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Prevalence of Clinically Important Abnormalities Found on Transthoracic Echocardiography Ordered for Indication of Heart Murmur Found on Physical Examination

Isla McClelland, MD, Victor Mor-Avi, PhD, Roberto M. Lang, MD, R. Parker Ward, MD

Department of Medicine, University of Chicago Medical Center Chicago, Illinois

A heart murmur (HM) is a common indication for transthoracic echocardiographic (TTE) imaging. Current American College of Cardiology/American Heart Association guidelines recommend TTE imaging, and appropriate use criteria (AUC) deem TTE imaging appropriate in the initial evaluation of any patient with murmur and a “reasonable suspicion” of valvular heart disease.^{1–3} The prevalence of significant TTE abnormalities in patients with HMs has not been well established, and the associated factors that predict TTE abnormalities in patients with HMs are unknown. We sought to determine the prevalence of clinically important abnormalities on TTE in patients with HMs referred for TTE imaging.

We reviewed 350 consecutive patients (> 18 years) referred for initial TTE imaging with an indication of HM to University of Chicago Medicine. The mean age of the study group was 62.3 years, 64% were women, and 86% were outpatients. Clinical details, ordering provider specialty, and TTE findings were recorded. For each study, AUC designation as “appropriate” or “rarely appropriate” was determined on the basis of the review of murmur characteristics and clinical factors supporting a “reasonable suspicion” of valvular heart disease. Of note, there are no “may be appropriate” indications included in the AUC for initial TTE imaging to evaluate HM. Composite end points of “any TTE abnormality” and “any major TTE abnormality” were noted. A major TTE abnormality was defined as any finding that would prompt immediate or short-term (<1 year) treatment or followup, including moderate or severe valvular heart disease (either stenosis or regurgitation), left ventricular outflow obstruction, and/or any intracardiac shunts.

We found that only 23% of patients had major TTE abnormalities, and 39% had completely normal TTE findings (Table 1). Severe valvular heart disease was present in only 4% of studies. Major TTE valvular abnormalities included 5% with moderate or greater aortic regurgitation, 5% with moderate or greater tricuspid regurgitation, 5% with moderate or greater mitral regurgitation, and 4% with moderate or greater aortic stenosis. Clinical documentation allowed AUC classification in 329 studies (94%). Among classifiable studies, 87% were appropriate, and 13% were rarely appropriate. The most common scenarios deemed rarely appropriate were studies for which “no murmur” was documented in the ordering provider’s physical examination and benign murmurs of pregnancy. Among appropriate studies, 28% had major TTE abnormalities, and 33% had completely normal TTE findings. Among rarely appropriate studies, no major TTE abnormalities were found, and 70% of TTE findings were completely normal.

Ordering provider specialty was internal medicine for 50% of studies, anesthesia for 33% (from an outpatient preoperative clinic), cardiovascular (CV) specialties for 12%, and surgery for 5%. CV specialists had the lowest percentage of ordered studies that were rarely appropriate (3% vs 15% for non-CV specialists, $P < .04$), while anesthesia providers ordered the highest frequency of rarely appropriate TTE studies (21% vs 9% of nonanesthesia specialists, $P < .01$), followed by surgeons (19%) and internal medicine providers (10%). TTE studies ordered by CV specialists had the highest frequency of major TTE abnormalities (33%) and were significantly less likely to have completely normal findings (21% vs 42% of non-CV specialists, $P < .02$). TTE examinations ordered by anesthesia providers had the lowest frequency of major abnormalities (18%) and were significantly more likely to have completely normal findings (47% vs 35% of nonanesthesia specialists, $P < .04$).

These findings show that in patients referred for HM, there is a low prevalence of major TTE abnormalities, including a very low prevalence of severe valvular heart disease. The application of AUC effectively stratifies the likelihood of finding abnormalities on TTE imaging, as no study deemed rarely appropriate was found to have a major TTE abnormality, and 70% had completely normal results. CV specialists, who would be expected to have the greatest experience recognizing pathologic HMs, were the most likely to order TTE studies with significantly abnormal findings and were the least likely to order those with completely normal findings. CV providers infrequently order rarely appropriate TTE examinations, likely partially because of clinical factors and disease prevalence in a referral population but perhaps also because of more diligence and comfort documenting murmur characteristics that help establish a “reasonable suspicion“ of valvular heart disease as dictated by the AUC. Finally, the low prevalence of significant TTE abnormalities may be a function of ordering conventions. For example, in a patient with symptoms and a murmur, the symptoms are entered as the TTE indication, thus selecting out the patients with HMs who may be most likely to have advanced valvular heart disease.

In conclusion, there is a low prevalence of significant TTE abnormalities in patients referred for initial TTE imaging for the indication of HM, and completely normal TTE findings in this group are common. Application of the AUC on the basis of supporting clinical factors effectively stratifies the likelihood of finding major abnormalities on TTE imaging, with rarely appropriate studies identifying patients very unlikely to have any significant TTE abnormalities. This study is timely in that it serves to highlight the value of the AUC, which will soon be required as part of a qualified clinical decision support mechanism for all Medicare imaging services as outlined in a recent Centers for Medicare and Medicaid Services mandate.

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Table 1

Summary of Findings.

	TTE findings		
	Normal	Any TTE abnormality	Major TTE abnormality
All TTE studies (N = 350)	39 (137)	61 (213)	23 (81)
Appropriate TTE studies (n = 286)	33 (95)	67 (191)	28 (79)
Rarely appropriate TTE studies (n = 43)	70 (30)	30 (13)	0 (0)
Ordering Provider			
CV specialty (n = 42)	21 (9) [*]	79 (33)	33 (14)
Internal medicine (n = 175)	38 (66)	62 (109)	25 (43)
Anesthesia [‡] (n = 117)	47 (55) [‡]	53 (62)	18 (21)
Surgery (n = 16)	44 (7)	56 (9)	19 (3)

Data are expressed as % (n).

^{*} P < .02 compared with non-CV specialist providers.

[‡] Ordered from an outpatient anesthesia preoperative clinic.

[‡] P < .04 compared with nonanesthesia specialist providers.