The Role of Cardiac Catheterization in the Diagnosis and Assessment of Heart Disease in Khartoum

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Abstract
Heart disease specialty is rapidly advancing and needs trained personnel and special equipments.

The purpose of this work was to evaluate the detection and characterization of common heart diseases using Cardiac catheterization.

This is a retrospective study of our early results with cardiac catheterization for common heart disease in Sudan Heart Centre (SHC).

During October 2012 - September 2013, 50 patients were performed, 25 male and 25 females for cardiac catheterizations, children (n = 8) and adults (n = 42) with age ranging from 1 year to 95 years. The most common of diagnostic catheterization were delineation of coronary artery disease (CAD) 86% included Left Coronary Artery (LCA) 36.5%, Right Coronary Artery (RCA) 11.6%, circumflex (CX) 36.5%, congenital heart disease (CHD) (Tetralogy of Fallot (TOF) 2%, Patent Ductus Arteriosus (PDA) 3.8% and Ventricular Septal Defects (VSD) 9.6%.

Cardiac catheterization for heart disease in Sudan is feasible and experience which is expected to expand rapidly.

Key words- Invasive coronary angiography, diagnosis, assessment, coronary artery disease

Introduction
Invasive coronary angiography (CA) is used to establish or rule out the presence of coronary stenosis, define therapeutic options, and determine prognosis. CA is also used as a research tool for follow-up after invasive procedures or pharmacologic therapy. The American College of Cardiology/ American Heart Association (ACC/AHA) Task Force and the European Society of Cardiology established the indications for CA1,2 Patients with suspected CAD who have severe stable symptoms and those with certain high-risk features for an adverse outcome should have CA. High-risk criteria include low ejection fraction and poor exercise capacity on an exercise test.
In patients with non–ST-segment elevation acute coronary syndromes (unstable angina and myocardial infarction) with high-risk features (e.g., ongoing ischemia, heart failure), CA is recommended during the hospitalization.\(^3,4\) In patients with acute ST-segment elevation myocardial infarction (STEMI), guidelines recommend CA in the acute phase for most patients.\(^5\)

Paediatric cardiology, which deals mainly with congenital heart disease (CHD) is a rapidly growing sub-specialty that was born to the adult cardiology branch of medicine in the 1950s.\(^6\) The last 50 years witnessed dramatic developments in the field of pediatric cardiology.

Cardiac catheterization started in the 1940-1950 and was the main diagnostic tool for CHD in the 1960s and 70s.\(^3\)

Echocardiographic (echo) technology started in the 1970s and refinement of this technology led to evolution of two dimensional (2-D) Doppler and three dimensional (3-D) echo which came up with the current technology of live 3-D echo.\(^8\) Advances in echo technology led to drastic changes in diagnostic methods of CHD from invasive catheterization to the non-invasive (echo) methods. This drastic change led to the shift of cardiac catheterization from diagnostic to therapeutic purposes, which added an exciting and promising dimension to this investigation.

Parallel to this were advances in Paediatric cardiac surgery, which were triggered by the successful ligation of the arterial duct in 1938 and palliation by Blalock-Taussig shunt for patients with Tetralogy of Fallot (TOF) in 1945.\(^9\) Subsequently rapid developments led to the invention of cardio-pulmonary bypass in 1950s and the repair of many complex CHD. Medical palliation with prostaglandins to keep the ductus arteriosus open, was established in 1970s and helped to decrease the pre and post operative morbidity and mortality.\(^10\) These major developments necessitated that patients with CHD be assessed by personnel specially trained in this field.

It has been suggested that acute coronary syndromes predominantly occur at the site of coronary stenosis with less than 50% diameter reduction, presumably related to thin-cap fibroatheromas. This finding has been questioned in more recent studies.\(^11\) Scoring systems have been developed to more specifically characterize the coronary vasculature with respect to the number of lesions and their functional impact, location, and complexity.\(^12,13\) Recently, the SYNTAX score was developed as an angiographic grading tool.\(^14\)

The purpose of this work was to evaluate the detection and characterization of common heart diseases using Invasive coronary angiography.

**Material and methods**

50 patients 25 male and 25 females for cardiac catheterizations, children (n = 8) and adults (n = 42) with age ranging from 1 year to 95 years with known or suspected disease who were evaluated by cardiac catheterization in SHC during October 2012 - September 2013 were included.

The need for cardiac catheterization was primarily determined by the cardiologist or suggested by the cardiac surgeon.

Catheterization was done as a day-case for diagnostic cases and in those who had uncomplicated procedures.

Before the procedure, a detailed explanation of the purpose, route and expected complications of catheterization were discussed by the cardiologist and a written consent was obtained. An assistant anesthesia technician was asked to sedate...
children. In older patients, the procedure was done with local anesthesia. Interventional cases and high risk patients were sedated by a consultant cardiac anesthesiologist. The cardiac catheterization laboratory is a monoplane Philips system with a single X-ray fluoroscopy tube that can be rotated 180 degrees in the lateral and cranial/caudal planes. Complete hemodynamic assessment with pressures, oxygen saturations and bloodgas analysis as well as angiographic assessment were performed. Cine-angiograms were recorded digitally and a computer disc is kept for each study.

**Results**

In the study period, 50 patients 25 male and 25 females referred for cardiac catheterizations, children (n=8) and adults (n=42) with age ranging from 1 year to 95 years Mean ± SD(50 ± 22.96).

**Diagnosis**

The most common diagnostic catheterization were delineation of coronary artery disease (CAD) 86% included Left Coronary Artery (LCA) 36.5%, Right Coronary Artery (RCA) 11.6%, circumflex (Cx) 36.5% , congenital heart disease (CHD) (Tetralogy of Fallot (TOF) 2% , patent ductusarteriosus (PDA) 3.8% and ventricular septal defects (VSD) 9.6%.were adults more than 18 years of age. Male to female ratio was 1:1. Diagnostic catheterization was done for all patients .Patients who underwent diagnostic catheterization are shown in Table (1,2) and Figures (1,2).catheterize findings of cardiac diseases are shown in (Figures 4-9).

**Table 1: shows sites of patients who underwent diagnostic catheterization**

<table>
<thead>
<tr>
<th>CAD</th>
<th>CHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>LAD</td>
<td>36.5</td>
</tr>
<tr>
<td>CX</td>
<td>36.5</td>
</tr>
<tr>
<td>RCA</td>
<td>11.6</td>
</tr>
</tbody>
</table>

**Table 2: shows the findings of catheterization of patients suffering from cardiac problems**

<table>
<thead>
<tr>
<th>Findings</th>
<th>NO</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>16</td>
<td>32</td>
</tr>
<tr>
<td>SVD</td>
<td>20</td>
<td>40</td>
</tr>
<tr>
<td>2VD</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>3VD</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Congenital</td>
<td>8</td>
<td>16</td>
</tr>
</tbody>
</table>
Figure 1: The final diagnosis in male and female

Figure 2: Affected area in male and female
Figure (3) shows image of female, 45 years old, Proximal LCX Total Occluded

Figure (4) shows images of a male of 26 years old, A-measurement of pulmonary annulus pre-dilatation, B- Invilated PTPC
Figure (5) show images of male, 4 years old with TOF / Dilated aortic root and ascending aorta
Figure (6) Image shows female, 67 years old 2VD

Figure (7) shows image of male, 61 years old with successful PCI to LAD

Figure (8) shows image of male, 73 years old with SVD
Discussion
Some coronary artery anomalies are very difficult to visualize at angiography, and even if they are visualized, their course may be delineated inaccurately. Hence, multimodular imaging should be considered in cases with signs of myocardial ischemia or unexplained syncope in young individuals, where no other etiologies are evident. CA usually helps confirm the diagnosis of ALCAPA and demonstrates collateral circulation between the RCA and LCA. This study aimed to describe the experience with cath for HD done by specialized personnel in Sudan. It is also described detailed for patients with CAD and CHD. We encourage our colleagues to refer patients with known or suspected disease for catheterization, but continue to communicate and discuss their management with adult cardiologists. This study only includes children with congenital heart disease. Care for adults with congenital heart disease is now evolving as a new specialty. Atrial septal defects are often diagnosed only in adulthood, and in this series. Indications for diagnostic procedures were mainly delineation of CAD and CHD in patients with TOF. These indications are not different from those reported in the literature. The experience with interventional catheterization is still small but is anticipated to expand rapidly as more patients and families are now aware of the obvious advantages of such treatment, namely avoidance of cardiac surgery and cardiopulmonary bypass. Although the percentage mortality may be exaggerated in our cohort, due to its small number, the rate of complications is generally comparable to the literature (16). Important limitations to the practice of cardiac catheterization in Sudan and other developing countries are the lack of regular supply of catheters and other accessories needed in the laboratory, the high cost of the diagnostic procedure as well as the occluders and the limited experience of the assisting paramedical staff. Bi-plane fluoroscopy can improve the efficiency of the laboratory and we would encourage new laboratories to adopt this system. CA is the standard for identifying coronary artery narrowing related to CAD. New diagnostic methods like cardiac computed tomography allow noninvasive anatomic assessment of the coronary tree and offer alternatives especially for patients with low or intermediate probability for coronary artery stenosis. Available tests, including CA, all have advantages and drawbacks. The choice of imaging method should be tailored to each person based on the clinical judgment of patient risk, clinical history, and local expertise.

Conclusion
CA will remain the method of choice in situations with high probability for an invasive therapeutic procedure, especially in acute coronary syndromes. Limited experience with cardiac cath inpatients presenting with CHD has been reported in an attempt to highlight the important advancements in the use of this technology in Sudan as well as some of its limitations.

References


