Should Pediatric Echocardiography Be Performed in Adult Laboratories?

Roger A. Hurwitz, MD, and Randall L. Caldwell, MD

ABSTRACT. Objectives. Current health care management has resulted in a change in referral patterns. The present study was undertaken to define the efficacy and value of pediatric echocardiography performed and interpreted in adult laboratories.

Methods. We reviewed the findings in 100 consecutive pediatric patients referred to a pediatric cardiology center with a history or suspicion of heart disease. A total of 52 (52%) were admitted for an outside diagnosis in agreement with our final diagnosis. Technical difficulties were reported in 14 (14%) studies by the original laboratory; we felt that 32 (32%) studies were inadequate. Interpretation of communication between the outside echocardiography laboratory, primary care physicians, and patients’ family was erroneous in 32 (32%) cases. Repeat echocardiography was necessary in 38 (38%) patients (6 because of planned surgery). If initial referral had been to our own institution, 25 to 30 patients would not have undergone echocardiography.

Conclusions. Slightly more than half of echocardiography studies performed in pediatric patients in adult laboratories were technically adequate and interpreted correctly with proper physician–family communication. Many patients require repeat studies on further referral. A significant number would be spared echocardiography if they were sent to a pediatric cardiology center initially.

METHODS

All 100 consecutive patients referred to the pediatric cardiology clinic of one physician at Indiana University Medical Center for additional evaluation after echocardiography performed at an outside adult laboratory were included. No echocardiography was performed at a teaching institution or interpreted by a private pediatric cardiologist. The period covered was January 1994 to December 1996. Admission criteria included patients 1 month to 18 years of age, with a median of 6.5 years (Fig 1). Patients were evaluated clinically, with electrocardiography and roentgenography as necessary. Outside echocardiograms were reviewed separately. Interpretation of the initial echocardiogram by actual report, family report of their understanding of echocardiography results, or referring physician understanding of results was tabulated. Repeat echocardiography was performed as necessary. Twenty-four (24%) patients had intervention: cardiac catheterization in three, cardiac surgery in 14, and catheterization and surgery in seven.

Evaluation of technical adequacy and initial interpretation of the outside echocardiography were done by review of the initial report or commentary by the family physician on the reason for referral to a pediatric cardiologist. Although some equivocation was present, final analyses included only the result of our evaluation of the patient and of the outside echocardiography. Interpretation of available outside echocardiograms and our own repeat studies was done by a pediatric echocardiographer not involved in clinical management of the patient.

RESULTS

A total of 100 patients older than 1 month of age with suspected heart disease and previous echocardiography performed at an outside adult-oriented facility were referred to Riley Children’s Hospital and evaluated by a single pediatric cardiologist. Thirty-two (32%) studies were performed in hospital laboratories and 68 (68%) in physician offices. Sixty-four (64%) patients eventually were diagnosed as normal (no cardiac pathology), and 36 (36%) were felt to be abnormal. Of these, 21 patients underwent surgery. Fifty-two (52%) of the patients arrived with an exact diagnosis that also agreed with our final diagnosis.

Technical quality was questioned by the initial laboratory in 14 (14%) studies (Fig 2). Our review of the outside echocardiograms identified 32 (32%) cases in which technical problems did not allow adequate and complete evaluation. Interpretation of the outside echocardiograms was incorrect by analyses of the data or communication in 32 (32%) cases and...
questionable in another 2 cases. Of these, echocardiography studies appeared to us to be technically adequate in 16 cases. Initial echocardiography was performed and interpreted correctly in 14 of the 24 patients undergoing invasive procedures.

Repeat echocardiography was performed by us in 38 (38%) patients; on six occasions this was done routinely, because we feel it necessary to perform echocardiography on all patients before surgery dependent on echocardiographic diagnosis. Repeat echocardiography also was technically inadequate when done in our laboratory in 1 patient. Our clinical diagnosis was definitely wrong in 1 patient and questionable in 2 others. One patient was diagnosed incorrectly during our interpretation of the accompanying echocardiogram.

**DISCUSSION**

The current increase in dispersion of medical care probably reflects change in health care management. Although geographic exigencies may promote an attempt to diagnose pediatric cardiac patients locally, the travel distance to a pediatric cardiology center has remained constant. Yet there has been a proliferation of sophisticated diagnostic procedures performed in many locales. This is most manifest in availability and possible over use of facilities that perform echocardiography.

We evaluated efficacy of pediatric echocardiography performed in adult-oriented laboratories. To eliminate the possibility of a significant number of patients being studied as an emergency, we concentrated on elective studies performed on children older than 1 month of age. Thus, cardiac defects might be less complex. Also, hospital based technologists, trained in our laboratory to study newborns in outlying nurseries, would unlikely be involved. Our clinical appraisal was done separately from echo reinterpretation. However, the clinician usually had knowledge of the outside echo interpretation; this could have caused some bias, but experience suggested outside echo findings to often be misleading.

Only 64% of patients were finally diagnosed as normal; thus, the physicians who referred patients were reasonably adept at the local triage of patients with innocent murmurs or benign chest pain, because at least 50% of the pediatric population has such an occurrence.\(^2,4,5\) Factors influencing overuse of
Echocardiography may be a general appreciation of the diagnostic precision of the study and awareness of physicians and the public of catastrophic events in young athletes, promoting use of more sophisticated technology in some cases.

Despite many studies of older patients (35% older than 10 years) and echocardiography done electively, 32 (32%) of the outside studies were thought to be technically inadequate by us. Even the initial laboratory report expressed dissatisfaction with 14 (14%) of the studies. Such technical problems reflect the limited experience with children in most adult-oriented laboratories.

Interpretation and/or communication by the adult cardiologists were erroneous in 32% of patients (Fig 2), of whom half had technically adequate studies. Fourteen patients with abnormalities were not diagnosed correctly. There were 8 patients with abnormalities not found or mentioned; in six of these eight, an overlooked cardiovascular abnormality was important. Four of the six patients with diagnostic misinterpretation had important lesions. Common errors included presence or absence of coarctation of the aorta, abnormalities of systemic or pulmonary venous connection, ventricular and atrial septal defects, and patent ductus arteriosus. Overdiagnosis was more prevalent. Eighteen patients with normal hearts were labeled as abnormal. A few of these patients may have been considered to have abnormal hearts because of misinterpretation of the original echo report by the family physician, but they still required referral and rediagnosis. Magnification of the importance of a patent foramen ovale and consideration of minimal valvular regurgitation as a significant abnormality accounted for most of these “overdiagnoses.”

Errors in diagnosis are possible at any institution. We definitely identified one error in our clinical diagnosis (presence vs absence of small patent ductus arteriosus), and one error in our echocardiographic diagnosis (segmental hypertrophic cardiomyopathy). Repeat echocardiography with no change in diagnosis was done by us in 6 patients facing surgery. It is customary at our institution to perform our own echocardiography before surgery based on definitive echocardiographic diagnosis.

Cost-effectiveness was a likely issue when patients were sent initially for echocardiography. These 100 pediatric echocardiograms undertaken in adult laboratories necessitated repeat echocardiography in 38 (38%) patients, including 6 reevaluated because of our own presurgery protocol and 2 in whom we erred on initial evaluation. Although difficult to quantitate, the need for echocardiography in 25 to 30 (25% to 30%) patients in this study may easily be questioned.

The present study shows that slightly more than half of echocardiography studies performed in pediatric patients in adult laboratories were technically adequate and have correct interpretation. Pediatric echocardiography should be performed at facilities with appropriate equipment and experience. These echocardiograms then should be interpreted by a pediatric cardiologist. Considering the performance and interpretation of pediatric echocardiograms in an adult facility, there should be considerable concern over management based on such results. Consequences may include overdiagnosis as well as failure to diagnose important lesions. Thus, it would be prudent to refer a pediatric patient to a pediatric cardiologist to determine presence or absence of any cardiac abnormality. Appropriate diagnostic tests and management may then ensue.

REFERENCES
Should Pediatric Echocardiography Be Performed in Adult Laboratories?
Roger A. Hurwitz and Randall L. Caldwell

Pediatrics 1998;102;e15
DOI: 10.1542/peds.102.2.e15
Should Pediatric Echocardiography Be Performed in Adult Laboratories?
Roger A. Hurwitz and Randall L. Caldwell

*Pediatrics* 1998;102:e15
DOI: 10.1542/peds.102.2.e15

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://pediatrics.aappublications.org/content/102/2/e15