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What Can Preoperative Echo Tell Us? Analysis of New Information Gained Through Transthoracic Echocardiography in Geriatric Orthopaedic Trauma Patients

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INTRODUCTION

- A diagnostic transthoracic echocardiogram (TTE) is frequently employed in geriatric orthopaedic trauma to assess for cardiac disease which could affect anesthetic or operative decisions. Getting a TTE often delays care can be costly for patients. The purpose of the study was to determine the incidence proportion of new abnormal TTE findings with the potential to change anesthetic or surgical management in geriatric orthopaedic trauma patients based on their perioperative cardiac risk.

METHODS

- A retrospective study was performed at a single Level 1 trauma center following approval by the Institutional Review Board. Through a prospectively collected trauma registry, patient medical records were reviewed for all patients ages 65 years or older who were admitted from October 2012 through October 2016 for extremity fractures and received TTE imaging prior to orthopaedic surgery. After excluding 12 patients who did not have available TTE reports in either of the two electronic medical records used at the site, 368 patients were included in the final analysis. The primary outcome was the incidence proportion of new abnormal TTE findings with the potential to change anesthetic or surgical management based on the patients perioperative cardiac risk and was defined as new reduced ejection fraction (EF \leq 30%), new pulmonary hypertension (\geq 60 mm Hg), or new severe valvular disease such as aortic regurgitation, aortic stenosis, mitral regurgitation, mitral stenosis, pulmonic regurgitation, or tricuspid regurgitation^{6, 7}. Fellowship trained cardiologists interpreted the TTE. Patients with audible heart murmurs upon auscultation or documented histories of said TTE findings were not considered. The senior anesthesia author individually reviewed the cases while being blinded to the adherence towards the clinical practice guidelines. The secondary outcomes were the overall proportion of cardiology consults which led to interventions based on the TTE results, the overall proportion of major adverse cardiac events (MACE), the risk of MACE in patients with a high, intermediate, or low perioperative cardiac risk. The cardiology team was consulted if patients had active cardiac conditions upon admission or if the TTE results indicate a reduced ejection fraction (EF \leq 30%) or segmental wall motion problems (hypokinesis or hyperkinesis of the left ventricle). The intervention was defined as an emergent change of operative plan or new procedure which the patient would not have otherwise received. MACE was defined as perioperative death, myocardial infarction, new arrhythmia, new heart failure, or postoperative cardiogenic shock.

	All (n=368)	High Perioperative Cardiac Risk (n=170)	Intermediate Perioperative Cardiac Risk (n=165)	Low Perioperative Cardiac Risk (n=33)	P Value
Age, years, mean (SD)	80 (9)	81 (9)	80 (9)	77 (9)	0.04
Sex, female, n (%)	268 (73)	119 (70)	126 (76)	23 (70)	0.39
Race, n (%)					
White	313 (85)	146 (86)	141 (85)	26 (79)	0.63
African-American	34 (9)	17 (10)	13 (8)	4 (12)	
Other	21 (6)	7 (4)	11 (7)	3 (9)	
ASA, n (%)					
Class I	3 (1)	0 (0)	2 (1)	1 (3)	0.01
Class II	34 (9)	8 (5)	22 (13)	4 (12)	
Class III	260 (71)	121 (71)	113 (68)	26 (79)	
Class IV	71 (19)	41 (24)	28 (17)	2 (6)	
Injury severity score, mean (SD)	9 (2)	9 (2)	9 (2)	8 (3)	0.08
Comorbidities, n (%)					
Hypertension	269 (73)	129 (76)	118 (72)	22 (67)	0.46
Diabetes	40 (11)	13 (8)	21 (13)	6 (18)	0.12
Coronary heart disease	80 (22)	46 (27)	29 (18)	5 (15)	0.07
Hypothyroidism	46 (13)	21 (12)	24 (15)	1 (3)	0.19
COPD	51 (14)	21 (12)	26 (16)	4 (12)	0.64
Fracture location, n (%)					
Hip	84 (23)	44 (26)	36 (22)	8 (12)	0.62
Upper extremity	49 (13)	22 (13)	21 (13)	6 (18)	
Pelvis/acetabulum	48 (13)	22 (13)	23 (14)	3 (9)	
Other lower extremity fracture surgery	187 (51)	82 (48)	85 (52)	20 (61)	

	High Perioperative Cardiac Risk (n=170)	Intermediate Perioperative Cardiac Risk (n=165)	Low Perioperative Cardiac Risk (n=33)	Total (n=368)	P Value	High versus Intermediate RR (95% CI)	High versus Low RR (95% CI)	Intermediate versus Low RR (95% CI)
New Abnormal TTE Findings Proportion (n)	8.8 (15)	7.3 (12)	3.0 (1)	7.6 (28)	0.50	1.21 (-0.04 to 0.07)	2.93 (-0.01 to 0.13)	2.43 (-0.03 to 0.11)

RESULTS

- Overall, 8% of the new abnormal TTE findings had the potential to change anesthetic or surgical management (n=28, 95% confidence interval [CI], 5 to 11%). There were no significant differences in the proportion of new abnormal TTE findings between those with a high, intermediate, or low perioperative cardiac risk (P=0.50). The TTE results led to cardiology consults which yielded interventions in 2 patients (95% CI, 0.6 to 7.6%). 17% of the sample suffered a major adverse cardiac event (MACE) (n=62, 95% CI, 13 to 21%). The proportion of patients with major adverse cardiac events did not differ based on the patient's perioperative cardiac risk (P=0.46).

DISCUSSION

- As only 7.6% of patients (9.5% in hip fracture surgery versus 7.0% in other fracture surgery) were discovered to have previously undiagnosed TTE results with the potential to change anesthetic or surgical management, the paper establishes a statistic different from the historical literature. Our approach examined de novo or unique instances of TTE showing unknown pathologies, all of which appeared to occur in patients irrespective of perioperative cardiac risk. Previous research investigated the topic from the perspective of clinical practice guidelines. The most concerning novel abnormalities were the 6 cases of reduced ejection fraction and the 3 cases of severe aortic stenosis but these were not mutually exclusive, however, 1.6% (n=6) of patients thus suffered from intraoperatively life-threatening conditions which otherwise would not have been acknowledged without a preoperative TTE to identify them. Cardiology consults were uncommonly helpful in changing management, however, the 2 scenarios mentioned required direct emergent intervention and otherwise would not have been treated. Though most of the cardiology consults were made in response to active cardiac conditions and not the TTE results themselves, we did not look at changes in perioperative medication regulation because they still did not modify anesthetic or surgical management and often delayed treatment. In one case, a patient had open wounds from a mangled extremity left untreated for many days during the wait for a cardiology consult, which may have caused the limb to become unsalvageable and subsequently amputated. Several other cardiology consults recommended diagnostic workups yielding no actual intervention, again delaying treatment, or simply recommended perioperative fluid balance, something which would have been done despite the cardiology consult. Regarding MACE in the 16.8% of patients (22.5% in hip fracture surgery versus 15.8% in other fracture surgery), there was a clinically significant but statistically insignificant association with perioperative cardiac risk, implying the indication level for TTE ambiguously tell us how patients will do in the future, suggesting our low risk group in particular may have been underpowered. The TTE infrequently reveals even theoretically actionable information. While increases in time to surgery has been linked with mortality in geriatric hip fracture patients, the rare potential benefit of these consults and tests must be weighed against the delays and expenses they incur. Routine TTE in all geriatric orthopedic trauma patients did not appear to change management in our cohort. Ultimately, further guidelines and studies are likely warranted to understand the most pragmatic situations for TTE.

- Table 1: Demographics; Table 2: New Abnormal TTE Findings Stratified by Perioperative Cardiac Risk