The evolution of cardiac catheterization in Sudan

Introduction:

Worldwide, cardiovascular disease (CVD) is responsible for 30% of all deaths and 10% of DALYs (Disability Adjusted Life Years) with ischemic heart disease (IHD) being the commonest cause of death worldwide [1] [2]. In Africa, the burden of CVD is increasing rapidly and it is now a public health concern [3]. Sudan is no exception with CVD a major cause of in-hospital mortality and with a significant prevalence in the community [4].
Cardiac catheterization is an integral part of the diagnosis and treatment of CVD and is one of the most widely performed procedures with the highest volumes seen in the United States where more than a million diagnostic coronary angiograms were performed in 2011 [5].

Cardiac catheterization has greatly evolved since Frossman performed the first right heart cardiac catheterization in 1929. From selective coronary angiography by Sones in 1958, to coronary balloon angioplasty by Gruntzig in 1977, cardiac catheterization has evolved into a myriad of diagnostic and interventional procedures like mitral valve repair, Trans-catheter aortic valve replacement, and congenital defect closure.

This review is written by several directors of public and private catheterization labs. It includes a historical background, a review of the current status and achievements, challenges as well as a future perspective.

Historical Background

The first attempt of cardiac catheterization was done by Dr Al Nour Abdel Majid during the early sixties who was able to pass a catheter, percutaneously, to the right heart. He used standard X-ray table to take still images and a blanket to role the patient into the different positions.

Angiography studies were also performed in the late sixties in Khartoum Teaching Hospital for neurovascular imaging and were performed by physicians including the famous neurosurgeon Hussien Abusalih.

The first cardiac catheterization machine was a Siemens single panel, straight table machine; a grant from German government to Sudan. It was installed in 1974 but was not operated due to lack of technical staff. The service and effort of Dr Halim Mohamed, Dr Ahmed Abdel Aziz and Prof Siddiq A Ismael in procuring the equipments, setting up the service and surveillance was remarkable and highly appreciated by the succeeding generations of cardiologists.

In January 1976 , Dr Siraj Abasher , a senior Registrar of Cardiology at Harefield Hospital in United kingdom, performed the first left and right heart catheterization

case on a 3 day trip to Sudan accompanied by a senior cardiac technician and senior cardiac radiographer from the same hospital.



Photo 1.This photo was taken in 1985 during the opening ceremony of Sudan Heart Foundation and shows in the center Dr Siraj Abasher with Dr Siddig Ibrahim Khalil on his right and Brigadier General Mohd H Siwaraldahab on his left. At the far right of the photo is ex-Prime Minister Dr Aljuzoli Dafallah.



Photo 2. Photo of the first cath lab in Sudan. The photo was was taken in 1984 and shows Dr Siddig Ibrahim Khalil performing a procedure on a Sudanese patient.

Routine work started in January of 1980 with cases mostly left and right heart catheters for valvular heart disease, cardiomyopathies and congenital heart disease.

Work stopped in 1988 due to difficult economic times hindering maintenance and supply of consumables and equipment together with drain of technicians to Gulf region.

From that time to the turn of the century there were no cardiac catheterization services in the country . Rebirth of cardiac catheterization occurred in 2000 at Sudan Heart Centre followed by Ahmed Gasim hospital in 2003 and Al Shaab Teaching Hospital in 2007 as the three major public centers to lead this field.

Current status:

Cardiac catheterization is currently available in the public sector and the private sector.

There are currently three active public catheterization laboratories (cath labs) in the state of Khartoum located in Sudan Heart Center, Ahmed Gasim Hospital and Al Shaab Teaching hospital and three other labs outside Khartoum in Wad Madani Heart Center, Mek Nimir Teaching Hospital in Shendi and Atbara Hospital.

There are also a number of private cath labs -found at but not limited to - Mawada Hospital, Zaitona Hospital, Faisal Hospital, Royal Care Hospital, Royal Scan hospital, Asia Hospital, Dar Alilaj, and Albaraha hospital. All are Located in Khartoum.

Table 1 shows number of procedures performed in cardiac catheterization labs till end of 2011.

Center	Cardiac catheterization	PPM
Sudan Heart center	7307	732
Ahmed Gasim Hospital	4287	NA
Al Shab Hospital	2930	671
Mek Nimir Hospital	30	NA
Wad Madani Hospital	257	16
Almawada Hospital	2356	165
Alzaitona	357	27

Table 1. Public and private centers with number of cardiac catheterization and pacemakers performed . PPM=Permanent pacemaker; NA = not available

Diagnostic coronary angiograms, left and right heart catheterization, and percutaneous coronary interventions are routinely performed in Sudan and these are the main cardiac catheterization procedures performed in the country.

Cardiac rhythm devices come next with single chamber and dual chamber permanent pacemakers being implanted on daily basis. Implantable cardioversion devices and cardiac resynchronization devices are also performed at less frequency. Sudan participated in the 11th World Survey of Cardiac Pacing and Implantable Cardioverter-Defibrillators . This was a project of the World Society of Arrhythmia for

the calendar year of 2009. Sudan and South Africa were the only African countries to present their data [6].

Of the valve interventions percutaneous mitral commisurotomy (PTMC) is the commonest in adult patients . Pediatric interventions including percutaneous closure of atrial septal defects and patent ductus arteriosus closure and percutaneous pulmonary valvotomies are routinely performed.

Challenges

Services at the cath lab are faced with many challenges relating to staff, equipment and financing.

Staff training and continuous professional development are inadequate with no clear National Guidelines or hospital policies for procedures. There is no formal recognized training program in the country for cardiac technicians and absence of any licensing body while there is a currently active fellowship training programme for cardiologists

Also financial incentives in the public sector for allied professionals in the cath lab is poor with loss trained staff to the private sector and abroad; one of the problems that lead to failure of the first experience of cardiac catheterization in the 1980s.

Equipment in the cath labs are plagued with recurrent malfunction with long break down times and lack of regular maintenance. Securing cath lab consumables also remains challenging with difficulties from the side of distributors as well as payment difficulties from the side of hospitals. The effect of United States embargo regarding many much needed US made products is also felt.

Lack of appropriate radiation protection and inability to measure radiation exposure to personnel is almost a uniform problem across cath labs.

The cost of a diagnostic angiogram varies from 300-500 US dollars and percutaneous angioplasty with stents varies from 1500-2000 US dollars in a country with Gross National Income per capita of 1300 US dollars [7].

In the public sector and to a lesser degree in some private center, a system of co-payment operates whereby the government would pay for 30-50% of interventional procedures. However, such government support is usually delayed and the expenses of cath lab procedures remain high for most patients resulting in undue delay in performing procedures. Such delay favors elective over urgent procedures with most mortality benefit derived from coronary interventions is from urgent rather than elective procedures.

Future

There is an increasing need to develop cardiac catheterization services to meet the ever increasing demand for the service.

The authors identify key areas for improvement. Setting standards ,for improving quality of care, in the cath lab; data collection and the need for a national registry for cath lab interventions; introducing new needed procedures especially in the field of electrophysiology; continuous professional development and certification of medical professionals working in the cath lab; and national policy for referral and funding of cath lab procedures especially emergency cases.

Recent developments are encouraging steps in the right direction. These include the rebirth of the Sudan Heart Society and its Interventional Cardiology Working group, the Cardiology Fellowship program of the Sudan Medical Specialization board and the establishment of a specialty register for Cardiologist at the Sudan Medical Council.

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