Five thousand echocardiograms: what have we done?

DAVID J BELL, DAVID A SANDLER

Abstract

This article describes the use of transthoracic echocardiography (TTE) in a series of 5,000 consecutive echocardiograms in a mid-sized UK district general hospital. The report highlights the basic demographics, reasons for the requests, yield of abnormal results and sources of the requests. The authors comment on the percentage of abnormal results for the different request categories and on how TTE can be best utilised as a cardiac investigation.

Key words: Transthoracic echocardiography, cardiac investigation, indications, results, district hospital.

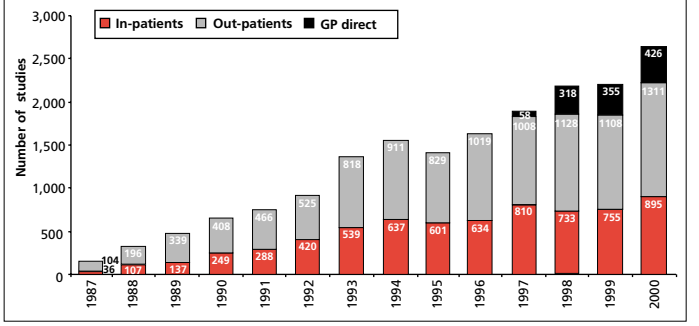
Introduction

Transthoracic echocardiography (TTE) has become the most important investigation in cardiovascular medical practice. It is widely available both within the hospital and to general practitioners (GPs). As a relatively inexpensive and non-invasive technique, it has become the cardiac investigation of choice in a wide range of clinical indications – many cardiac conditions can be accurately diagnosed by TTE without the need for more invasive investigation. The original M Mode and two-dimensional (2D) echocardiogram techniques have seen the addition of colour flow and Doppler studies, allowing the accurate assessment of blood flow between cardiac chambers and across valves. More recently, transoesophageal echocardiography (TOE) has further advanced cardiac diagnosis. This latter technique requires more expensive equipment, higher technical expertise and is more invasive for the patient. Because of this, TOE is not as widely available in the UK and TTE remains the most frequently utilised form of echocardiography.

This paper describes the current practice of TTE in one district general hospital in England, reporting 5,000 consecutive TTE investigations performed in one department over a period of 27 months. The report describes the patients, the indications for and results of the investigations. It also attempts to suggest clearer guidelines for the best use of TTE as an investigative tool.

Medical Directorate, Chesterfield and North Derbyshire Royal Hospital, Calow, Chesterfield, Derbyshire, S44 5BL.
David J Bell, Specialist Registrar
David A Sandler, Consultant Physician and Cardiologist
Correspondence to: Dr DA Sandler
(email: david.sandler@cndrh-tr.trent.nhs.uk)

Figure 1. Number of echocardiograms performed 1987–2000



Methods

Chesterfield and North Derbyshire Royal Hospital (CNDRH) is a 555-bedded district general hospital serving a catchment area of approximately 250,000 people. Echocardiography is performed in the diagnostic imaging department on one ATL 3,000 echo machine. Technical staff from the sonography or the cardiography departments perform investigations, and they are usually reported by the consultant cardiologist. Basic M-Mode and 2D-echocardiography, as well as Doppler and colour flow studies, are routinely carried out in all patients. Images are stored on videotape for later review and reporting.

As well as noting the numbers of TTEs performed each year since the service commenced in 1987, more detailed information was available for 5,000 consecutive echocardiograms performed over 27 months, between June 1998 and August 2000. The data collected included the age and sex of each patient, together with the source of referral (hospital in-patient, out-patient or direct general practitioner referral) and the reason for the request. We noted the number of days elapsing from the day of the referral to the day the scan was done, and also noted who performed and reported the scans. We identified 14 different reasons for TTE requests. One of us (DAS) determined whether the TTE demonstrated the abnormality being sought by the clinician, classifying each echocardiogram as 'normal' or 'abnormal' in the context of the request. The data was prospectively recorded from the request form and the reporting book. On rare occasions, some factual details could not be determined from the request form, but this only happened in a very small number of cases.

Results

Figure 1 shows the number of TTEs performed since an echocar-

Table 1. Reasons for requests by diagnostic category

Reason for TTE request	Number (%) of scans
Left ventricular dysfunction	2,307 (46%)
? Aortic murmur	841 (17%)
Atrial fibrillation	484 (10%)
Other murmur	440 (9%)
? Source of emboli	200 (4%)
Cardiomyopathy	174
Hypertension	119
? Pericardial effusion	104
? Bacterial endocarditis	89
Aortic root/Marfan's	40
Mural thrombus	16
Myxoma	3
Miscellaneous	169
Reason unknown	14
Total	**5,000**

Figure 2. Reason for requesting 5,000 TTE studies

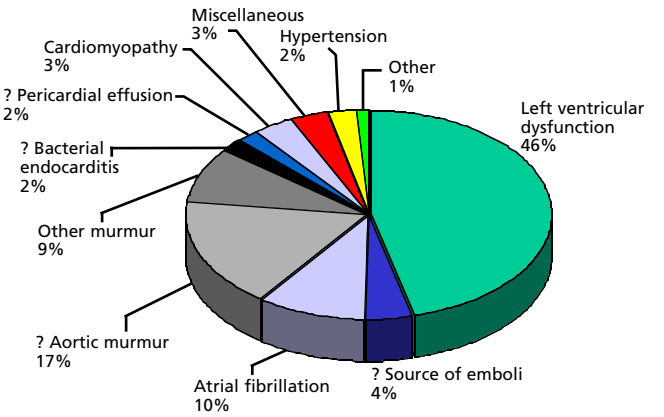
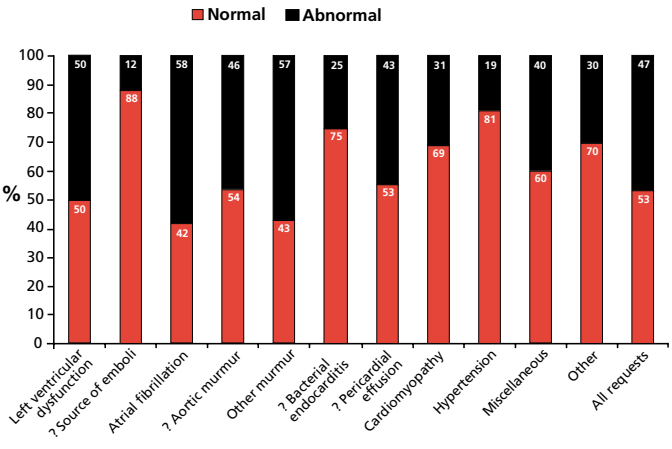


Figure 3. Proportion of abnormal TTEs for the top 10 categories of request



diography service was introduced to this hospital in 1987. It shows the relative proportions of in-patients to out-patients and also reflects the introduction of open access direct referrals from general practitioners (GPs) since 1997. This open access service has been described previously.[1]

Of the 5,000 patients, 2,435 (49%) were male. The patients' ages ranged from four to 99 years, with a mean of 64 years. Some 1,709 (34%) were in-patients at the time of the TTE, 2,499 (50%) were out-patients, and 788 (16%) were direct GP referrals. In four cases the source of the request was unknown. The mean number of days from the receipt of the request for the TTE to the investigation was two days for in-patients, 61 days for out-patients and 76 days for GP referrals. Ultrasonographers performed 53% of the scans, cardiac technicians performed 40% and medical staff undertook 6%. Medical staff reported 97% of the studies and the technical staff reported the remaining 3%.

Table 1 shows the number of TTE requests for each of the 14 categories identified. Miscellaneous scans included requests for conditions such as right heart failure, pulmonary hypertension, congenital heart disease, atrial or ventricular septal defects or where there was a family history of heart problems. The category 'Aortic root/Marfan's' refers to patients with suspected or known Marfan's disease where information is requested on the aortic root dimensions.

The 10 most frequent reasons for the echocardiogram requests appear in figure 2. Figure 3 shows the proportion of echocardiograms that were found to be abnormal in each of the top 10 diagnostic categories.

Discussion

There has been a huge increase in demand for echocardiography services in this DGH over a 13-year period and we fully expect this rise to continue. There was a broad range of reasons cited for the echocardiogram requests. The GP direct access service, launched in 1987, limited the requests to suspected left ventricular (LV) dysfunction, murmurs and atrial fibrillation (AF). This decision was guided by the desire of the primary care community to access this investigation in those key areas. Whilst limiting GPs to ask for TTE for those indications, no such restrictions were imposed upon hospital colleagues.

Our survey study has demonstrated that under half of the 5,000 echocardiograms were reported as 'abnormal'. Interestingly, TTE was abnormal in more than half of requests for investigation of LV dysfunction, murmurs or AF. In contrast, when looking for sources of possible emboli in stroke patients, mural thrombus after myocardial infarction or in the investigation of hypertension, less than one in five was abnormal. Whilst we accept that a 'normal' echocardiogram may, in some cases, be clinically relevant and helpful, we were struck by the low yield of abnormalities in some of the request categories. However, as this study was not designed to assess the action taken by the requester when the TTE result was received, we are unable to be sure how useful the investigation proved. That said, we discovered that in patients with suspected LV dysfunction, half had

Key messages

- TTE is one of the most important cardiac investigations. It is relatively non-invasive and widely available to GPs and hospital physicians
- 47% of the 5,000 echocardiograms in the series were reported as 'abnormal'
- TTE was abnormal in more than half of requests for investigation of LV dysfunction, murmurs or AF. Less than 20% of TTEs were abnormal when looking for sources of possible emboli in stroke patients, mural thrombus after myocardial infarction or in the investigation of hypertension
- Clearer guidelines for the best use of TTE as an investigative tool are required in order to increase the diagnostic usefulness of the service

good LV function. We believe that this is one of the clear indications for the investigation and may well have resulted in a useful therapeutic change for symptomatic patients.

TTE is useful in the assessment of patients with AF for a number of reasons. It has a role in determining aetiology, it can guide therapeutic choices in terms of rate control and possible cardioversion and it can also help the assessment of thromboembolic risk.[2] In our study, 58% of TTEs in patients with AF demonstrated an abnormality that was likely to be clinically relevant. We would encourage this investigation in all patients with AF.

The role of TTE in the evaluation of systolic murmurs has been reviewed and abnormal echocardiogram findings were commonly found in older patients with murmurs. A valve abnormality was seen in 55% of patients over 60 years old with a systolic murmur; in those aged less than 50, this yield fell to 24%.[3] Another study showed that healthy young patients with murmurs, especially females, were least likely to have abnormal TTEs.[4] In our own study, half of all TTEs performed to investigate a murmur demonstrated an abnormality.

The value of TTE in the assessment of patients with ischaemic strokes or transient ischaemic attacks (TIAs) has been debated. One study on the use of TTE in the assessment of stroke patients concluded that, in the absence of any clinical or laboratory evidence of heart disease, TTE is unlikely to yield findings that alter clinical management.[5] Transoesophageal echocardiography has been shown to be more sensitive in these patients.[6] Our own finding, that very few of those TTEs requested for embolic sources were abnormal, supports this conclusion. It has been suggested that TTEs in patients with stroke might be limited to those with a proven cerebral infarction and other suspicious cardiac features[7] (e.g. abnormal ECG, presence of a murmur, previous heart disease, AF, cardiomegaly on chest X-ray).

World Health Organisation guidelines have recommended that an echocardiographic assessment may be useful in risk stratification of hypertensive patients.[8] The presence of LV hypertrophy is an independent marker of cardiovascular risk in hypertensive patients.[9] Recently, a review of the role of echocardiography in hypertensive patients concluded that for patients not currently on treatment, echocardiography should be recommended as it may influence the decision to treat. However, in hypertensive patients already on treatment because of other identified risk factors, echocardiography was unlikely to change management and was not necessary.[10] Our TTE service received 119 requests in hypertensive patients, of which less than one in five appeared to demonstrate any abnormality. Perhaps the 'normal' report was considered useful by the requesting clinician, but the low yield of abnormality does cause us to consider whether this indication for TTE should be limited to patients in whom a specific clinical question is being asked.

In our study, only a quarter of the 89 TTEs performed for suspected endocarditis were abnormal, yet clinicians frequently request a TTE in such patients. A normal TTE does not exclude bacterial endocarditis and, conversely, clinicians have been shown to disregard TTE demonstrations of vegetations if clinical suspicion is low.[11] TTE is useful for detecting the complications of endocarditis such as valve rupture, and serial TTEs can be useful if clinical suspicion remains despite a normal initial study. TOE is generally better than TTE in imaging posterior structures of the heart, like the aortic and mitral valves, and is a more sensitive test in suspected endocarditis.[12] This might be the preferred investigation in such patients.

Conclusions

TTE use is rapidly increasing with a wide range of clinical reasons being cited for the requests. Overall, our diagnostic yield of abnormal scans was 47%. This study and other studies have shown that the frequency of any TTE abnormality differs greatly for different reasons for request. Clearer guidelines for TTE indications might be useful in order to increase the diagnostic usefulness of the service.

We believe that TTE is a very reasonable investigation in patients with breathlessness or other symptoms that might be due to LV systolic dysfunction; in those with atrial fibrillation; for suspected pericardial effusions; and, also in search of an embolic source in patients with other clues suggesting underlying cardiovascular disease. We are less sure of the role of TTE as a diagnostic investigation in suspected bacterial endocarditis and in hypertensive patients as a routine test. The role of TTE in the investigation of murmurs remains to be clarified. However, we agree that the request is reasonable as a 'first look and see' test, to try (with the help of a Doppler study) to rule out haemodynamically significant murmurs.

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