Published in final edited form as:

Anesth Analg. 2017 November ; 125(5): 1479–1481. doi:10.1213/ANE.0000000000002156.

The Implementation of a Preoperative Transthoracic Echocardiography Consult Service by Anesthesiologists

Sasha K. Shillcutt, MD, MS, FASE*, Daniel P. Walsh, MD*, Walker R. Thomas, RDCS, FASE*, Elizabeth Lyden, MS†, Tara R. Brakke, MD, FASE*, Sheila J. Ellis, MD*, Steven J. Lisco, MD, FCCM*, and Nicholas W. Markin, MD, FASE*

*Department of Anesthesiology, University of Nebraska Medical Center, Omaha, Nebraska.

†Department of Biostatistics, University of Nebraska Medical Center, Omaha, Nebraska.

Abstract

We describe a preoperative transthoracic echocardiography consult service led by anesthesiologists. The implementation process and the patient cohort are described. Preoperative transthoracic echocardiographic examinations were mostly performed in patients undergoing intermediate or high-risk noncardiac surgery and in patients with a higher calculated mortality risk. All transthoracic echocardiographic examinations were interpreted by anesthesiologists.

Address correspondence to Sasha K. Shillcutt, MD, FASE, University of Nebraska Medical Center, 984455 Nebraska Medical Center, Omaha, NE 68198. sshillcu@unmc.edu.

DISCLOSURES

Name: Sasha K. Shillcutt, MD, MS, FASE.

Contribution: This author helped analyze the data and write the manuscript.

Conflicts of Interest: Dr Shillcutt is an author for e-echocardiography.com, the owner of Brave Enough, LLC, and has funding from the National Institute of Aging for Clinical Trial 1R03 AG045103–01A1 on the use of echocardiography to guide hemodynamic management in elderly noncardiac surgical planning.

Name: Daniel P. Walsh, MD.

Contribution: This author helped analyze the data and write the manuscript.

Conflicts of Interest: None.

Name: Walker R. Thomas, RDCS, FASE.

Contribution: This author helped analyze the data.

Conflicts of Interest: None.

Name: Elizabeth Lyden, MS.

Contribution: This author helped analyze the data and write the manuscript.

Conflicts of Interest: None.

Name: Tara R. Brakke, MD, FASE.

Contribution: This author helped analyze the data.

Conflicts of Interest: None.

Name: Sheila J. Ellis, MD.

Contribution: This author helped analyze the data.

Conflicts of Interest: None.

Name: Steven J. Lisco, MD, FCCM.

Contribution: This author helped analyze the data.

Conflicts of Interest: None.

Name: Nicholas W. Markin, MD, FASE.

Contribution: This author helped analyze the data and write the manuscript.

Conflicts of Interest: None.

This manuscript was handled by: Nikoloas J. Skubas, MD, DSc, FACC, FASE.

Acting EIC on final acceptance: Thomas R. Vetter, MD, MPH.

Reprints will not be available from the authors.

Health care interventions, aimed at improving patient outcomes while decreasing health care expenditures, continue to evolve. In the Perioperative Surgical Home model, anesthesiologists may be tasked with the additional responsibility of preoperative optimization and risk modification.¹⁻³ Anesthesiologists with cross-training in transthoracic echocardiography (TTE) may have a unique advantage in preoperative cardiac risk evaluation.^{1,4,5}

We present a model where TTE examination is integrated by anesthesiologists during the preanesthesia assessment. If a Preanesthesia Assessment and Treatment (PAT) attending physician or an anesthesiologist in the holding area deems that a TTE examination is necessary during the preoperative evaluation, the TTE examination is performed on-site with immediate interpretation and communication of the TTE examination findings. We present the model using 172 subjects who underwent preoperative TTE evaluation by such an anesthesiologist-led consult service. The primary purpose of this report was to describe the workflow paradigm of the consult service.

METHODS

Following Institutional Review Board approval, retrospective data were obtained from the Perioperative Echocardiography Consult Service (PECS) quality assurance database within the Department of Anesthesiology. The electronic medical record was queried to match all subjects aged 19 years or older who received a TTE performed by PECS between June 1, 2013, and August 31, 2016. All TTE examinations were ordered independently, by either anesthesiologist or internist evaluating the patient or by the anesthesiologist assigned to the case, and performed either in the PAT clinic or in the preoperative holding area, respectively.

TTE examinations were ordered based on the 2014 American College of Cardiology/American Heart Association Guidelines on Perioperative Medicine.⁵ TTE examinations were performed in instances where sending the patient to the echocardiography laboratory would have delayed or canceled surgery due to time constraints. Exclusion criteria were TTE examinations performed as part of a study protocol for research purposes.

TTE Examinations

Either the PECS sonographer (94%) or the anesthesiologist (6%) performed the TTE examinations. The sonographer was a registered diagnostic cardiac sonographer certified through the American Registry of Diagnostic Medical Sonography with 10 years of experience in performing TTE. Interpretation of the TTE examinations was completed by 3 anesthesiologists certified in Advanced Perioperative Transesophageal Echocardiography, who were also testamurs in the Examination of Special Competence in Adult Echocardiography by the National Board of Echocardiography, and completed TTE training courses as previously described by Shillcutt et al.⁴ TTE examinations were performed using either a Philips CX50 ultrasound machine with an S5-1 sector array transducer probe or IE33 ultrasound machine using either the S5-1 or the X5-1 matrix array probe (Philips Healthcare, Andover, MA). The Department of Anesthesiology's TTE protocol was used.

TTE examinations were interpreted immediately by the PECS Faculty and results verbally communicated to the preoperative physician and reported in the electronic medical record. Each patient was assigned a Surgical Mortality Probability Model (S-MPM) risk score and class level described by Glance et al.⁶ The S-MPM risk score for each patient was determined from 3 risk factors: American Society of Anesthesiologists Physical Status (ASA-PS), surgical risk category, and emergency status. The point value of the score ranged from 0 to 9 and was classified into 3 levels with an associated risk of 30-day mortality assigned to each class (ie, class I: 0–4, <0.50% mortality; class II: 5–6, 1.5%–4.0% mortality; class III 7–9, >10% mortality).⁶

RESULTS

TTE examinations were performed in a minority of subjects (1.1%, n = 172/15,701) evaluated in the PAT clinic. The majority of TTEs were performed in PAT (61%, n = 105/172), while 39% (n = 67/172) were performed in the immediate preoperative holding area. The majority of subjects were ASA-PS 3 (65.7%, n = 113/172) and were undergoing intermediate or high-risk surgery (72.1%, n = 107/172) as defined by the European Society of Cardiology and European Society of Anesthesiology Guidelines.⁷ Subject demographics and findings are summarized in the Table.

Subjects had a surgical mortality risk of S-MPM class level I (27.9%, n = 48/172) or S-MPM class level II (65.1%, n = 112/172). Twelve subjects (7.0%) had an S-MPM class level III or an estimated surgical risk of >10%. The location where the TTE examination was performed differed based on surgical mortality risk. While the majority of S-MPM class II subjects (69.5%) had their TTE examination performed in the PAT clinic, the higher S-MPM class III subjects were more frequently imaged in the immediate preoperative holding area.

The most common indications for ordering TTE examinations were new murmur, history of congestive heart failure, and unknown functional status. No complications related to TTE were reported.

DISCUSSION

The purpose of this article was to describe an anesthesiologist-led preoperative TTE service. The implementation of the clinical service was feasible, typically requested by preoperative physicians in ASA-PS 3 subjects, undergoing intermediate or high-risk procedures. Since the introduction of this model as an alternative option for preoperative TTE examinations, it has become the primary method for performing TTE examinations for preoperative cardiovascular risk assessment. The TTE examinations were ordered to answer clinical questions raised by physicians in the PAT clinic or preoperative holding area. As the stewardship of health care dollars continues to increase and evolve, so does the importance of identifying ways to improve patient safety, outcomes, and value of clinical services. Our study is limited by a small cohort at a single institution. We were able to demonstrate the ability to conduct these examinations in a timely fashion, which has the potential to optimize operating room throughput. Prospective studies to define the impact of such a service are needed.

ACKNOWLEDGMENTS

The authors thank Julia Hoffman, RN, BSN, for her administrative support.

Funding: This study was funded by the Department of Anesthesiology at the University of Nebraska Medical Center in Omaha, Nebraska.

REFERENCES

1. Dexter F, Wachtel RE. Strategies for net cost reductions with the expanded role and expertise of anesthesiologists in the perioperative surgical home *Anesth Analg*. 2014; 118:1062–1071. [PubMed: 24781575]
2. Kash BA, Zhang Y, Cline KM, Menser T, Miller TR. The perioperative surgical home (PSH): a comprehensive review of US and non-US studies shows predominantly positive quality and cost outcomes *Milbank Q*. 2014; 92:796–821. [PubMed: 25492605]
3. Raphael DR, Cannesson M, Schwarzkopf R. Total joint Perioperative Surgical Home: an observational financial review *Perioper Med (Lond)*. 2014; 3:6. [PubMed: 25177486]
4. Shillcutt SK, Brakke TR, Thomas WR, Porter TR, Lisco SJ. The development of a perioperative echocardiography consult service: the Nebraska experience *J Cardiothorac Vasc Anesth*. 2015; 29:777–784. [PubMed: 25575406]
5. Fleisher LA, Fleischmann KE, Auerbach AD. American College of Cardiology; American Heart Association 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing noncardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on practice guidelines *J Am Coll Cardiol*. 2014; 64:e77–e137. [PubMed: 25091544]
6. Glance LG, Lustik SJ, Hannan EL. The Surgical Mortality Probability Model: derivation and validation of a simple risk prediction rule for noncardiac surgery *Ann Surg*. 2012; 255:696–702. [PubMed: 22418007]
7. Kristensen SD, Knuuti J, Saraste A. Authors/Task Force Members 2014 ESC/ESA Guidelines on non-cardiac surgery: cardiovascular assessment and management: The Joint Task Force on non-cardiac surgery: cardiovascular assessment and management of the European Society of Cardiology (ESC) and the European Society of Anaesthesiology (ESA) *Eur Heart J*. 2014; 35:2383–2431. [PubMed: 25086026]

Table.**Subject and Procedure Data (Total n = 172)**

Variable	Mean (SD)	Absolute Range
Age (y)	66.9 (14.7)	23–93
Body mass index	30.6 (9.9)	12.4–86.0
Sex		
Male	73 (N)	42.4%
Female	99 (N)	57.6%
ASA-PS Score		
I	0	0.0
II	15	8.7
III	113	65.7
IV	43	25.0
V	1	0.6
Surgical procedure type		
General	41	23.8
Orthopedic	39	22.7
Neurosurgical	19	11.0
Ear, nose, and throat	17	9.9
Vascular	13	7.6
Urological	12	7.0
Gynecological	11	6.4
Endoscopy	6	3.5
Interventional radiology	6	3.5
Other	8	4.6
Surgical risk class (S-MPM class level)		
I (30-d risk of mortality <0.5%)	48	27.9
II (30-d risk of mortality 1.5%–4.0%)	112	65.1
III (30-d risk of mortality >10%)	12	7.0
Location of performed examination		
PAT clinic	105	61.0
Immediate preoperative area	67	39.0
Indication for examination		
New heart murmur	76	44.2
History of congestive heart failure	15	8.7
History of coronary artery disease	14	8.1
History of valvular heart disease	12	7.0
New ECG changes	12	7.0
History of pulmonary hypertension	7	4.1
Symptoms of congestive heart failure	5	2.9
New arrhythmia	5	2.9
Sepsis	2	1.0

Shortness of breath	2	1.0
Other	22	12.8

Abbreviations: ASA-PS, American Society of Anesthesiologists Physical Status; ECG, electrocardiogram; PAT, Preanesthesia Assessment and Treatment; S-MPM, Surgical Mortality Probability Model.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript