Replacing the mercury sphygmomanometer

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Requires clinicians to demand better automated devices

When Scipione Riva-Rocci published his papers on a new sphygmomanometric technique in 1896[1] he could not have anticipated that his method was to become the mainstay of clinical measurement for over a century. Because of this long and fruitful record of service any threat to the familiar mercury sphygmomanometer is met with resistance—which may be interpreted as arising more from sentimentality than from scientific principle. But is this fair? May there not be more to the Riva-Rocci/Korotkoff technique than meets the eye?

Clinical sphygmomanometry will change as we move into the next millennium. Firstly, we will no longer be allowed to use mercury, and with its passing will disappear the main argument against introducing the kilopascal as the unit of measurement—namely, that we measure what we see. Mercury will no longer be permitted because it is toxic to the environment, and the replacement of the millimetre of mercury with the kilopascal, used throughout science as the unit of pressure, may be seen as an opportunity to tidy up an irksome anomaly in scientific nomenclature.[2 3]

The mercury thermometer has been replaced in many countries, and in Sweden and the Netherlands the use of mercury is no longer permitted in hospitals.[4 5] In other European countries, however, including the United Kingdom and Ireland, the move to ban mercury from hospital use has not been received with enthusiasm because we do not have an accurate alternative to the mercury sphygmomanometer. None the less, the fear of mercury toxicity[6] is making it difficult to get mercury sphygmomanometers serviced, and the precautions recommended for dealing with a mercury spill are influencing purchasing decisions. Indeed, this is what government policy in many countries would favour—the gradual disappearance of mercury without having to face the consequence of collecting redundant mercury from hospitals should a ban become operative.

One consequence of this policy is that hospitals and individual doctors are replacing mercury sphygmomanometers with unreliable devices, such as aneroid sphygmomanometers, which become inaccurate with use and should not therefore be substituted for the mercury instrument.[7] Most automated devices have had a poor record for accuracy,[8] though more devices are now satisfying the stringent criteria of the British Hypertension Society[9 10] and the Association for the Advancement of Medical Instrumentation,[11] and more will undoubtedly do so in the future.

The advent of accurate automated devices, however welcome, is not without problems. Firstly, the available automated devices were designed for self measurement of blood pressure, and it should not be assumed that they will be suited for clinical use, though some are being used successfully in hospital practice and in several major hypertension studies. Secondly, oscillometric techniques cannot measure blood pressure in all situations, particularly in patients with arrhythmias, such as rapid atrial fibrillation, but there are also individuals in whom these devices cannot measure blood pressure for reasons that are not always apparent. Thirdly, doctors are uneasy about trusting algorithmic methods, zealously guarded by manufacturers. To ensure that new devices conform with recommended validation protocols the mercury sphygmomanometer will have to be retained as a gold standard in designated laboratories.

Finally, there is an issue that goes beyond scientific logic: the Riva-Rocci/Korotkoff technique possesses that mystique peculiar to the clinical relationship, which is sensed by doctors and nurses and appreciated by patients. Understandably, therefore, clinicians are unhappy at having to relinquish the Riva-Rocci/Korotkoff technique, which for all its inaccuracies possesses subtle virtues. These include the performance of an acquired skill, which may be important in establishing the rapport from which a successful clinical relationship between doctor and patient may develop. Others mourn the sacrifice of yet another clinical skill to the relentless march of technology.

Against all this, the passing of mercury sphygmomanometers should not in itself be a cause for concern. In fact it might be argued that the sooner we rid ourselves of an inaccurate technique,[1 4 7] on which we base so many important decisions of management, the better. Automated devices can remove observer error and also provide printouts of the measurement with the date and time of the measurement and digital output that can be stored and plotted. Indeed, technology should be able to give us the best of both worlds: a device that allows us to continue using the Riva-Rocci/Korotkoff technique without mercury.

We must prepare therefore for changes in clinical sphygmomanometry. Several simple measures can be taken immediately. Healthcare providers can phase out mercury sphygmomanometers and replace them with devices that have been independently validated against the relevant protocols. Automated devices should provide blood pressures in both millimetres of mercury

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and kilopascals so that users become familiar with kilopascals. Finally, the medical and nursing professions, the clinical market for blood pressure measuring devices, must ensure that manufacturers provide us with accurate devices designed to our specifications, rather than accepting, as we have in the past, devices in which these considerations are secondary to the commercial success of the product.

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EO'B is a member of the board of AccuSphyg LLC, New York, a company developing an automated device. He has also received funding over the past decade from several blood pressure device manufacturers to perform validation studies on automated devices, the results of which have been published in peer reviewed journals.

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Heart and heart-lung transplantation in Down's syndrome

The lack of supportive evidence means each case must be carefully assessed

Congenital heart disease is common in Down's syndrome, occurring in about 40% of individuals.[1] Twenty years ago cardiac surgery was often not attempted in children with Down's syndrome because of operative mortality of up to 60% and a short life expectancy.[2] With improvements in paediatric cardiac surgery and changes in attitude towards children with Down's syndrome such children now undergo corrective cardiac surgery. Some will inevitably develop complications and may benefit from heart transplant. There is also a large group of young adults with Down's syndrome who did not have heart surgery when young and who have uncorrected heart lesions that are now inoperable because of irreversible pulmonary vascular disease. They too are potential candidates for heart-lung transplantation. There is no published literature on heart or heart-lung transplantation in Down's syndrome, which makes it hard to predict the outcome in these patients.

Heart transplantation is now a widely accepted treatment, and medium term survival has steadily improved.[3] The results of heart-lung transplantation are not as good but have also improved. Long term outcome of both is uncertain, with rejection and the side effects of immunosuppressive drugs (malignancy and infection) the major complications.

During a 14 year programme with over 800 transplants we have received only one referral for a patient with Down's syndrome. A questionnaire sent to other UK transplant centres revealed only two other referrals. None of these patients underwent transplantation (for reasons other than Down's syndrome). However, the paucity of referrals is surprising given the high prevalence of Down's syndrome and associated cardiac problems. A similar situation has been noted in paediatric oncology, with a lower than expected number of referrals for bone marrow transplant.[4]

Although few people are consciously prejudiced, parents, referring physicians, and transplant centres may all worry that that a transplant will be "too much" for someone with Down's syndrome or that the patient will be difficult to manage. Coexisting medical problems are common and may be contraindications to transplantation. There is also concern over infective and malignant complications. Although no published work addresses the risks of heart transplant in Down's syndrome, some information can be drawn from literature about the immune system, bone marrow, and renal transplants in this population.

Well documented immunological abnormalities in Down's syndrome result in a high incidence of infection, autoimmune disease, and malignancy. Impaired chemotaxis, antibody production, phagocytosis, and bacteriocidal activity; reduced numbers of circulating lymphocytes; and an abnormal thymic structure are all recognised, although controversy exists on the precise immune defects.[5] Immune abnormalities lead to an excess of all types of infection, but particularly to pneumonia (because of physical differences, including smaller airways, enlarged tonsils and adenoids, and lax muscle).[1]

Leukaemia is 10-30 times more common in Down's syndrome. Reports on bone marrow transplantation describe increased infective complications, higher early mortality after transplantation, and more chemotherapeutic toxicity.[6] Both the increased incidence of haematological malignancy and the increased sensitivity to chemotherapeutic agents may be due to a decreased ability to repair genetic damage, which has been shown in vitro.[7] This has implications for the risk

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