The decline of our physical examination skills: is echocardiography to blame?

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It was a logical expectation that scientific progress and the availability of sophisticated imaging modalities over the last decades would have strengthened the effectiveness of the traditional physical examination, which had not changed in almost 150 years. But, on the contrary, we witness a progressive decline in examination skills.1–7 Many colleagues bemoan this loss and blame our increasing reliance on imaging technologies and, more particularly, on echocardiography.3,4,6–8 However, the high quality of patient care of today has been the result from better diagnosis, and this has not been achieved by the traditional examination skills but by the application of imaging technologies.

Therefore, rather than blaming echocardiography, there are many arguments why pocket-size ultrasound imagers should be used as an integral part of the physical examination at the point of care.

Just like the introduction of the aural stethoscope initiated to the ‘golden era’ of clinical diagnosis, the incorporation of bedside ultrasound imaging will undoubtedly lead to a ‘new golden era’ of physical examination by providing a more accurate diagnosis, cost reduction by avoiding inappropriate tests, and a better patient–doctor rapport.

The physical examination: historical evolution

Taking an accurate medical history followed by a physical examination including inspection, palpation, and indirect auscultation was the practice of Pharaonic doctors (G. Ebers Papyrus, ca. 1550 B.C.)

Later, Hippocrates (5th century B.C.) and his disciples adapted these procedures for bedside examination and during the following two millennia medical practice remained essentially unchanged.

By the 18th century, the physical examination was largely abandoned and medicine relied primarily on subjective opinion.

Interest in the physical examination re-appeared after the pioneering work of G.B. Morgagni (1682–1771) who demonstrated for the first time the gross pathological changes by disease in the body organs. This stimulated some clinicians to correlate the anti-mortem symptoms and clinical signs with the post-mortem findings.

J.N. Corvisart (1755–1821) and H. Laennec (1781–1826) were the greatest pioneers. They re-introduced the examination principles employed by the Pharaonic doctors 3000 years earlier, but now based on more objective knowledge. Laennec introduced the ‘aural stethoscope’, the first technological aid in bedside diagnosis. The device augmented the sense of hearing and the detection of long bruits, heart sounds, and murmurs. Its potential was not readily accepted by most clinicians at the time, but history shows that its introduction was a milestone leading to the ‘golden era’ of bedside diagnosis.

The next major advances in diagnostic medicine were the electrocardiography and X-ray techniques in the first half of the 20th century. After World War II, the rapid evolution of digital technology and miniaturization led to the development of a wide range of new imaging technologies with impressive diagnostic performance. Among these, the non-invasiveness, the unprecedented versatility of application, and the integrated assessment of cardiac structure function and haemodynamics of echocardiography have made it the primary diagnostic imaging test. Since most often a definitive diagnosis is made, cardiologists feel that there is less need to develop the skills to perform a traditional physical examination. There are several reasons for this evolution.

Why cardiologists increasingly rely on echocardiography

Extending our physical senses by ‘seeing the heart or an organ’ provides objective information far beyond the indirect information obtained by inspection, percussion, palpation, and auscultation. Direct visualization considerably increases both the diagnostic yield and accuracy and allows quantitative assessment.9–11 The pathophysiology of many cardiac disorders, clinical signs, and auscultatory findings have also been elucidated by echo-Doppler studies. Why then should we rely on indirect information and secondary acoustic events when we actually can see what is wrong with the heart and its structures? Diseases such as small-to-moderate pericardial effusion, ventricular dysfunction, some cardiomyopathies, silent valvular disease, and mass lesions (vegetations and myxoma), all regularly encountered in daily practice, are elusive to the physical examination even when performed by experienced clinicians.
These conditions are readily diagnosed by a routine echo-Doppler examination with additional information. In addition, unexpected abnormalities are quite often detected. Clearly, clinicians embrace this potential.

The physical examination only detects disease after organ and/or tissue damage has occurred. In recent years, there has been a paradigm shift towards ‘pre-symptomatic’ diagnosis, because it leads towards a greater chance for effective treatment and outcome. Pre-symptomatic disease (e.g. early ventricular dysfunction) is regularly and unexpectedly diagnosed by a echo-Doppler examination.

The time pressure imposed by today’s high-volume practices and the increasing demands of our healthcare systems leave less time to perform a tedious traditional physical examination. In addition, both the examination setting in the outpatient clinics (comfort and quiet) and the habitus of many of our patients have changed making the standard physical examination more challenging.

The frequency of cardiovascular misdiagnosis in unselected patients who die in the hospital has halved over the past decades, and this decrease paralleled the increasing use of echo-Doppler examinations. In fact, it remains unknown how often the clinical diagnosis was wrong before we used echocardiography unless the patient underwent surgery or autopsy data were obtained.

Furthermore, there is an increasing and compelling demand from patients to be examined by new imaging technologies because of information on the internet as well as advise from other patients.

**Are imaging technologies and echocardiography to blame?**

Before the widespread use of echocardiography, the decline of examination skills was already a concern. Could faulty teaching and training have been reasons for the decline? It should also be realized that training and clinical experience are also not a guarantee for examination skills since part of them are an ‘art’ requiring specific talents.

We regularly see publications reporting on a patient in whom a bedside clinical sign or auscultatory finding led to a specific diagnosis, and this gives the authors the opportunity to review many clinical clues that are already known for almost a century and were elucidated by echo-Doppler. They are an illustration of the emotional dependence on the traditional physical examination. The skills of the old ‘master teachers’ who were able to recognize them are mentioned and praised with nostalgia, while the current generation of clinicians are labelled as ‘hyposkilled’ or ‘gadgetphillic’. These are unacceptable ‘monikers’ considering the high quality of clinical care they provide these days. We rather should recognize that most of us never were able to match the talents and skills of the master teachers, and that our examination skills gradually decline with time and age.

Since many of these clinical signs are infrequently encountered in a busy practice, there is a great chance that they are missed.

There is a plea for more training in traditional examination skills. However, we must be realistic and accept that there are increasing time constraints in the medical curriculum leaving less time for practical training programmes. Students and fellows have to spend a great deal of their time learning about new imaging technologies and most of them (will) effectively use them in practice.

**Point-of-care echocardiography**

The natural evolution for medical devices always shows a trend towards miniaturization and simplification of use.

The idea of a simple to use miniaturized echocardiograph as a diagnostic aid at the point of care for immediate diagnosis goes back to the mid-70s. At the Thoraxcentre—Rotterdam, we constructed a hand-held battery-powered ultrasound imager which we named ‘the ultrasound stethoscope’. Since stethoscope stands for ‘seeing the heart’ (stethos: chest and skopein: see), the term ultrasound stethoscope seems most correct. The standard aural ‘stethoscope’ should be more appropriately termed ‘stethophone’ (stethos: chest and phone: sound).

I used it in the Rotterdam Harbour/Tropical Hospital on consultation rounds, where there was no echocardiography available. It was very useful for diagnosing pericardial effusion and its differentiation from an enlarged heart, estimating cardiac chamber size, valvular disease, and mass lesions. Two major journals rejected the paper mainly because of the name ‘ultrasound stethoscope’. When we used the term ‘ultrasound cardioscope’ it was accepted in a secondary journal.

In 1995, Sonosite, Inc., a subsidiary of ATL Ultrasound, Inc., started with the support of the US Department of Defense a programme developing battery-powered ultrasound imagers for diagnosing severe trauma on the battlefield. In 2001, they introduced the Sonosite 180. Soon, a wide range of hand-carried devices with many modalities and measurement functions, some with digital and wireless connections, became available for applications in many disciplines. The latest generation is pocket-size, weighs ~400 g (V-scan, GE Vingmed Ultrasound AS, Horten, Norway). They provide high-resolution, two-dimensional imaging combined with colour flow imaging and measurement capabilities. These functions have been tested against higher-end systems and excellent diagnostic agreement has been reported. Of course, they cannot replace the high-end laboratory systems and should only be used as part of the clinical examination. These devices also offer the unique opportunity to show and discuss the findings during the examination, which significantly improves the physician–patient rapport.

Images are stored on microcards and can be downloaded to a workstation or any database. Remotely downloaded images can be transmitted for interpretation support from experienced laboratories or nearby intensive care units. This provides a practical alternative for remote areas and developing countries, where health care facilities or resources are limited with little or no access to other forms of imaging technology.

**Experience with point-of-care echocardiography**

The performance of the traditional physical examination has been evaluated in several studies, indicating that 30% major and 65% minor pathologies are missed. Correct identification of heart sounds and murmurs ranged between 20 and 50%, respectively. Would these results pass the current tests applied in clinical trials for reliability?
A physical examination integrated with echocardiography increases its diagnostic yield by >50%, adds greater accuracy, and unsuspected or clinically relevant abnormalities are diagnosed in ~20% of patients. The negative predictive value of an integrated physical examination is >95%, so that further tests and costs can be avoided in patients with a normal study.

Its use during consultation rounds in both cardiac and non-cardiac departments has been shown to quickly provide information that results in cheaper and more efficient management. Their use has been proven extremely useful for screening and identification of cardiac disorders either in the general population or in the selected groups (early heart failure, left ventricular hypertrophy, and abdominal aortic aneurysm). An increasing number of studies stress the advantages of using point-of-care echocardiography in situations where quick decisions are essential and in intensive care medicine.

Its uses and advantages in many medical specialties are presented in an extensive recent review by Moore and Copel. Medical students after 18 h of instruction detected common pathologies with both high sensitivity and specificity and outperformed the physical examination of experienced cardiologists for diagnosing valvular disease, left ventricular enlargement, left ventricular dysfunction, and hypertrophy. Recent studies indicated that medical doctors after a brief training with a pocket-size device greatly improved their diagnostic performance over history, physical examination, and ECG alone.

Training requirements

As with any technological device, effective use of a pocket-size imager requires dedicated training and experience. The American Society of Echocardiography and the European Association of Echocardiography published guidelines and recommended Level 2 training. However, the required level of training and competence might vary depending on the application and clinical scenarios. For instance, identification of acute problems in an emergency or critical care environment is different from answering referral questions in an outpatient clinic. The American College of Emergency Physicians provided specific guidelines to perform and interpret basic ultrasound studies in emergency situations.

The penetration of pocket-size devices in all medical disciplines is increasing, and it is realistic to expect that they will ultimately be used by all clinicians including general practitioners. Therefore, the ultrasound stethoscope should not only be incorporated in training programmes for its use in the physical examination, but also as a teaching tool as it provides an effective bridge between several basic disciplines including physics, anatomy, pathology, and pathophysiology.

Conclusion

Point-of-care echocardiography rapidly diffuses across the practice and care of all medical disciplines. It is a user-dependent technique demanding competence and proper training. This can best be realized by initiating teaching and training programmes in the core curricula of medical schools. Future generations of doctors will find it hard to believe that, in 2013, many clinicians were still relying on the vague findings of a 200-year-old traditional physical examination and were compromising clinical efficacy when direct information was available from point-of-care echocardiography.

History will undoubtedly show that point-of-care echocardiography was the beginning of a ‘new glorious age’ of the physical examination.

References


