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Original Article

Development of a cardiac technician led paediatric echocardiographic service – experience from a district general hospital in the United Kingdom

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Abstract *Objectives:* To report our experience in providing cardiac technician led paediatric echocardiography services in a district general hospital in the United Kingdom. *Methods:* We have collected prospectively the numbers of referrals, and the proportion of abnormal echocardiograms, since inception of the service in 2000. In additional, for a period of 12 months, we have audited in detail the patterns of referral to the service, and outcomes, assessing the effect of the service on the outreach clinic run by a visiting paediatric cardiologist. *Results:* Use of the system resulted in detection of a wide range of abnormalities, with our audit showing that the patients received appropriate management. The total referrals to the service increased 10 fold over the 4 year period of the study. The proportion of abnormal hearts detected by echocardiography, however, dropped from 90 per cent to 16 per cent over the same period. The numbers of patients seen in the outreach cardiology clinic remained unaltered. *Conclusions:* Having been proved to be an effective model for the triage of children with suspected congenital cardiac disease, adoption of a cardiac technician led echocardiographic service has seen a dramatic increase in the numbers of echocardiograms requested, without decreasing the workload of the visiting paediatric cardiologist.

Keywords: Congenital cardiac disease; ultrasound; provision of service

A NUMBER OF POTENTIAL SOLUTIONS HAVE BEEN suggested to deal with the problem now being experienced in the United Kingdom of increasing numbers of referrals to the out-patient clinics conducted at tertiary level by paediatric cardiologists.[1–4] Most incorporate some form of triage within the centers making the referrals. One model, when appropriate expertise is available, is the local provision of an echocardiographic service led by technicians. We report our experience with the development of such a service over the last 4 years.

Methods

York district general hospital in the county of Yorkshire in the United Kingdom, provides a paediatric service to a total population of 300,000 patients. Prior to 2000, referrals for echocardiographic evaluation of patients with suspected cardiac disease were dealt with by the tertiary congenital cardiac service in Leeds, usually in an outreach clinic established 20 years ago. In 2000, the appointment of Jane Allen as senior cardiac technician, with more than 25 years experience working within a tertiary level paediatric echocardiographic department, including unsupervised reporting of echocardiograms, to run the adult cardiac technical department enabled a paediatric echocardiographic service to be commenced. Direct referrals for in-patient and out-patient echocardiography were accepted from members of the paediatric medical team, but not directly from the local family practitioners. Criterions for referral were not specified. Echocardiograms were performed and reported by the technician, with support where necessary from the tertiary department in Leeds.

The longstanding outreach clinic for paediatric cardiology organized by the team from Leeds continued during this period. Echocardiograms on new patients,

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and those undergoing follow-up as out-patients, were performed and recorded separately by the technician-led service.

We collected prospectively the numbers of normal and abnormal echocardiograms assessed within the service over the period of 4 years. In the calendar year of 2004, numerical data was collected for a full 6 months, and extrapolated to create a complete data set for the year. In addition over the period of 12 months from 1 May, 2003, through 30 April, 2004, we carried out an in-depth review of the service, recording the stated reasons for referral to the service, the final anatomical diagnosis, and the outcome for each patient referred. In order to ascertain the effect of the service on the workload of the paediatric cardiologists supervising the outreach clinic, we ascertained the numbers of out-patients seen with suspected cardiac disease in the clinic since 1995, using an electronic congenital cardiac database collected prospectively in Leeds, together with the records of the clinic held in York.

Results

Overall workload. Over the 4-year period, the total numbers of echocardiograms performed by the cardiac technician increased 10 fold. The increase in activity was almost entirely as a result of increased echocardiograms performed on out-patients (Fig. 1). In-patient activity was constant over the 4 years, at a mean of 27 scans, with standard deviation of 8.5 scans, each year.

In the first year of the study, echocardiograms carried out on children represented less than 0.5 per cent of the workload of the echocardiography department at York District General Hospital. By 2004, work carried out for children represented 8 per cent. The proportion of abnormal echocardiograms fell from 90 per cent in 2000, to 16 per cent in 2004 (Fig. 1).

Effect on the out-patient clinic for tertiary paediatric cardiology. The total numbers of patients assessed over the period from 1996 through 2004 proved to be constant (Fig. 2), with the creation in 2000 of the cardiac technician led echocardiographic service not affecting the number of patients seen as out-patients by the visiting paediatric cardiologist. The proportion of patients with normal as opposed to abnormal hearts seen in the clinic did not change over the period of the study.

Period of audit from 1 May, 2003, through 30 April, 2004. Patients were referred for echocardiographic evaluation of varied suspected diagnoses (Fig. 3). Structural cardiac abnormalities were discovered in 32 of the 157 of the patients (20 per cent–95 per cent confidence intervals from 22.1 to 42.9 per cent). All structural cardiac abnormalities were found in patients referred for evaluation of audible murmurs. Abnormal

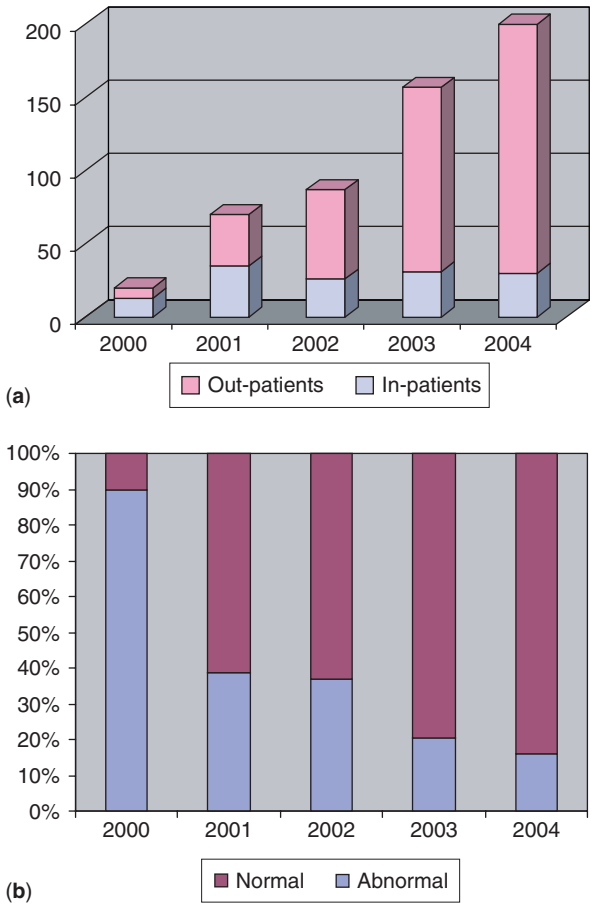

Figure 1.
*The graph (**a**) shows the numbers of referrals for out-patient (pink) and in-patient (blue) echocardiograms each year, with the second graph (**b**) showing the proportion of abnormal echocardiograms by year.*

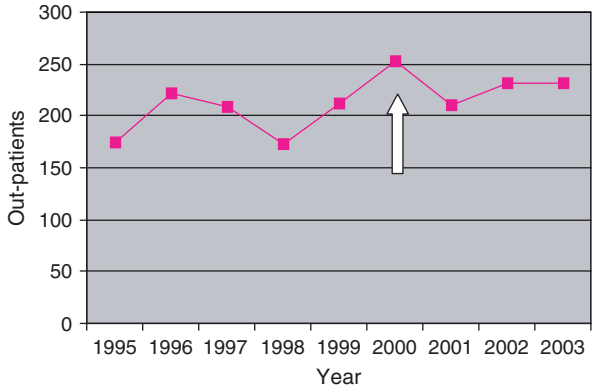

Figure 2.
The numbers of out-patients seen in the tertiary outreach clinic over the period 1995 through 2003.

echocardiograms were significantly more common in the scans made for hospitalized patients, 20 of 31, when compared to scans performed on those referred as out-patient scans, with only 12 of 125 proving

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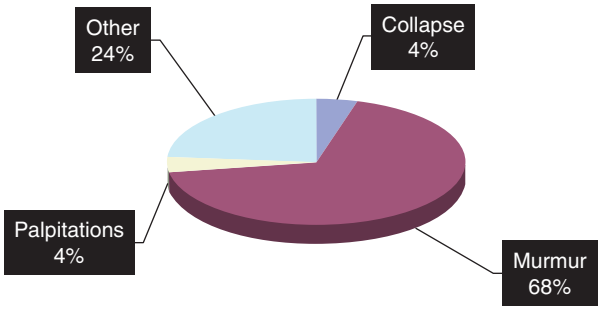

Figure 3.
The reasons given for referral for echocardiographic examination.

abnormal (p value for difference less than 0.0001). The lesions most commonly detected were ventricular septal defects, in 11 patients, and persistent patency of the arterial duct, in 5 patients. A range of other lesions were identified, including restrictive cardiomyopathy, Ebsteins malformation of the tricuspid valve, and Fallot's tetralogy. In 7 of the 157 patients (4.5 per cent, with 95 per cent confidence intervals from 1.9 to 12 per cent) lesions were discovered that either required, or would be expected to require, surgery in early life.

Discussion

Our findings show that a cardiac technician led echocardiographic service for children seen with suspected cardiac disease in a district general hospital, but supported by the tertiary cardiac centre, is an effective means of providing triage. A recent regional audit[1] showed that the General Hospital in York has one of the lowest proportions of patients with normal hearts referred as new patients to the tertiary center in Leeds. If such a system is to be effective elsewhere, then it requires a both a highly trained sonographer, able and willing to act with a degree of independence, and support from the tertiary centre, including clear mechanisms for advice provided by the paediatric cardiologic team. In our case, we were able to instigate the service because of the relocation from the tertiary centre of an extremely experienced echocardiographer, with more than 25 years experience in scanning children with cardiac diseases, her primary remit being to organize the services provided for adult echocardiography. Echocardiograms reported as normal were not formally checked by the paediatric cardiologist, as the sonographer was fully trained to report congenital echocardiograms independently, and had been doing so for over 10 years previously as part of the paediatric cardiac department within the tertiary centre. All abnormal scans, however, along with any scans considered equivocal, were audited, with the audit proving diagnostic accuracy to be extremely high. No significant errors were identified in any of the patients found to have abnormal hearts.

Our data also shows that offering an open service led by a technician resulted in a greatly increased demand for out-patient paediatric echocardiograms over a relatively short period. After less than four years, this 10 fold increase now represents a substantial proportion (8 per cent) of the total workload of the echocardiographic laboratory in the General Hospital. The implications of this increase on resources are not inconsiderable. By implication, our data suggests also that the increases in out-patient activity seen by specialist paediatric cardiologists may be the tip of the iceberg, reflecting an arena in which generalist paediatricians are increasingly unhappy to make the diagnosis clinically of normality when assessing children referred with suspected cardiac disease.[5]

The development of the service led by a technician, however, did not result in decreased activity in the outreach clinic provided by the visiting paediatric cardiologist from the tertiary centre. This does suggest that the population of patients referred to the echocardiographic service now known to be led by the technician is different from that referred for a specialist paediatric cardiac opinion. It seems likely that many, perhaps most, of the out-patients referred to the technician would not have had an echocardiogram in the period prior to the development of the new service. The question arises, therefore, as to whether the service led by the technician fulfills a previously unmet need, or whether echocardiograms are requested without a clear indication that they will be clinically useful, and that the findings will subsequently influence management.

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