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## Open heart surgery in sub-Saharan Africa: challenges and promise

Perhaps the greatest advances in diagnosis of acquired heart defects were made by James Hope [1801-41]. His ethical principles were remarkable:

*"In the first place, never keep a patient sick when you can do something for him.*

*In the second place, never take a higher fee than what you truly feel you are entitled to.*

*In the third place, always pray for your patients" (1).*

Throughout the history of surgery in the world, challenges were constantly part of the way forward, and this is certainly true for open heart surgery (OHS). In the past, challenges often inspired surgeons to develop innovative treatments leading to better quality of OHS performance. Therefore, challenges had a positive impact on the development of OHS over the last century.

Let us remember two giants in their respective surgical odyssey to improve cardiac surgery during their lifetime (2): Doctor John W. Kirklin and Doctor Alfred Blalock.

In the eighth edition of William Osler's principles and Practice of Medicine [1912], Osler wrote: *"Congenital heart disease have only a limited clinical interest, as in a large proportion of the cases the anomaly is not compatible with life and in others nothing can be done to remedy the defect or even to relieve the symptoms"*.

At that time, surgical treatment for congenital heart malformations did not exist and early death was inevitable. An example of a cyanotic congenital heart disease (CHD) is Tetralogy of Fallot (TOF), which was a challenge for cardiologists and surgeons. Finally, hope came from Helen Taussig who developed the concept of a "blue baby operation" and asked Dr. Alfred Blalock for implementation. Mary Allen Engle, a pioneer in pediatric cardiology was present in the operating room during the historic first "blue baby" operations. She describes that the so-called "Blalock-Taussig procedure" was realized successfully for the first time in 1944 on Eileen Saxon, a 1-year-old very blue baby with frequent Tetralogy attacks. It was introduced by surgeon Alfred Blalock and pediatrician Helen Taussig from Johns Hopkins Medical School, North America and still gives hope to date. The Blalock-Taussig procedure has opened the door for open heart total repair of TOF to be done with confidence.

In the 1950' one of the major challenges was to accomplish correction of intra-cardiac lesions within a bloodless heart using a heart-lung machine. One day, Earl Wood, a well-known physiologist and advisor to Dr. John W. Kirklin, called Dr. Kirklin in his office at Mayo Clinic in Minnesota, North America and said: *"John, you're never going to do any better with a heart like this until you get inside of it and can work in there at your leisure"*. John replied: *"Well, that means a heart-lung machine..... then, we'll have to have one"*. Finally, the "Mayo-Gibbon heart-lung machine" was created allowing Dr. Kirklin to successfully perform OHS as a standard operation.

As it was at the beginning in North America, African surgeons faced several and multifaceted challenges in practicing OHS in our region: sub-Saharan Africa (3-5). As far as open-heart surgery is concerned, socio-economic barriers are one of the major challenges; they are in proportion to a rapid poverty growth, sometimes political instability, bad governance, widespread corruption and a lack of universal health coverage.

Looking at the unfavorable factors of growth index in sub-Saharan African countries, it may be considered impossible for our states to provide consistent and/or complete financing for the daily running of open-heart surgery centers in terms of maintenance of existent infrastructures and equipment and providing the necessary supplies. The lack of universal health coverage or of public health insurance leads to inaccessibility of most patients to OHS; a huge majority of patients in sub-Saharan Africa cannot afford out of pocket payment; it has been demonstrated that in sub-Saharan Africa, gross domestic product (GDP) per capita remains low vis a vis OHS cost, which remains beyond the reach of our population financial capacities. Confronted with this deficit, funding from our States is insignificant or does not exist at all in some of them.

The challenges are also political; armed conflicts and ongoing rebellions provide a fertile ground for political instability that is sometimes chronic in some countries; this often prevents financial investment, which on the one hand increases the problems related to the lack of medical infrastructures for growing populations, and on the other hand, explains the lack of more efficient supply chain for medical equipment.

It is also a pity to notice that open-heart surgery is not a priority for our governments. The great financial efforts are mainly brought to the fight against infectious and parasitic diseases: Diarrhea, Malnutrition, Malaria, and AIDS/HIV. Yet, it would be wise to take into account the reports of the World Health Organization (WHO) related to the epidemiological extent of cardiovascular diseases. Nowadays, in Africa, according to WHO (6), rheumatic heart diseases attack more than 4 million people; they cause about 90,000 deaths per year. In addition, during the 20 or 40 next years, developing countries will be confronted with the persistence of both rheumatic cardiac diseases and atherosclerotic cardiovascular diseases.

The insufficient infrastructure adds to the list of obstacles to open-heart surgery. Compared with the United States of America where there is one open-heart surgery center for 150,000 inhabitants or Europe with one for 1 million inhabitants, Africa has one center for 50 million people (7). Only three West-African centers have a regular open-heart surgery activity, including centers in Cote d'Ivoire, Ghana and Senegal. The average number of operations performed in these three centers is insignificant, faced with the yearly number of cardiovascular patients in our countries. Apart from them, only two other sub-Saharan African countries still have OHS done with some frequency, specifically Sudan and South-Africa.

The weakness of our human resources is also one of the challenges of open-heart surgery in sub-Saharan Africa. There is a shortage of skilled health staff: the number of nurses, doctors or heart specialists is inferior to the actual needs. To that, we can add the bad distribution of the existing staff across the national territories. The consequence is a lack of diagnosis or a numerical undervaluation of cardiovascular diseases or a long diagnostic delay, so that in Cote d'Ivoire for example, 80% of the valvulopathies are diagnosed in the hospital at advanced stages of cardiac failure. Another consequence following from that is the impossibility to carry out an efficient prevention policy or to make registers for statistical data that might have made easier the reliable scientific data storage.

One reason for that shortage of human resources might be the scarcity of specific training programs for cardiology and cardiac surgery or the continuous brain drain to Europe or North America. Fortunately, despite challenges enumerated (8,9), and serious difficulties met, as said, a few cardiac centers in sub-Africa continue to offer OHS.

In the present issue of this journal, teams from Sudan, Ghana, Nigeria and Cote d'Ivoire have presented their experience on OHS.

Dr. El Sayed in Sudan in his article "*The rebirth of cardiac surgery in Sudan*" describes the experience between 1998 and 2007. The authors reported 2,868 OHS cases, including 1,800 cases (63%) of valvular diseases, 650 cases (23%) of CHD, 339 cases (12%) of ischemic heart diseases and others 59 cases (2%). He recommends an increase of OHS services to satisfy the population needs.

Dr. M. Tettey in Ghana published his article "*The practice of cardiothoracic surgery in Ghana*". The authors report 532 OHS between 2002 to 2011 with valvular surgery (n=196), coronary artery bypass grafting (n=29), ventricular septal defect (VSD) surgery (n=135), TOF complete repair (n=83), Ostium secundum defect surgery (n=55), partial atrio-VSD surgery (n=19), pulmonary valvotomy (n=7). Hospital mortality after valve replacement decreased from 9.9% in 2002 to 5.3% in 2011 and was 3% after surgery for CHD overall.

Dr. B. Falase, from Nigeria, in his study entitled "*The challenges of cardiothoracic surgery practice in Nigeria: A 12 years institutional experience in Nigeria*", described that 496 OHS procedures were performed in 15 centers in Nigeria between 1974 and 2016. Among those 496 cases, 51 OHS were done in Lagos State University Teaching Hospital (LASUTH) such as: valve replacement (n=20) or repair (n=1), Ostium secundum defect closure (n=14), ventricular septal defect repair (n=8), TOF complete correction (n=2), atrial myxoma excision (n=2) with an overall early mortality at 17.6% (n=9).

Our team describe the experience from Cote D'Ivoire in the article entitled "*Cardiac Surgery in Africa: A thirty-five year OHS in Cote d'Ivoire*". In his retrospective study we describe 2342 patients who underwent OHS between 1978 and 2013. Indications include rheumatic heart diseases (n=1,475), endomyocardial fibrosis (n=126) and CHD (n=741), 1,481 valve replacements, 445 valve repairs have been performed with an early and late mortality after valvular surgery were 6.7% and 8.7% respectively; one hundred and 26 cases of endomyocardial fibrosis were diagnosed; in all patients an endocardectomy was done combined with valve replacement (n=90) or valve reconstruction (n=36) with an early mortality at 16% (n=20). The most frequent CHD were: VSD (n=240), Atrial septal defect (ASD) (n=200), Partial atrio-ventricular septal defect (PAVSD) (n=30) and TOF (n=220) with an overall early mortality after VSD, ASD, PAVSD and TOF total repair at 6.3% (n=44).

Besides the OHS experiences published, F. Ondo-Ndong from Gabon, M. Tettey from Ghana and Y. Tanauh from Cote

d'ivoire summarize their experience on general thoracic surgery characterized by similar pathologies in both series such as infections and lung tuberculosis, trauma, and oesophageal and lung malignancies. All of those authors have presented excellent surgical results.

Faced with these challenges, what could we recommend?

From what has been summarized, our countries must be equipped with adequate means for the removal of the obstacles and growing programs of open-heart surgery. This can be achieved with the introduction of the recent progress of heart surgery, for example ventricular assistance, total endoscopic bypass surgery, transmyocardial laser revascularization, robot-assisted valve surgery, cardiomyoplasty, genetic therapy, total artificial heart, etc. into our daily practices,

This removal of the obstacles mentioned above could mean to:

- ❖ Increase the number of Centers of Excellence dedicated to training, clinical care and research in heart surgery in sub-Saharan Africa;
- ❖ Develop international north-south and south-south cooperation through Centers of excellence, foundations and Non-Governmental Organizations, and through scientific associations or societies for cardiology and cardio-thoracic and vascular surgery worldwide; through also training of local staff on site and abroad;
- ❖ The mission of that cooperation would be to help reinforce skills in terms of professional competences, exchanges, knowledge, innovative surgical techniques, new technologies, equipment and human resources;
- ❖ 3-Reinforce scientific exchanges among cardio-thoracic and vascular surgeons in Africa through our "African association of thoracic and cardio-vascular surgeons (AATCVS)" founded in 2002, through our "African annals of thoracic and cardio-vascular surgery" started in 2005 and by AATCVS yearly international conference commenced in 2013 in Accra, Ghana; then took place consecutively in Luanda, Angola [2014] in Nairobi, Kenya [2015] and in Maputo, Mozambique [2016];
- ❖ Encourage international humanitarian services for OHS in developing countries without any capacity to take care of children with acquired or CHD as it is currently done with success in sub-Saharan Africa;
- ❖ Grant financial aid to the care of the poorest patients by public, governmental or private initiatives;
- ❖ Reinforce the support of pharmaceutical industries and medical equipment;
- ❖ Initiate money collection actions in favor of investments for Centers of Excellence and research for cardiothoracic and vascular surgery in Africa.

In spite of our challenges, our human and economic potential enable us to anticipate positive developments, including rapid growth of Open-Heart Surgery and Cardio-Thoracic and Vascular Surgery at large in sub-Saharan Africa.

We must dream, we must act, because without dream, without action, no progress can become a reality, no progress can be made.

However, the progress of medicine including heart surgery must have respect for the fundamental ethics for the benefit of humanity and Human Rights.

Without humanity, there would be no grandeur of medicine.

In connection with that, Jean-François Mattei, in his book entitled '*Man in search of Humanity*' (10) writes: "*I am still convinced of the incomparable value of medicine. Simply because its nature is to deal with deeply human problems. Doctors wonder about life... death ... and sufferings ...; the nature of the differences among people ... destiny and the freedom of each one*".

And Jean Bernard, added in his book '*The Future of Medicine*' (11): "*the Honour of Medicine and its difficulty are in an alliance of science duty and humanity duty*".

That alliance of science and love is necessary, whatever the form of the practiced medicine may be.

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