Hand-held echocardiography for primary care

A low cost, miniature ultrasound device makes it possible for primary care to gain instantaneous access to echocardiography. This could make a greater contribution to improving cardiac care in the community than the currently available, albeit scarce, open access echocardiography services. Here Han Xiao looks at questions which need addressing before hand-held echocardiography becomes integrated into primary care.

Abstract

Echocardiography is a commonly used diagnostic tool in assessing cardiac disease. The advent of hand-held ultrasound devices means useful information on cardiac cavity size, ventricular wall thickness and function, or apparent valvular pathology can now be obtained by general practitioners after adequate training. This will be particularly useful in the care of patients with suspected heart failure, left ventricular hypertrophy, a cardiac murmur or atrial fibrillation. It will reduce the number of patients needing referrals and the waiting times for hospital echocardiography services. It is limited by the technical specifications of the equipment and operators expertise.

Key words: echocardiography, hand-held devices, primary care.

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'Hand-held ultrasound devices have been shown to provide useful information on cardiac cavity size, ventricular wall thickness and function, or apparent valvular pathology'

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Introduction

The appropriate management of cardiac diseases relies on prompt and accurate diagnosis. As with all branches of medicine, history and physical examination are a critical part of clinical cardiology; history taking can be perfected with good cooperation between the clinician and patient as well as concise questioning. But physical examination – may confront difficulties, particularly in circumstances where quantification is required – such as grading the severity of a valvular lesion, for instance or, assessing the degree of ventricular hypertrophy, or the dilatation and identification of early stage left ventricular dysfunction. Echocardiography – either in hospital or primary care – can readily resolve all these concerns.

In the last five decades, echocardiography has developed rapidly to become one of the most commonly used diagnostic tools in assessing cardiac diseases.[1,2] It provides detailed and immediate information on cardiac structure and function although, unfortunately, the use of such a useful diagnostic tool is very limited in primary care. The shortage of qualified echocardiographers remains the main limiting factor to its use in the UK.[3] Other factors include exhaustive training, its high cost coupled with the bulky and immobile equipment associated with performing echocardiography. Recently, however, many of these latter limitations have been overcome by the development of miniature ultrasound systems.

The concept of a hand-held echocardiographic device was introduced over 20 years ago,[2,4,5] although, it is only recently that such a device has become commercially available.[6-9] The newly developed hand-held ultrasound devices have been shown to provide useful information on cardiac cavity size, ventricular wall thickness and function or apparent valvular pathology.[7,10,11]

In this article, I review the two hand-held ultrasound systems currently available on the UK market (table 1 and figure 1) and answer questions on their use in primary care.

Who should perform echocardiographic studies in primary care?

The physician looking after the patient is the best candidate for this task, although this would be an impossible mission without adequate training. Complete echocardiographic investigation is often not needed, even in hospital care, so limited or point-of-care echocardiography may well be sufficient in primary care. Previous experience suggests that non-cardiologists – including medical residents and clinical cardiology fellows – can perform adequate point-of-care echocardiograms

Table 1. Comparison of two hand-held echocardiographic devices

	OptiGo (Philips)	SonoHeart Elite (SonoSite)
Dimension (cm) (lengthxwidthxheight)	33x23x9	34x9.3x6.4
Weight (kg)	3.3	2.6
Power	Rechargeable battery AC mains	Rechargeable battery AC mains
Transducer	2.5 MHz phased array	2 to 4 MHz Broadband array
Imaging specification		
2 dimension	Yes	Yes
M-Mode	No	Yes
Pulsed wave Doppler	No	Yes
Continuous wave Doppler	No	Yes
Colour flow mapping	Yes	Yes
Real time measurement facility	Distance calipers x 2 sets	Distance calipers x 2 sets Calculation package
Display	16.5 cm LCD screen	12.7 cm LCD screen
Image storage and cine	Still images	Still images
Peripheral connections	None	ECG, VCR, video printer, external monitor and PC
Guide price	£9,500	£15,700

Figure 1. Two examples of hand-held ultrasound systems: the Philips OptiGo (left) and SonoHeart Elite (right) devices

after a short period of intensive training.[7,9,11-13] It is likely, therefore, that general practitioners (GPs) could master limited echocardiography after some training.

What kind of patients should have a point-of-care echocardiogram?

A variety of patients will benefit from an immediate echocardiogram in the GP's clinic. Those patients found to have a normal heart echocardiographically will be reassured immediately, while those with any cardiac abnormalities can be appropriately referred to hospital care. In addition, the waiting time for an echocardiography referral will be diminished and any concomitant anxiety reduced.

Patients with suspected heart failure

Heart failure has a high prevalence worldwide. Heart failure patients have an impaired quality of life and shortened life expectancy, which constitutes a great economic burden.[14] Prompt and adequate treatment of heart failure can lessen these adverse impacts, but it relies on accurate diagnosis. Unfortunately, a significant number of patients with heart failure are diagnosed on history and clinical signs alone, even though echocardiography is recommended as the diagnostic test of choice.[14-16] This has led to two apparent unfavourable consequences: i) patients without objective evidence of heart failure are treated unnecessarily with anti-heart failure agents, ii) at the same time, patients with heart failure are not on optimal medication because quantitative assessment is lacking.[17,18]

Patients with possible left ventricular hypertrophy

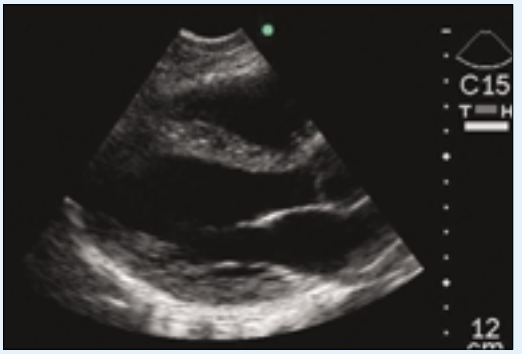
Left ventricular hypertrophy (LVH) is a significant and independent risk factor for adverse cardiac events including death.[19-21] Electrocardiography, although widely available, is less reliable than echocardiography in assessing the severity of LVH,[22,23] leading to the latter being considered the gold standard for LVH assessment. It is not unreasonable to suggest that all patients with hypertension should have an echocardiogram before antihypertensive agents are commenced. If LVH is present at baseline, serial follow-up echocardiograms should be carried out until it is completely resolved.

Patients with a cardiac murmur

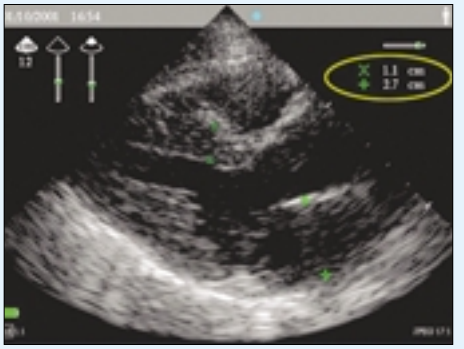
An experienced physician can easily recognise a cardiac murmur and differentiate a pan-systolic murmur from an ejection systolic murmur. It would, however, be hard for him/her to grade the severity of a valvular lesion on auscultation. Conversely, an echocardiographer with limited experience can easily grade the severity of a valvular lesion. Furthermore, an innocent mur-

Figure 2. Echocardiograms showing (**a**) parasternal long axis view of a normal heart recorded by the SonoSite system and (**b**) left ventricular hypertrophy recorded by the Optigo system

a



b



mur can cause a lot of anxiety to both the GP and patient without an echocardiogram to confirm the normal cardiac morphology.

Patients with atrial fibrillation

Atrial fibrillation is the most common cardiac arrhythmia and its incidence increases with age. The duration of atrial fibrillation, though a determinant of successful cardioversion, is difficult to define as the onset is invariably earlier than the first electrocardiogram confirming the rhythm. Atrial size increases with the duration of atrial fibrillation and influences the outcome of cardioversion. Echocardiography should be performed in all patients with atrial fibrillation not only to exclude possible atrial thrombus but also to determine atrial size on both sides and make an objective prognostic assessment.[24-26]

Key messages

- Hand-held echocardiography devices can help in the care of cardiac patients in the community
- With adequate training, general practitioners can use these devices successfully
- They should help improve patient care, and provide practical and continuing medical education to the referring doctor
- Equipment specifications will limit its uses

What are the potential limitations of hand-held echocardiography in primary care?

The potential limitations of hand-held echocardiography are strongly related to two principal factors: equipment and training. As a highly integrated device, hand-held ultrasound systems do not possess the same technical specifications or the same quality as conventional echocardiographs. Meanwhile, it would be impossible and not sensible for a GP to obtain the same level of training or experience as either an echocardiographer or a cardiologist with an interest in echocardiography. Bearing these two facts in mind, hand-held devices may not offer reliable information on any subtle change in wall motion or the precise grade of valvular lesion, and so, I would recommend a cardiology out-patient referral, with a complete echocardiographic study, if there is any uncertainty in the echocardiography findings recorded in primary care. This is likely to improve patient care and provide practical and continuing medical education to the referring doctor.

> ***'it has great potential in helping primary care manage cardiac patients in the community'***

Hand-held echocardiography, though not widely available, has great potential in helping primary care manage cardiac patients in the community. In order to use its full capacity, basic and intensive formal training will be necessary.

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