3.

Table 5: perioperative heart rate, systolic, diastolic and mean blood pressure changes.

	Group	Preoperative	1/2Hr.after surgery	1Hr.after surgery	2Hr.after surgery	Postoperative
Heart Rate	Control	94.36±11.06	99.48±10.71	96.38±8.9	97.78±6.52	96.08±7.08
	Group 1	97.14±6.52	100.01±8.17	102.4±11.8	98.08±6.51	100.8±11.02
	Group 2	98.01±11.01	108.6±15.1	100.1±13.02	101.02±14.05	100.2±5.12
	Group 3	102.24±14.19	114.08±13.57	105.75±14.35	103.75±13.69	101.06±12.11
Systolic Blood Pressure	Control	123.2±80.80	126.48±82.89	120.25±79.17	124.0±14.10	124.08±12.10
	Group 1	122.04±14.01	130.81±10.02	124.01±11.1	119.06±8.52	122.8±11.16
	Group 2	115.04±15.37	127.28±78.08	119.91±78.33	116.77±76.61	117.12±12.74
	Group 3	114.8±11.51	131.46±7.52	116.03±15.61	110.61±16.81	108.7±8.52
Diastolic Blood Pressure	Control	80.80±8.12	82.89±8.33	79.117±1.17	80.67±10.2	82.1±11.20
	Group 1	78.01±8.11	82.11±11.2	81.2±11.16	83.01±7.51	80.14±16.12
	Group 2	75.6±10.44	78.08±10.12	78.33±8.17	76.61±9.43	76.64±10.11
	Group 3	75.1±11.12	80.11±12.02	74.11±9.88	73.19±10.41	70.01±6.11
Mean Blood Pressure	Control	94.01±11.21	97.62±10.0	92.69±8.1	95.07±12.41	93.01±7.31
	Group 1	91.82±7.31	98.01±17.11	96.07±8.61	92.01±11.13	94.81±11.10
	Group 2	86.73±6.0	96.11±11.33	90.01±11.23	92.00±7.83	90.71±6.13
	Group 3	79.21±8.42	88.0±0.92	88.81±10.17	84.01±6.15	82.62±10.0

Table 6: Number of patients developing intraoperative cardiovascular abnormalities in different groups.

S.N	Complications	Control		Group 1		Group 2		Group 3	
		No	%	No	%	No	%	No	%
1	Ischemic events (ST-T Changes)	01	04%	-	-	01	11.1%	03	25%
2	CHF	03	12%	01	25%	02	22.2%	05	41.6%
3	Arrhythmia	02	08%	-	-	02	22.2%	04	33.3%
4	Others	04	16%	-	-	02	22.2%	03	25%

Table 7: Odds ratio (OR) with 95% confidence interval (CI), Z values, P values for ischemic events, CHF, arrhythmia of different groups.

	Groups	OR	95%CI	Z- Value	P-Value
Ischemic Events	Group 1	-	-	-	-
	Group 2	3.0	-0.108,0.250	0.770	0.2184
	Group 3	8.0	-0.004,0.424	1.926	0.0271
CHF	Group 1	2.4	-0.234,0.494	0.700	0.2419
	Group 2	2.1	-0.168,0.372	0.742	0.2289
	Group 3	5.2	0.013,0.580	2.052	0.0201
Arrhythmia	Group 1	-	-	-	-
	Group 2	3.2	-0.103,0.388	1.136	0.1281
	Group 3	5.7	-0.0,0.507	1.957	0.0252

Table 4 shows echo abnormalities detected preoperatively in the study group.

Table 5 shows perioperatively pulse rate, BP and hemodynamic changes. Patients of Group 3 show more tachycardia and hypotension in comparison to other group patients.

Table 6 shows intraoperative cardiovascular abnormalities in different groups. Cardiac related deaths, nonfatal MI, Unstable angina, CHF, Ventricular tachycardia were considered.

Table 7 shows Odd's ratio (OR), 95% CI, Z value and P-value for ischemic events, CHF, arrhythmias of different groups. P value for Ischemic events 0 .0271 for CHF p value=0.0201 and p value for Arrhythmia was 0.0252 respectively for Group 3 patients.

DISCUSSION

Because of high cost and some other controversies of the dipyridamole thallium scintigraphy and radio nucleide assessment of left ventricle function tests, less expensive approaches are being investigated. One commonly used test, TTE is increasingly used before surgery to assess cardiac risk because it provides information on global and regional ventricular function.

A finding consistent with table 2 was earlier reported by Halm EA et al who reported 70% of patients in class 1, 19% in class 2,10% in class 3 in their control group and in study group 63% of patients in class 1, 27% in class 2, 9% in class 3 of GCRI, in a study of 339 patients who underwent non-cardiac surgery.[7] In our study coronary heart diseases was the most common pathology found in patients constituting 14%, hypertension 12%, pulmonary heart diseases in 8%. D Poldermans in the study of 136 patients with suspected case of coronary artery disease (CAD), who underwent noncardiac surgeries, found (25%) patients with CAD, and 11.7% had hypertensive cardiovascular disease.[1] Halm EA et al in the study of 339 patients reported (25.3%) CAD and (12.09%) hypertension and (9.4%) of pulmonary heart disease.[7] Rohde LE et al reported (22.4%) CAD and (14.5%) hypertensive cardiovascular disease and (9%) cases of pulmonary heart disease.[3] Mangano et al. studied 444 patients with CAD/suspected case of CAD and they found (12.6%) patients of chronic obstructive pulmonary disease(COPD) and (3%) cases of cerebro vascular accident(CVA).[8] Swada et al found pleural effusion in (2%) cases while studying 103 patients of CAD undergoing non-cardiac surgery.[9] Table 4 shows echocardiographic abnormalities detected preoperatively in the study group. Halm et al. found (31.8%) of patients with wall motion abnormality (WMA) ,(49.2%) patients with diastolic dysfunction (DD) and (17.9%) patients with left ventricle hypertrophy (LVH), (34.2%) patients show DD and WMA both.[7] 12% show LVH with DD and 4% LVH with DD and WMA both. Don Poldermans et al found decreased left ventricle ejection fraction (LVEF<50%) in 38% patients.[1] Rohde et al found (45%) patients with DD, (32.6%) patients with LVEF<50% and 28% patients show WMA, 8% show DD and WMA both.[3] Table 5 showing haemodynamic changes. Rohde LE et al reported that 40% patients had mild tachycardia and hypotension during perioperative period.[3] Table 7 showing Odds Ratio (OR), 95% confidence interval (CI), P value and Z value for ischemic events, CHF and arrhythmias. Halm et al showed that (3%) patients had ischemic events, 8% patients had CHF and 8% had ventricular tachycardia.[7] Brawner et al showed that 15 had ischemic events, 30 had CHF without ischemia and 38 had ventricular tachycardia.[10] Pellika P et al performed echocardiography including the assessment of wall motion score index (WMSI) and LVEF in 767 patients with acute myocardial infarction (MI).[11] Patients were followed for a median of 19 months. During follow up 216 patients died and 54 patients hospitalized for CHF. By univariate analysis both LVEF ($p<0.0001$) and WMSI ($p<0.0001$) were powerful predictors of all-cause mortality. WMSI also proved to be an independent predictor of hospitalization for CHF (hazard ratio 1.21 per 0.2 unit increase, 95% CI 1.07-1.37, P=0.002), whereas LVEF did not (P=0.56).And they concluded that both LVEF and WMSI provide powerful prognostic information after acute MI; however, the predictive power of WMSI is greater. The findings of our study are comparable to the findings of other authors.

CONCLUSION

After observing the parameters and statistical evaluation and the studies done in the past, we conclude that TTE is a very important tool for cardiac assessment and prediction of outcome in cardiac patients undergoing non-cardiac surgery. Complications and perioperative hemodynamic a change is directly related to severity of cardiac lesion. So we conclude that preoperative TTE and intense monitoring is advisable in cardiac patients undergoing non-cardiac surgery.

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