A Review of 364 Perioperative Rescue Echocardiograms: Findings of an Anesthesiologist-Staffed Perioperative Echocardiography Service

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Objective: **Review the findings and use of rescue echocardiography performed by the Division of Perioperative Echocardiography and its impact on patient management.**

Design: **Retrospective observational study.**

Setting: **Single institution, tertiary care hospital.**

Participants: **Three hundred sixty-four consecutive rescue echocardiograms in the perioperative setting.**

Interventions: **Rescue transesophageal or rescue transthoracic echocardiography.**

Measurements and Main Results: **Of a total of 1,675 perioperative echocardiograms performed in a 28-month period, 364 (21.8%) were rescue studies. Of these, 95.9% were transesophageal and 4.1% were transthoracic. Location at time of rescue echocardiography was intraoperative (55.5%), postoperative (44.2%), and preoperative (0.3%). No single diagnosis predominated the intraoperative or postoperative environment, and the frequency of common etiologies did not allow for assumption. There was a change in management for 214 patients (59%) as the result of findings. The methods used in performing rescue echocardiography at the authors' institution are reported.**

Conclusions: **The heterogeneity of diagnoses and the frequency with which rescue echocardiography changed management further supports the growing body of evidence that the hemodynamically unstable perioperative patient benefits from its use.**

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KEY WORDS: rescue echocardiography, hemodynamic instability, transesophageal echocardiography, transthoracic echocardiography, intraoperative hypotension

TRANSESOPHAGEAL ECHOCARDIOGRAPHY (TEE) has been used to guide hemodynamic management of noncardiac surgical patients in the operating room who undergo procedures in which large volume shifts are expected or who encounter unanticipated hemodynamic instability.[1] The use of echocardiography extends into the postoperative period, with many centers using both transthoracic echocardiography (TTE) and TEE in the intensive care unit (ICU) to guide treatment in lieu of invasive monitors.[2,3]

Prior studies have shown the value of echocardiography during cardiopulmonary arrest or severe hemodynamic instability before arrest, which has been termed "rescue echocardiography."[4–6] Though the cohorts were small, these publications supported the tremendous diagnostic potential of echocardiography in cases of cardiopulmonary arrest or severe hemodynamic instability.[1–3,6,7] The American Society of Anesthesiologists and the Society of Cardiovascular Anesthesiologists recognize these results and have included "life-threatening and unexplained hemodynamic instability" as a category-1 indication for echocardiography in their guidelines.[8]

The aim of this study was to review rescue echocardiography in a diverse perioperative population at a tertiary care hospital. Specifically, the frequency of rescue echocardiograms over a 28-month period was evaluated, as well as key diagnostic findings and the management changes that resulted. The authors hypothesized that the use of rescue echocardiography would be similar to previously reported intraoperative and ICU cohorts but that a larger experience would further refine the frequency of various causes of hemodynamic instability in surgical patients. Furthermore, the review examined the influence of rescue echocardiography findings on the clinical management of these patients. Finally, the authors' approach to the performance of rescue echocardiography in the perioperative setting is described.

METHODS AND MATERIALS

The Division of Perioperative Echocardiography in the Department of Anesthesiology at the authors' institution had 14 members who provided coverage 24 hours a day, 7 days a week for perioperative echocardiography consults during the time period reviewed. Each day, one team member was responsible for the perioperative echocardiography service, which includes overnight home-call responsibilities for the 24-hour workday. In addition to echocardiography, team members supervised the presurgical screening clinic and at times supervised a single operating room with an anesthesiology resident or certified registered nurse anesthetist. On average, the service received 2 to 5 consults for perioperative echocardiography daily, including planned echocardiograms (for both cardiac and noncardiac surgical patients) and rescue echocardiograms. There were 32 operating rooms that the perioperative echocardiography service covered, including an average of 2 cardiac operating rooms per day performing 500 to 550 cardiac surgical cases a year in the time period reviewed.

All members of the division of perioperative echocardiography were diplomats of the American Board of Anesthesiology, had Level 3 echocardiography training,[9] and were testamurs of both the Examination of Special Competence in Adult Echocardiography (ASCeXAM) and the Examination of Special Competence in Advanced Perioperative Transesophageal Echocardiography (Advanced PTEeXAM) administered by the National Board of Echocardiography. Some of the team members were certified in the PTEeXAM, and others were in the process of applying for certification. Of the 14 perioperative echocardiography service team members, 6 individuals were also members of the cardiac anesthesiology team.

With approval from the institutional review board, 1,675 documented perioperative examinations between February, 2010 (the initiation of the division's Continuous Quality Improvement [CQI] database) and June, 2012 were identified and reviewed. Rescue echocardiography was defined as any examinations ordered by a perioperative physician on

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an urgent/emergent basis for a patient with hemodynamic instability. Patients in whom a TEE probe was used for routine intraoperative monitoring were excluded. Initial review of the CQI database identified 440 studies meeting the inclusion definition of rescue echocardiography. Four entries were excluded because of missing data. After chart review, an additional 72 studies were found to have been performed for planned monitoring and not hemodynamic instability and were excluded, resulting in a final cohort of 364 rescue echocardiograms as displayed in Fig 1.

Consultation requests for perioperative rescue echocardiograms from the primary physician occurred when there was unexplained hemodynamic instability despite standard interventions as determined by the requesting physician. The workflow for these rescue echocardiograms from consultation through evaluation is summarized in Fig 2. These rescue echocardiograms were categorized by patient location at the time of the request: Preoperative, intraoperative, or postoperative. Rescue echocardiograms performed in the ICU or the postanesthesia care unit were considered postoperative. All exams were conducted and read by a member of the division, using the standard abbreviated exam sequence used at the authors' institution to allow for a timely focused evaluation for causes of hemodynamic instability. A formal written report was prepared for all TEE and TTE exams and entered into the electronic medical record in addition to a verbal report to the requesting physician.

Echocardiography was performed using a Phillips iE33 or Phillips CX50 with either an S5-1 transthoracic probe or the X7-2t transesophageal probe (Phillips Healthcare, Andover, MA) or the Acuson Sequoia 256 and Acuson Sequoia 512 models with the TE-V5Ms transesophageal probe (Siemens Medical Solutions USA, Inc., Malvern, PA). All rescue exams were obtained using a standardized exam sequence for TEE and TTE with additional images obtained as needed for further assessment of any abnormality found requiring additional quantification. The standard views and order of acquisition for this basic exam sequence for both TTE and TEE are displayed in Table 1. Studies were read on a designated workstation (Syngo Dynamics Workstation, Siemens Medical Solutions USA, Inc., Malvern, PA). Echocardiography studies underwent regular peer review to comply with a CQI process as outlined by the American Society of Echocardiography to promote consistency and accuracy.[10,11]

The electronic medical records of subjects in the final cohort were reviewed, including clinical notes, anesthetic records, echocardiography reports, and echocardiographic images. Study data were collected and managed using a secure, locally hosted database with a web-based interface (REDCap Version 5.9.4, Vanderbilt University, Nashville, TN).[12] The criteria for classification of echocardiographic findings

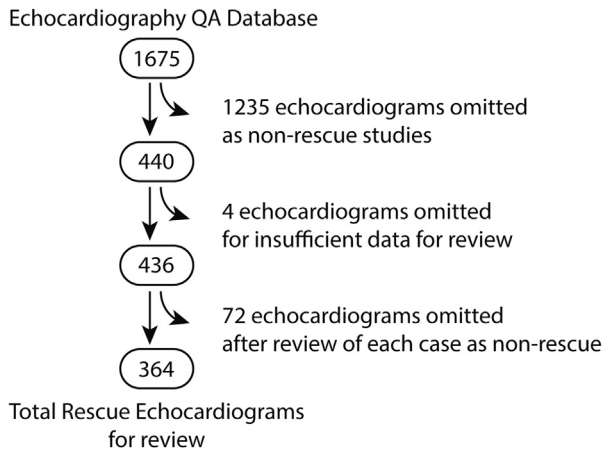

Fig 1. Flow chart showing the review process for the Perioperative Echocardiography Quality Assurance (QA) Database. Starting with 1,675 echocardiograms over the 28-month period, a final 364 rescue echocardiograms were identified.

regarding left ventricular (LV) systolic and diastolic function, right ventricular (RV) systolic function, hypovolemia, pericardial tamponade, valvular abnormalities, and left ventricular outflow tract (LVOT) obstruction were based on recommendations published by the American Society of Echocardiography and are presented in Table 2.[13–17] This classification allowed the determination of which, if any, of the etiologies of hemodynamic instability the rescue echocardiogram helped diagnose. Those subjects with normal and mild LV systolic dysfunction were grouped into a broader single classification (normal/mild dysfunction), because mild LV systolic dysfunction alone is an unlikely cause of significant hemodynamic instability.[6] Left ventricular segmental wall motion was assessed using the 17-segment model.[13] Subjects with global myocardial segment dysfunction were considered to have global hypokinesis of the LV, rather than particular segmental wall motion abnormalities. Finally, the diagnosis of reduced systemic vascular resistance was supported by the presence of normal LV end-diastolic filling and hyperdynamic LV systolic function.

During retrospective analysis of the electronic medical record, all pertinent perioperative documentation was reviewed for evidence that there were changes made as a result of the rescue echocardiogram findings. Management changes were determined by evaluating the medical record for evidence of explicit or implicit changes based on the rescue echocardiography findings. Explicit changes were seen in the formal echocardiography report stating management changes as a result of findings, in the anesthesia record, in the operative record, or in the ICU clinical documentation. Implicit changes as a result of the rescue echocardiogram were considered only if the timing of intervention on the anesthesia record or the ICU record correlated with both the timing and the findings of the rescue echocardiogram.

In review of the electronic medical record, both medical and surgical management changes secondary to findings on rescue echocardiography were evaluated. When possible, the exact medication and its intended use based on documentation were recorded. Medications were classified as those used predominantly to improve inotropic function (epinephrine, ephedrine, milrinone, or dobutamine) or to predominantly improve vascular tone (norepinephrine, phenylephrine, or vasopressin). Because methylene blue was administered to subjects with suspected catecholamine-refractory vasoplegia, it was included within this subset of pharmacologic intervention. Although not a vasopressor by itself, the mechanism of action of methylene blue inhibits the production of endothelial nitric oxide, which is thought to contribute to catecholamine refractory vasoplegia.[18]

Results were determined to be "other medical management" for cases in which medical management decisions were otherwise unclassified, such as the cessation of an inotrope in the setting of LVOT obstruction or administration of a different medication class such as beta-blockers. All cases in which a change to surgical management, including additional procedures, a change in the planned procedure, or a cancellation of a procedure, occurred as a result of rescue echocardiography findings were noted using descriptive statistics.

RESULTS

Of the 364 rescue echocardiograms reviewed, 212 (58.2%) were performed for male patients; average age of patients was 58.8 years (SD ± 15.7 years). Two hundred seventy-five subjects, representing 75.5%, survived to discharge. There were no reported cases of TEE-related complications in this cohort, including bleeding, dental, oropharyngeal, esophageal, or gastric injury.

The most common modality used for rescue echocardiography was TEE, and greater than 50% of all rescue echocardiograms were performed in the intraoperative setting. A summary of the modality and subject location at time of rescue echocardiography is presented in Table 3.

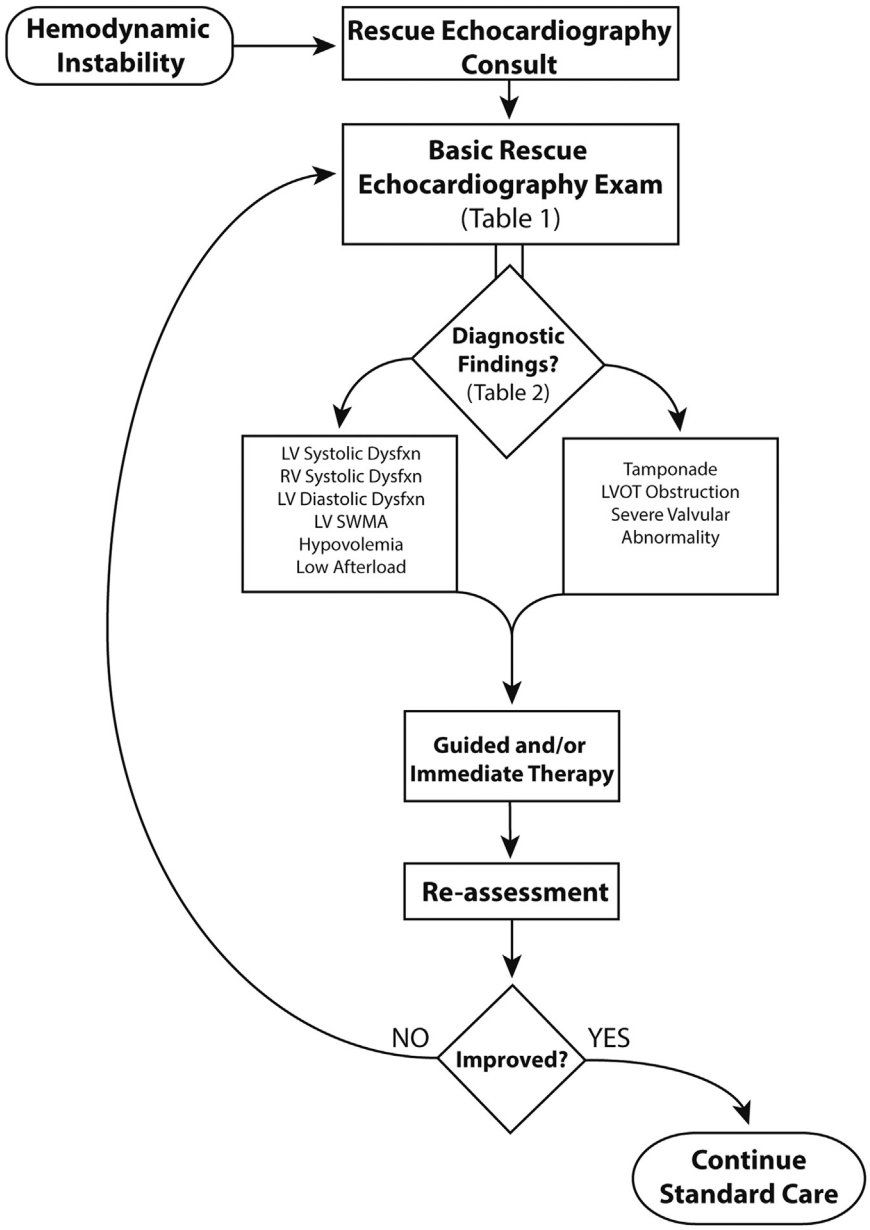

Fig 2. Flow chart showing approach to performance of rescue echocardiography used by the Division of Perioperative Echocardiography. Abbreviations: LV, left ventricular; RV, right ventricular; Dysfxn, dysfunction; SWMA, segmental wall motion abnormalities; LVOT, left ventricular outflow tract.

Review of surgical procedure category showed that 74 (20%) of rescue echocardiograms were performed for subjects who underwent an initial cardiac procedure. Of these, 63 were performed in the postoperative setting and 11 were performed in the intraoperative setting. All 11 intraoperative exams were performed during emergent return to the operating room for either bleeding or hemodynamic instability. The diagnostic findings made by rescue echocardiography and the frequency distribution of these findings are presented in Table 4. Some rescue echocardiograms resulted in more than one diagnosis, and for some, the cause of hemodynamic instability was not documented. Of the 364 rescue echocardiograms reviewed, 51 had no findings to explain a cause of hemodynamic instability.

When divided by location at the time of rescue echocardiography, common diagnoses for the intraoperative setting were hypovolemia (n = 65, 32.2%), LV systolic dysfunction (n = 23, 11.4%), and RV systolic dysfunction (n = 20, 9.9%). The most common diagnoses in the postoperative setting were RV systolic dysfunction (n = 39, 24.1%), LV systolic dysfunction (n = 36, 22.2%), and LV segmental wall motion abnormalities (n = 31, 19.1%). In the perioperative population, less common causes of instability were seen, such as pericardial tamponade (n = 13, 3.6%) and dynamic LVOT obstruction (n = 13, 3.6%).

Table 1. The Basic Rescue Echocardiography Exam Sequences for Transesophageal and Transthoracic Echocardiography Used by the Division of Perioperative Echocardiography

Clips#	Position	View	Angle
13-View Basic TEE Exam Sequence			
1	ME	AV SAX	40
2	ME	AV LAX	130
3	ME	AV LAX w/ CFD over AV	130
4	ME	Bicaval	110
5	ME	RV Inflow/Outflow	60
6	ME	RV In/Out w/ CFD over PV	60
7	ME	4 Chamber	0
8	ME	4 Chamber w/ CFD over MV	0
9	ME	4 Chamber w/ CFD over TV	0
10	ME	2 Chamber	90
11	ME	LV LAX	130
12	TG	LV SAX	0
13	TG	Descending Aorta SAX	0
8-View Basic TTE Exam Sequence			
1	PS	LV LAX	
2	PS	LV LAX w/ CFD over AV	
3	PS	LV LAX w/ CFD over MV	
4	PS	LV SAX	
5	AP	4 Chamber	
6	AP	2 Chamber	
7	AP	LV LAX	
8	SC	LAX IVC, sinoatrial junction	

Abbreviations: AP, apical window; AV, aortic valve; CFD, color-flow Doppler; IVC, inferior vena cava; LAX, long axis; LV, left ventricle; ME, midesophageal position; MV, mitral valve; PS, parasternal window; PV, pulmonic valve; RV, right ventricle; SAX, short axis; SC, subcostal window; TEE, transesophageal echocardiography; TG, transgastric position; TTE, transthoracic echocardiogram; TV, tricuspid valve;.

Regarding rare findings, one subject was found to have Takotsubo cardiomyopathy in the ICU, which prompted a change in management by augmenting inotrope administration. One subject underwent TTE rescue echocardiography intraoperatively, which showed evidence of venous air embolization during the resection of a pineal mass. Another subject was found to have new-onset severe LV systolic dysfunction and a highly mobile mass in the sinus of valsalva adjacent to the left main coronary ostium, which obstructed coronary flow in a ball-valve manner. A total of 14 subjects with left ventricular assist devices (LVAD) were evaluated with rescue echocardiography in the postoperative setting. Six of the 14 had RV systolic dysfunction, and 3 had suction events (dynamic collapse of the LV chamber around the LVAD inflow cannula, which can be due to low LV preload or cannula malposition) as the etiology of the hemodynamic instability.[19]

Overall, management was changed in 59% of the 364 rescue echocardiograms performed. Details regarding management changes and the exact medication used as a result of rescue echocardiography findings are shown in Table 5. Of these 51 reportedly normal rescue echocardiograms, 43 had explicit documentation stating that the recommendation was no change in management, and because this did not result in a management change, this subset was counted in management changes. A subset of subjects had more than one management change, such as fluid administration and inotrope administration. Surgical management changes included an additional surgical procedure, a change in the surgical plan, or procedure cancellation.

DISCUSSION

The most important finding of this retrospective analysis was the wide variety of etiologies of hemodynamic instability within this perioperative population. The heterogeneity of echocardiographic findings suggests that the provider is unlikely to accurately deduce the cause after normal assessments and interventions have not yielded expected results in the setting of unknown hemodynamic instability. This is further supported by the large percentage of subjects who had management changes as a result of the rescue echocardiogram. In neither the intraoperative group nor the postoperative group did a single diagnosis encompass even 40% of all rescue echocardiography diagnoses. This paralleled previously published studies on perioperative rescue echocardiography, both intraoperatively and in the ICU, which have reported no single predominant etiology (greater than 50%) in any

Table 2. Criteria for Classification of Echocardiographic Diagnostic Findings

Diagnostic Findings	Echocardiographic Criteria
LV systolic function*	Hyperdynamic (EF >70%)
	Normal-to-mildly decreased (EF 70%-45%)
	Moderately decreased (EF 44%-30%)
	Severely decreased (EF <30%)
RV systolic function†	Normal (TAPSE ≥1.6 cm)
	Mildly decreased (TAPSE 1.5-1.2 cm)
	Moderate-to-severely decreased (TAPSE <1.2 cm)
LV diastolic function‡	Normal (E>A, s>d)
	Impaired relaxation / Grade 1 (E<A, s>d)
	Pseudonormal / Grade 2 (E>A, s<d)
	Restrictive / Grade 3 (E>>A, s<d)
SWMA	Absence of SWMA
	Presence of SWMA
Hypovolemia	Reduced LV end-diastolic volume
	Normal/reduced LV end-systolic volume
Pericardial tamponade	None
	Effusion without hemodynamic consequence
	Tamponade physiology
Valvular abnormalities§	Normal-to-mild valve dysfunction
	Moderate-to-severe valve dysfunction
Dynamic LVOTO	Absence of LVOTO
	Presence of LVOTO
Reduced afterload	Normal LV end-diastolic volume
	Reduced LV end-systolic volume

Abbreviations: A, late diastolic filling mitral inflow velocity; d, peak anterograde diastolic pulmonary venous flow velocity; E, peak early filling mitral inflow velocity; EF, ejection fraction; LV, left ventricle; LVOTO, left ventricular outflow tract obstruction; RV, right ventricle; s, peak systolic pulmonary venous flow velocity; SWMA, segmental wall motion abnormalities; TAPSE, tricuspid annular plane systolic excursion.

*Classification adapted from Lang et al.[13]

†Classification adapted from Rudski et al.[14]

‡Classification adapted from Quiñones et al.[15]

§Classifications adapted from Baumgartner et al.[16] and Zoghbi et al.[17]

Table 3. Characteristics of the Rescue Echocardiograms Performed

Type of Echocardiogram	TEE n (%)	TTE n (%)
Total (%)	349 (95.9%)	15 (4.1%)
Location of rescue study		
Preoperative	1 (0.3%)	0
Intraoperative	199 (57.0%)	3 (20%)
Postoperative	149 (42.7%)	12 (80%)
PACU	0	7 (43.8%)
ICU	149 (42.7%)	5 (33.3%)

Abbreviations: ICU, intensive care unit; PACU, postanesthesia care unit; TEE, transesophageal echocardiography; TTE, transthoracic echocardiography.

setting.[1,3,4,6,7,20,21] Furthermore, many of the most common diagnoses, such as hypovolemia and ventricular dysfunction, require different therapeutic measures, underscoring the importance of determining the exact etiology of hemodynamic instability to avoid patient harm.

Earlier studies have focused on point-of-care echocardiography in small cohorts of hemodynamically unstable patients.[2,3,6,7] The present approach builds on this by using echocardiography to diagnose not only the cause of hemodynamic instability in a broader perioperative population, but also as a continuous monitor to evaluate the results of treatment (Fig 2). Additionally, the present study provided a larger subject population in both an intraoperative and postoperative setting, which further confirmed that the cause of hemodynamic instability in these patients was extremely varied and may require imaging to sort out the diagnosis. It was found that the standardized approach of an initial basic exam, followed by a more focused evaluation of key findings or abnormalities seen on the initial imaging sequence, optimized the efficiency, completeness, and reproducibility of rescue echocardiograms. A disciplined approach is particularly important when performing and comparing serial exams to evaluate the efficacy of management changes.

When the intraoperative population and postoperative population were evaluated separately, the results in Tables 4 and 5 showed association between rescue echocardiography findings and management changes. The frequency of hypovolemia within the intraoperative population was 32.2%, and the incidence of management change resulting in fluid administration intraoperatively was 41.1%. This held true for biventricular systolic failure, for which the combined incidence approached 20% and 16.8% of subjects with documented changes in management who were administered inotropes.

A high percentage of intraoperative patients diagnosed with hypovolemia was expected, because of the predictable relative reduction in preload during general anesthesia. However, volume status can be an elusive parameter to quantify via cardiac imaging. Indeed, only 113 of the 202 intraoperative study

Table 5. Management Changes as a Result of Rescue Echocardiography Findings

Management Changes	Number of Rescue Echocardiograms Showing Management Change		
N = 364	Total (%)	Intraoperative n = 202 n (%)	Postoperative n = 162 n (%)
All management changes*	214 (58.8%)	126 (62.4%)	87 (53.7%)
Fluid administration	113 (31.0%)	83 (41.1%)	30 (18.5%)
Inotropes	64 (17.6%)	34 (16.8%)	30 (18.5%)
Epinephrine	38	27	11
Milrinone	14	5	9
Dobutamine	8	2	6
Ephedrine	1	1	0
Unspecified	7	2	5
Vasopressors	40 (11.0%)	25 (12.4%)	15 (9.3%)
Vasopressin	25	17	8
Norepinephrine	19	10	9
Phenylephrine	39	9	0
Methylene Blue†	1	0	1
Unspecified	3	1	2
Inhaled vasodilators	8 (2.2%)	3 (1.5%)	5 (3.1%)
Diuretics	5 (1.4%)	1 (0.5%)	4 (2.5%)
Surgical changes‡	27 (7.4%)	9 (4.5%)	17 (10.5%)
Other medical changes	18 (4.9%)	11 (5.4%)	7 (4.3%)

*Totals may exceed 100%, because some rescue echocardiograms resulted in multiple management changes.

†Methylene blue is not a vasopressor by definition but is used in the setting of refractory vasoplegia to reduce endothelial nitric oxide production and improve vascular smooth muscle tone and improve afterload.

‡One surgical change occurred in the single preoperative rescue echocardiogram performed in which the subject underwent percutaneous coronary intervention.

Table 4. Rescue Echocardiography Findings by Overall and Location-Specific Frequency

Rescue Echocardiography Findings	Frequency of Diagnoses by Location at Time of Rescue Echocardiography		
N = 364	Total (%)	Intraoperative n = 202 n (%)	Postoperative n = 162 n (%)
LV systolic dysfunction (moderate or severe)*	60 (16.5%)	23 (11.4%)	36 (22.2%)
RV systolic dysfunction (moderate or severe)	59 (16.2%)	20 (9.9%)	39 (24.1%)
LV diastolic dysfunction (moderate or severe)	35 (9.6%)	15 (7.4%)	20 (12.3%)
LV SWMA*	49 (13.5%)	17 (8.4%)	31 (19.1%)
Hypovolemia	89 (24.5%)	65 (32.2%)	24 (14.8%)
Pericardial tamponade	13 (3.6%)	4 (2.0%)	9 (5.6%)
Valvular abnormalities (moderate or severe)	41 (11.3%)	15 (7.4%)	26 (16.0%)
Dynamic LVOTO	13 (3.6%)	6 (2.0%)	7 (4.3%)
Reduced afterload	16 (4.4%)	8 (3.9%)	8 (4.9%)

Abbreviations: LV, left ventricle; LVOTO, left ventricular outflow tract obstruction; RV, right ventricle; SWMA, segmental wall motion abnormalities.

*This diagnostic category also included the single subject who underwent rescue echocardiography in the preoperative setting.

reports commented on volume status. Of these 113 patients, 64 (57%) were diagnosed with hypovolemia by echocardiography. The observation that many rescue echocardiography reports did not comment on volume status led to a quality improvement measure to include this parameter in the report.

The present retrospective review showed that 26 subjects (7.1%) had surgical management changes resulting in an additional procedure, a change to an ongoing procedure, or the cancellation of a procedure as a result of the rescue echocardiogram. In the intraoperative population, surgical management changes occurred in 4.5%. Surgical management changes were more common in the postoperative population at 10.5%. However, the incidence is lower than that reported by other authors (13%-15%).[6,7]. This difference may be the result of a broader use of rescue echocardiography at the authors' institution or variations in study populations.

Perioperative hypotension is influenced by a complex interplay of hemodynamic factors, and point-of-care echocardiography by appropriately trained anesthesiologists has become an increasingly valuable tool to answer the age-old question: "What is the cause of the patient's hypotension?" Rescue echocardiography can help to direct pharmacotherapies and fluid administration to optimize hemodynamics and can direct surgical management changes as reflected in the overall management change rate of 59%, consistent with other previously published studies.[1,4–7]. Likewise, if there is no indication to change management, it can reassure the provider that the patient's hemodynamic needs are being addressed appropriately.

This retrospective review was limited in its the ability to truly determine the frequency with which rescue echocardiography assists in decision-making in the perioperative period, because it is possible that some findings were communicated but not documented on the official report. Also, this was an observational review of perioperative populations at a single tertiary care university hospital, and the findings may not be entirely applicable in different clinical settings. With an institutional bias toward transesophageal echocardiography as a monitoring tool in the intraoperative setting, it is possible that the rates of rescue echocardiography were higher in the present population than at other institutions, due to increased availability.

CONCLUSIONS

There are a wide variety of diagnoses contributing to hemodynamic instability, both in the intraoperative and postoperative populations. While certain diagnoses are more common than others, there is not a single diagnosis that occurs so frequently that a heuristic approach to the diagnosis of hemodynamic instability might be successful in the absence of echocardiographic evaluation. Additionally, other rare findings, such as tamponade, dynamic LVOT obstruction, or reversible causes of hypotension in LVAD patients, allow for prompt and rational intervention. This review supports the idea that "if you don't look, you don't know." Rescue echocardiography is a high-yield, low-risk diagnostic modality, which continues to play an important role in the care of hemodynamically unstable patients.

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