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Invasive cardiovascular needs in South Africa: a view from afar up close

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Unmet interventional cardiology needs have been identified in South Africa. These relate to inadequate staffing in terms of the consultant faculty in public teaching hospitals, a marked shortage of trained interventional cardiologists, limited experience of fellows in complex interventions, availability of the newer devices, haemodynamic assessment and treatment of structural heart disease, and limited interaction between public and private practice cardiologists. Resolution will require multiple initiatives. Managing these challenges would allow South Africa to become a model for other underserved healthcare systems.

Interventional cardiovascular care is evolving rapidly in terms of the specific diseases to be treated. These include paediatric and adult congenital heart disease, complex coronary pathology, structural heart disease, the early and longer-term manifestations of rheumatic fever and other infectious diseases, together with the technology available and the healthcare and societal systems involved. Professional societies have recognised the need to identify opportunities and challenges in this evolving field. The South African Society of Cardiovascular Intervention (SASCI) developed a programme where selected global interventional cardiology leaders were offered the opportunity as visiting professors to spend a substantial two- to three-month time period working primarily in public cardiovascular units throughout South Africa. This involved teaching at these institutions, working directly with residents, fellows, consultants and paramedical staff, and interaction with the specific healthcare systems concerning opportunities for optimising care and training in this rapidly changing field.

An important component was to understand the challenges as well as the opportunities for the entire country. The purpose of this article is to identify both the opportunities and the challenges for South Africa as understood by the co-authors, all of whom have participated in the SASCI programme dating back to 2010, and to posit potential options for change.

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South Africa has a superb history of extremely important contributions to cardiovascular medical care from physicians working at the pre-eminent hospitals: Chris Hani Baragwanath, Charlotte Maxeke (Johannesburg), Tygerberg Academic, Groote Schuur (Cape Town), Steve Biko, Sefako Makgatho (Pretoria), Universitas (Bloemfontein) and Inkosi Albert Luthuli Central Hospital (Durban). Important contributions have also come from expatriates who trained at these institutions before emigrating. Seminal advances include the first heart transplant, observations about tuberculosis and its cardiac involvement, HIV, rheumatic heart disease (RHD), electrocardiography and electrophysiology, pharmacology, imaging and vascular physiology. Advances from institutions within South Africa, as well as from expatriates from those institutions, continue to help form the background of scientific achievement in cardiovascular medicine. Since the end of the Apartheid government, significant changes in access to healthcare have been instituted in both the public and private sectors.

Works in progress

There are great opportunities in South Africa for expanding current efforts in developing disease-based local, regional and national registries. These include, among others, strategies for the treatment and prevention of RHD, and for the continued success of the largest mass antiretroviral therapy programme in the world, and approaches to decreasing tobacco use and improving blood pressure control at the community level. Durable new heart valve prostheses which can be used in the younger populations with earlier structural heart disease (seen in South Africa and other parts of Africa) are being developed along with devices which can be implanted without the need for anticoagulant therapy, making subsequent care and follow-up easier. Such initiatives can be applied elsewhere to benefit patients throughout the African continent and beyond.

Current opportunities/challenges

Against this robust history there are substantial challenges which represent unmet needs but also great opportunities. South Africa is a land of marked variability, not only in the geographic but also in the professional and societal landscape. In this very large country with a population of 55 million people, there are only approximately 170 cardiologists and 45 cardiothoracic surgeons. Of the 170 cardiologists, approximately 120 perform routine invasive cardiology procedures and fewer than half are trained and able to perform advanced interventional coronary and structural procedures. The number of cardiologists primarily serving the government-supported healthcare system (which serves approximately 80% of the population) is very small.

Training programmes are variable but lengthy and occur in public sector facilities: six years of university medical school (after 12th grade), two years of internship (both medicine and surgery disciplines), then one year of community service (typically in a more rural setting also practising both medicinal and surgical elements). After this, the individual can be registered as a general practitioner. The practitioner can then specialise – usually four years of general internal medicine in an academic environment, and then three years of cardiology. However, these training programmes are very limited in number and are oversubscribed. Most physicians are therefore obliged to work as senior house officers in state hospitals until a training post becomes available. The three years of cardiology training involve one year of cardiac catheterisation, six months of electrophysiology (EP) (mainly implantation and care of patients with pacemakers), six to eight months of echocardiography and the remainder focused specifically on clinical cardiovascular care. There are specific required numbers attached to these three years: 300 diagnostic angiograms, ~100 interventional procedures (either as primary or secondary operator), a total of 40 pacemakers (30 VVI and 10 DVI devices) and 500 echocardiograms. After that, there is a detailed test with written and oral components. Successful completion of these multiple steps and the final test result in certification as a cardiologist.

There is no established pathway for advanced interventional cardiology, echocardiography, heart failure or electrophysiology. Experience varies significantly at each training site: in some there is only a single faculty member who has to address all training, both laboratory and clinical, for cardiology fellows, as well as the cardiology training of general medical residents. The quality of the teaching in clinical reasoning and general medical care is superb but limited by time and personnel constraints. Some individual faculty members, like most South African cardiologists, have not undergone additional specialised training. Accordingly, at least in interventional cardiology, fellows may leave their training programme to enter, for example, into private practice, very well trained in cardiology but sometimes with only basic catheterisation skills including limited or no exposure to a variety of interventional devices. In some training centres with more faculty cardiologists, training is substantially broader but overall still remains quite varied.

One important issue relates to the specific patient subsets seen during training. The large catchment areas served by the tertiary hospitals and the lack of efficient transport mean that diagnosis and treatment of acute infarction is performed in community hospitals which may not have any cardiology coverage. Following diagnosis, thrombolysis is typically the first line of therapy with streptokinase along with antiplatelet agents, rather than newer more selective agents. This is based completely on economic considerations. Following lytic therapy, considerations as to whether lytic therapy has worked are based on patient symptoms and changes in ST-elevation (a reduction of 50% is felt to be indicative of successful reperfusion). In cases of failure of lysis or the development of a mechanical complication such as severe mitral regurgitation or shock, patients may not be referred to the tertiary centre or may not be considered able to survive transfer. Typically however, the medicine resident on call for cardiology at the tertiary centre (which may be several hours away) is called for advice, even though transport may not be feasible. Instead, the patient may be referred within the next 24-48 hours to the tertiary hospital, although the number of cardiology beds at those institutions is

typically very limited. On arrival at the central hospital, decisions as to whether lytic therapy has been successful or not are often based on evolution of electrocardiogram (ECG) changes. Those patients may be taken to the laboratory 24-48 hours or even later after symptom onset or after lytic therapy. If the anatomy is felt appropriate based on vessel size and the presence or absence of flow, an intervention may be performed. Fractional flow reserve (FFR) or instantaneous wave-free ratio (iFR) technology is often unavailable and adjunctive therapy with drugs, such as glycoprotein IIb/IIIa inhibitors is very uncommon. Decisions for treatments in these patients relatively late after an index event, i.e., conservative vs. invasive, are based on consensus as there are few scientific data; it is important to remember that ACC/AHA and ESC guidelines may not be generally relevant or applicable in such patients. The development of robust time-mandated protocols tailored to the South African situation would improve patient flow and remove judgement calls by less experienced cardiologists which may delay treatment.

Exposure to primary percutaneous coronary intervention (PCI) in South Africa is very limited because patients present to the tertiary hospitals long after the event. Other limitations are that some public hospitals have only one catheterisation laboratory which must also be used for pericardiocentesis, thoracentesis and pacemaker implantation (among other procedures), and the fact that the number of beds available for patients post PCI may be very limited. Finally, basic equipment such as activated clotting time (ACT) machines may not be available to assess the adequacy of anticoagulation.

Patients with chronic angina can be referred for catheterisation more electively. Typically, by that time functional testing has been performed. Many of these patients have very advanced comorbidities and severe coronary artery disease (CAD). It is a misconception that CAD is uncommon in parts of the world such as South Africa, as the epidemic of that disease is starting to affect all demographic groups. Once again, facilities for FFR or iFR are not typically available. If the anatomy is very complex, the procedure may be stopped, particularly if complex bifurcation, left main stenosis or a chronic total occlusion (CTO) is present. Discussion centres on whether the anatomy looks favourable, if an experienced operator can be found (often from the private sector), if the centre has a cardiovascular (CV) surgeon, and if there is a surgical opportunity. In institutions with a CV surgeon, a prescheduled Heart Team approach is used. However, because of limited personnel and resources, the waiting list for surgery may be as long as weeks to months.

In addition to limited exposure to interventional procedures, there is limited training in haemodynamics and assessment of complex structural heart disease or haemodynamically difficult cases, such as a non-compliant left atrium (LA). In these cases, decisions may be made based only on echocardiography, which in some cases may be non-diagnostic. In some institutions there may be exposure to mitral balloon valvuloplasty for the treatment of mitral stenosis or paravalvular leak following valve replacement; however, exposure to these cases remains limited. Finally, well established procedures for treatment of other conditions such as transcatheter aortic valve replacement (TAVR) or percutaneous procedures for mitral regurgitation are very infrequent because of government funding constraints and are subject to negotiations even in the case of patients with private insurance.

The cardiology fellows in our SASCI experience are very good, well versed in the literature, and take excellent care of patients in very busy practice settings. They have excellent textbook knowledge of interventional approaches such as those for bifurcation lesions, but often very limited exposure to actual hands-on experience. In addition, they have very limited if any experience with advanced imaging modalities such as intravascular ultrasound (IVUS) or optical coherence tomography (OCT), advanced lesion assessment with techniques such as FFR or iFR, and little if any exposure to vascular closure devices.

After graduation, the majority of cardiology fellows move to private hospitals which are typically better funded, equipped and staffed and offer better benefits and reimbursement packages. However, there are other economic considerations which pertain to leaving the public training institutions, namely that there is often no government or university funding for academic consultant positions. This latter issue is extremely problematic: some institutions are not granted governmental approval for either additional consultant positions or replacement of current staff who either retire or move to private practice. These issues combine to result in the fact that fellows who are not completely trained in more complex procedures enter private practice where they are consulted concerning patients for whom more complex procedures should at least be considered. In private practice, there are physicians who are very experienced in a variety of complex cardiovascular therapeutic procedures and who are excellent teachers: some continue to have joint appointments with academic hospitals and have "sessions" there for teaching more complex procedures. However, such sessions are quite limited according to how busy the private practice consultants are with their own practices. In the private practice setting, in addition to more current radiographic systems, there is better availability of more sophisticated technologies including left atrial appendage occlusion devices, rotational atherectomy, and haemodynamic support devices among others. However, even in these situations these devices may need to be specially ordered and may not be reimbursed by insurance.

Overview and recommendations

1. There is a significant need to address the disparity between academic and private practice. This disparity involves significant economic differentials, differences in equipment available such as ACT machines, advanced imaging technology and a variety of interventional devices. There are differences in patient populations with more affluent patients having access to better acute and follow-up care in the private sector, and more resources for the support of nursing and paramedical personnel.

2. The government sector must be made aware of the issues of an inadequate number of trained cardiologists and develop strategies to mitigate the problem. This will be increasingly important as the incidence of coronary disease continues to increase in a more affluent and ageing society and importantly in a demographic area where it was once uncommon. More consultant cardiologists need to be recruited to practise and teach in the public hospitals and educational systems that have responsibility for the care of approximately 80% of the population. As part of this, new innovative strategies to increase the number of consultant positions at public hospitals are needed. Potential approaches include governmental and industry funding, and grants from professional societies.
3. The private sector includes superbly trained interventional cardiologists. Their involvement in public hospitals for education and practice is underutilised. Robust integration in some standardised format and schedule of private practice experienced cardiologists with clinical practice sessions should be encouraged at public hospitals. Ideally, this requires joint appointments of the private practice consultants with the tertiary centre with the advantage of enhanced and ongoing education for the physicians in training and faculty at the public hospitals as well as an opportunity for teaching and mentoring which is often very important to the consultants coming from the private hospitals. In addition, it offers the potential to develop joint research and quality control initiatives which would benefit both groups.
4. Fellows coming out of training have varying deficits and limited "hands-on" experience in interventional cardiology skills as they relate to increasingly complex disease patterns such as bifurcation disease and even CTO, the use of haemodynamic support devices and application for stroke prevention devices such as PFO and left atrial appendage occlusion. Development of standard educational clinical programmes including the use of standardised central facilities with equipment and personnel for education of postgraduate students and cardiology fellows in basic catheterisation skills, wire manipulation, and approaches to intervention would be a great advance. These clinical training programmes should include experience with simulators which have been developed not only for specific technology, such as rotational atherectomy, but for strategies for specific anatomic subsets such as bifurcation disease. Such simulator technology is available in some South African centres but is not uniformly used. Once out of training, it is difficult to become proficient in new procedures or approaches even for physicians in the private sector. These teaching centres could be expanded and adapted to train physicians both in private and public university practice in new more advanced technologic approaches as they are developed and implemented. Central locations of these facilities would facilitate inclusion as part of the training programme. Such a training programme could be implemented by professional societies. Finally, they would be very useful for team training with the rest of the paramedical catheterisation laboratory staff.
5. Fellows often leave training programmes with extremely limited exposure to complex haemodynamic assessment. This is a particular issue with structural heart disease as therapeutic options become available for a percutaneous approach to the treatment of valvular heart disease (both TAVR and mitral valve disease). Training for this area of practice could be part of the central training facility listed above as well as in specialised medical device company facilities.

In closing, South Africa has skilled physicians who have made a great number of extremely important advances in cardiovascular disease. There are great opportunities but also great challenges which need a systematic approach to address them. The country might consider working with professional societies for the development of a steering committee comprising various stakeholders to develop strategies to overcome the challenges. There is great opportunity for the development of strategies for long-distance learning. South Africa's evolution to embrace and manage the challenges could become a model for constrained healthcare systems in other countries.

Conflict of interest statement

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