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INSTRUCTIONS AUX AUTEURS

Les Annales Africaines de Chirurgie Thoracique et Cardio-Vasculaire publient des articles originaux, des éditoriaux, des revues générales, des faits cliniques, des lettres à la rédaction, des notes de technique et des articles de pédagogie médicale.

Conditions générales de publication

Les manuscrits ne doivent avoir fait l'objet d'aucune publication antérieure ni être en cours de publication dans une autre revue. Les textes doivent être saisis en double interligne, de police de caractère 12 minimum, 25 lignes par page maximum, et adressés en triple exemplaires à la rédaction de la revue. Les photos, figures et tableaux sont également fournis en triple exemplaires. Une version sur disquette est exigée. Les disquettes doivent être de type IBM ou IBM-compatibles, logiciel Word 98 ou 2000. Elles doivent porter une étiquette indiquant le nom du premier auteur, le titre abrégé de l'article, le logiciel et le programme utilisés.

Présentation des textes

La première page du manuscrit doit comporter le titre de l'article, les initiales des prénoms et les noms des auteurs, la dénomination et l'adresse complète de l'institution dans laquelle le travail a été effectué, les titres et affiliations hospitalo- universitaires de chaque auteur, l'adresse complète avec numéro de téléphone et de fax de l'auteur à qui doit être envoyé la correspondance. La disposition des manuscrits est la suivante : page de titre, résumés et mots-clés, texte, références, tableaux, et légendes des figures. Les pages doivent être numérotées dans cet ordre, la première page étant celle de la page de titre, et la dernière celle des légendes des figures.

- Les articles originaux ne doivent pas dépasser 15 pages, références, figures et tableaux non compris. Ils doivent comporter systématiquement une introduction, un chapitre matériel et méthodes, suivi des résultats et une discussion
- Les éditoriaux sont sollicités par la Rédaction, et n'excèdent pas 6 pages, références comprises, et limitées à 10.
- Les faits cliniques et les notes de technique ne doivent pas dépasser 6 pages, références non comprises mais limitées à 15.
- Les revues générales peuvent être sollicitées par la rédaction. Elles ne doivent pas dépasser 20 pages. Les références ne sont pas limitées.
- Les lettres à la rédaction doivent compter au maximum 2 pages, et 5 références.
- D'une façon générale, les abréviations doivent être évitées autant que possible. Elles doivent être indiquées à leur première apparition dans le texte, après l'expression ou le mot qu'elles abrègent. Il faut éviter de les employer dans le titre et le résumé.

Résumés et mots-clés

Un résumé en Anglais et un résumé en français n'exédant pas 250 mots accompagnent le manuscrit. Ce résumé doit être structuré de la façon suivante, pour les travaux originaux : objectifs méthodes, résultats et conclusions. Pour les faits cliniques et les notes techniques, le résumé ne doit pas dépasser 100 mots. 3 à 5 mots-clés en français et en anglais doivent figurer sous les résumés. Ils doivent être extraits de la liste des mots-clés de l'Index Medicus

Références

Les références sont numérotées dans l'ordre d'apparition dans le texte, en chiffres arabes et entre parenthèses. Les abréviations des titres des journaux doivent être celles qui figurent dans l'Index Medicus. Les références sont présentées selon le style dit de Vancouver :

- Pour une revue : MORTINIERA N.C., MBAMEND AME S., OKOME P., et al. Le syndrome de Cockett : à propos de deux cas. Bull. Med. Owendu, 2002, 20 : 36-38. Lorsqu'il y a plus de 6 auteurs, citer les 3 premiers, suivis de «et al».
- Pour un chapitre d'un livre : HUANG GJ, WU YK. Operative technique for carcinoma of the esophagus and gastric cardia. In : HUANG GJ, WU YK, editors. Carcinoma of the esophagus and gastric cardia. Berlin. Springer, 1984 : 313-348
- Pour un livre : MAGER RF. Comment définir des objectifs pédagogiques. Paris. Dunod, 2001 : 71-87.

Tableaux, figures et illustrations

Les tableaux sont numérotés en chiffres arabes dans l'ordre de leur première citation dans le texte. Chaque tableau est dactylographié en double interligne sur une feuille séparée, mentionnant le numéro du tableau et son titre. Le contenu des tableaux ne doit pas faire double emploi avec celui du texte. Les courbes, schémas, dessins, diagrammes et autres illustrations sont numérotés en chiffres arabes dans l'ordre de leur première citation dans le texte. Les documents doivent être de qualité professionnelle. Ils sont fournis sur papier photo noir et blanc, glacé, en format 13 x18cm. Les indications sont inscrites au verso sur une étiquette adhésive indiquant le nom du premier auteur, le numéro de la figure et le sens du cadrage.

La fourniture de documents de toute nature implique l'autorisation de publication et de reproduction uniquement par la Revue, sauf convention particulière préalable entre l'auteur et l'éditeur.



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African Annals of Thoracic and Cardio-Vascular Surgery publish original articles, leading articles, general reviews, clinical facts, letters to editor, notes of technique and articles of medical pedagogy.

General conditions of publication

The manuscripts should have been the subject of no former publication nor to be in the course of publication in another review. The text must be seized in double space, of bil l of character 12 minimum, 25 lines per m aximum page, and be address sed in triple specimens to the drafting of the review. The photographs, figures and tables are also provided in triple specimens. A version on diskette is re quired. The diskettes must be of type IBM or IBM-compatible, software Word 98 or 2000. They must carry a label indicating the name of the first author, the shortened title of the article, the software and the perogram used.

Layout of texts

The first page of the manuscri pt must comprise the title of the article, the initial ones of the first names and the names of the authors, the denomination and the complete address of the institution in which work was carried out, titles and teaching hospital affiliations of each author, the complete address with fax and telephone number of the author, who must be sent the corre spondence.

- The provision of the manuscripts is as follows: title page, summaries and key words, text, references, tables, and legends of the figures. The pages must be numbered in the order, the firs t page being that of the title page, and the last that of the legends of the figures
- The original artic les should not exceed 15 pages, references, figures and tables not included. They must systematically comprise an introduction, a material and method chapter, followed by results, and a discussion.
- The leading articles are requested by the drafting, and do not exceed 6 pages, references included, and limited to 10.
- The clinical facts and the notes of technique should not exceed 6 pages, references not included, and limited to 15.
- The general reviews can be requested by the drafting. They should not exceed 20 pages. The references are not limited.
- The letters to the editor must count to the maximum 2 pages, and 5 references. Generally, the abbreviations must be avoided as much as possible. They must be indicated to their first appearance in the text, after the expression of the word which they shorten. It is necessary to avoid employing them in the title and the summary.

Summaries and key words

An English summary and a French summary not exceeding 250 words accompany the manuscript. This summary must be stru ctured in the following way, for original work : objectives, methods, results and conclusions. For the clinical facts and the technical notes, the summary should not excced 100 words. 3 to 5 English and French key words must appear under the summaries.

They must be extracted from the list of the key words of the Medicus Index

References

The references are numbered in the order of appearance in the text, in Arab numerals and between brackets. The abbreviations of the titles of the newspapers must be those which appear in the Medicus Index. The references are presented according to the style known as of Vancouver:

- For a review: MORTINIERA N.C., MBAMENDAM E S., OKOME P., et al. The Syndrome of Cockett: report of two cases. Bull. Med.Owendo, 2002, 20 :36-38. When there is more than 6 authors, to quote 3 first, follow-ups of « et al »
- For a chapter of a book : HUANG GJ. WU YK Operative for carcinoma of the esophagus and gastric cardia. In HUANG GJ. WU YK, editors. Carcinoma of the esophagus and gastric cardia. Berlin. Springer, 1984 ; 313-348
- For a book : MAGER RF. How to define teaching objectives. Paris Dunod, 2001 : 71-87.

Tables, figures and illustrations

The tables are numbered in Arab numerals in the ordre in their first quotation in the text. Each table is typed in double space on a separeted sheet, mentioning the number of the table and its title. The contents of the tables should not not make double employment with that of the text. The documents must be of professionnall quality. They are provided of photo paper black and white, frozen, in format 13x18 cm. The indications are registered with the black on an adhesive label indicating the name of the first author, the number of the figure and the direction of framing. The supply of documents of any nature implies the authorization of publication and reproduction only by the review, except preliminary particular convention between the author and the editor.



ANNALES 2ème SEMESTRE 2015

ANNALES AFRICAINES DE CHIRURGIE THORACIQUE ET CARDIO-VASCULAIRE
AFRICAN ANNALS OF THORACIC AND CARDIO-VASCULAR SURGERY

Volume 10 Numéro 2, 2015 / Volume 10 Issue 2, 2015

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CHIRURGIE CARDIAQUE / CARDIAC SURGERY

AMINU KANO TEACHING HOSPITAL LECTURE SERIES

OPEN HEART SURGERY IN WEST AFRICA: HISTORY, SURGICAL EXPERIENCE, AND CHALLENGES

Part 1: Africa, cradle of humanity; challenges of modern day Africa; history of cardiac surgery

By

Professor Koffi Hervé YANGNI-ANGATE, FWACS, FICS

Aminu kano teaching hospital lecture series given on wednesday, november 26th, 2008 at Kano teaching hospital auditorium,
Kano,Nigeria

1- Preamble (slide1)

I would like to thank all of you for honoring me. I always find it exciting to talk about "Open Heart Surgery in Africa". I remember that skilled and famous surgeons, including Professors E.Q. Archampong (slide 2) and O.O. Ajayi (slide 3) have delivered a speech on this platform.

Professor Ajayi, may I tell you how we are filled with admiration for you on looking at your brilliant professional career. The West-African College of Surgeons is proud to consider you among its Past-Presidents. Thank you for your presence among us. Doctor Yakabu, Head of Surgery Department of Aminu Kano Teaching Hospital, our frequent contact by letters shows your organizational ability and dedication to the promotion for surgery in your country. I have been pleased to talk with you and wish long life to your initiatives.

I find it important to bring in this homage, the Fellows of West African College of

Surgeons (slide 4) who are here with us and the hospital, university, political and administrative authorities who have given me a warm welcome.

I still remember my first contact with Nigeria Teaching Hospitals ; it took place at "Enugu Teaching Hospital" (slide 5) ; I met there devoted Nurses, competent Doctors and an administrative staff with a sense of responsibility.

I have a fresh memory of these open heart operations that Professor Martin Aghayi and myself had carried out in the Cardiac Centre of Excellence at "ENUGU Teaching Hospital".

Nigeria, your country is a Great Nation; (slide 6) it is very impressive with its inhabitants'eagerness,theirfightingspiritand great confidence in a more glorious future. I share these hopes with you because I believe in a conquering Africa, leader as formerly,

of the future world; an Africa that carries lost human values ; an Africa that forgives (slide 7), a radiant Africa, an Africa open to foreign continents. Before getting to the heart of my topic, may I recall essential truths that African people should not overlook, and to which we should go back, so that Africa could become again what it was previously. Isn't our dear Africa, the Cradle of Humanity"?; the Mother of civilization? the Cradle of Sciences? ;the Birthplace of Religions.

2- Africa, Cradle of Humanity, Civilization, Science and Religions ^{1, 2, 3} (slide 8)

a) Africa, Cradle of Humanity

Why is the African continent considered as the cradle of Humanity?

According to Günter Brauer, Paleoanthropologist at Hamburg University, the man who is "anatomically normal", the common ancestor of all human beings seems to have been born in Sub-Saharan Africa, more than 100,000 years ago (slide 9). Then, from Africa, that man is said to have conquered Asia and Europe. This information was given by mitochondrial DNA technique and researches on more than 6,000 old skulls from all over our planet. From that experiment, Sub-Saharan Africa is unanimously known as the origin of our mankind.

Another author, Dr. Leonard Jeffries, in his article entitled "African Origins of Early Humanity" (slides 10 & 11), remarks that the oldest man called "the East African" was discovered in Tanzania, he is said to be 1,750,000 years old. From his discoveries in Tanzania, the same author also maintains that Humanity seems to have started millions of years ago, from Africa and spread throughout Asia and Europe, taking with it, its tools, mathematical science and culture.

Another evidence of the African origin of Humanity is the discovery of the oldest engravings in the world, in the cave of

BLOMBOS, 200 km far from Cape Town, in South Africa (about 12,000 years B.C), which also makes of Africa the cradle of civilization.

b) Africa, Cradle of Civilization (slides 12 - 16)

Civilization is said to have emerged from Africa, at least 7 million years ago ; the use of fire and early domestic tools, fishing, hunting, astronomy, mathematics, writing, art and jewelry might have started initially from Black Africa. In other words, Africa must be the starting point of world civilization and its scientific knowledge.

c) Africa, Cradle of Scientific Knowledge (slide 17)

Throughout antiquity, for more than two thousand years, old Egypt had worldwide influence in the field of science. Egypt might be the origin of Greek-Roman knowledge; geometry, arithmetics, astronomy might come from Egyptian scholars. There are many mathematic or physic theories whose origin is said Egyptian. Greek or Roman philosophy are thought to have originated from Egyptian priests who were Greeks' and Romans' philosophy teachers. Philosophy might be African first, mathematics and their theorems as well, including geometry, the knowledge of brain, the basic laws of physics and medicine in which Hippocrate, was a famous Greek Doctor : he was taught diseases by Egyptian Doctors, for three years.

d) Africa, Cradle of Religion (slide18)

From Polytheism to Monotheism, that was the way taken by Egyptians. From the belief in many gods lived through by Egyptians, Greeks and Romans, the former might have shifted to the belief in one God, in the reign of Pharaoh Amenophis IV who is said to have changed his name for Akhenaton.

In conclusion, we will quote CHEICK ANTA DIOP : "So, Africa that Europe considers as a continent with no historic past, has

given birth to the oldest humanity guides of our civilization ; they are the ones who created arts, religions, literature, medicine, architecture, agriculture, etc... at a moment when the rest of the world (Asia, Europe, Greece, Rome) had sunk into barbarism..." (slide 19)

3- Challenges of Modern-day Africa ^{4,5} (slides 20-27)

After being the guide of the world in the past, Africa seems to be losing ground today. As Tony Blair said : "Africa is the only continent to have grown poorer in the last 25 years". It has many problems : poverty is increasing, hunger is spreading, the youth is in a desperate situation, education is eroded. The number of children with no education is disturbing, mother-and-child mortality remains worrying, the decrepit condition of the infrastructures is becoming worse, the natural environment is deteriorating continuously, pollution and soil damage are expanding significantly, the lack of drinking water in some regions is a topical question, the nonconformism of Africa in the world trade and worldwide investments and repeated wars continue.

Yet, this desperate situation of Africa can't hide the great progress which has been made: the accepted introduction of democracy, the economic changes in many countries, the greater collaboration among Pan-African institutions ; the emergence of more human efficient abilities ; the outstanding appropriation of the new information and communication technologies by Africans.

Faced with these challenges, it's important to underline the different initiatives for the benefit of Africa : for example, the committee for Africa, created on Tony Blair's initiative in 2004. Its mission is to put in place strategies of fight against poverty and conflicts in Africa, to promote policies for the improvement of education, economy, the fight against AIDS, health and environment.

The other example is that of the New Economic Partnership for Africa's

Development (NEPAD) about which Abdoulaye Wade, the President of Senegal said : «we, Africans we consider the NEPAD as a catalyst that will propel Africa to the Future»

On the whole, in Africa, the different challenges are political, economic, social, environmental, educative and medical; these challenges can't hide the great progress which is made or in hand, and the great hopes created by international initiatives.

In addition, among these challenges of Africa, we can't fail to recognize the consideration of that great number of children and young adults, the driving force of our development, who are suffering from acute or chronic heart diseases whose treatment requires open-heart surgery : a surgical speciality whose story dates back to only some decades in the world and in Africa.

4- History of Cardiac Surgery in the World and in Africa ^{6, 7, 8, 9} (slide 28)

Open-heart surgery opened on to the world since May 6th, 1953. That year, John Gibbon, by Gibbon-IBM type artificial heart-lung machine, started the period of open-heart surgery (slide 29 & 30). At that historic moment, the first surgical treatment of intra cardiac malformation was successfully performed. After him, Lillehei carried out an intra cardiac correction on March 26th, 1954. The development of this surgery became more pronounced with the contribution of John W. Kirklin, essentially thanks to a great number of continuous and technological innovations in the building of artificial heart-lung machines.

So, in the late 50's, many university training programs for open-heart surgery developed so well that so far more than one million open-heart operations have been made in the world.

In front of the growing quality and security brought by artificial heart-lung machines, the surgeons are achieving more and more

frequently malformations corrections, with growing difficulty and satisfactory results among younger patients. These surgical operations involve ischemic heart diseases, cardiac rhythm disturbance, cardiac malformations or even heart transplant. Acquired valvular heart diseases.

It is in 1967, in South Africa that Christian Barnard (slide 31) successfully performed the first heart transplant in the world, marking the beginning of open-heart surgery in Africa.

In West Africa, many great surgeons did a pioneering work in open-heart surgery: Professors Easmon Charles (Ghana) (slide 32), Udekwu (Nigeria) (slide 33), Anyanwu (Nigeria) (slide 34), Adebajo (Nigeria) (slide 35), Metras Dominique, Ouezzin-Coulibaly Andre and Ouattara Kouame (Côte d'Ivoire) (slides 36-37). In this West-African region, the first open-heart operations took place in the 70's : January 1974 in Enugu (Nigeria) (slide 34), March 1978 in Abidjan (Côte d'Ivoire) (slide 36), December 1978 in Ibadan (Nigeria). Later in the 90's, new cardiac centres were built, namely in Ghana and Senegal.

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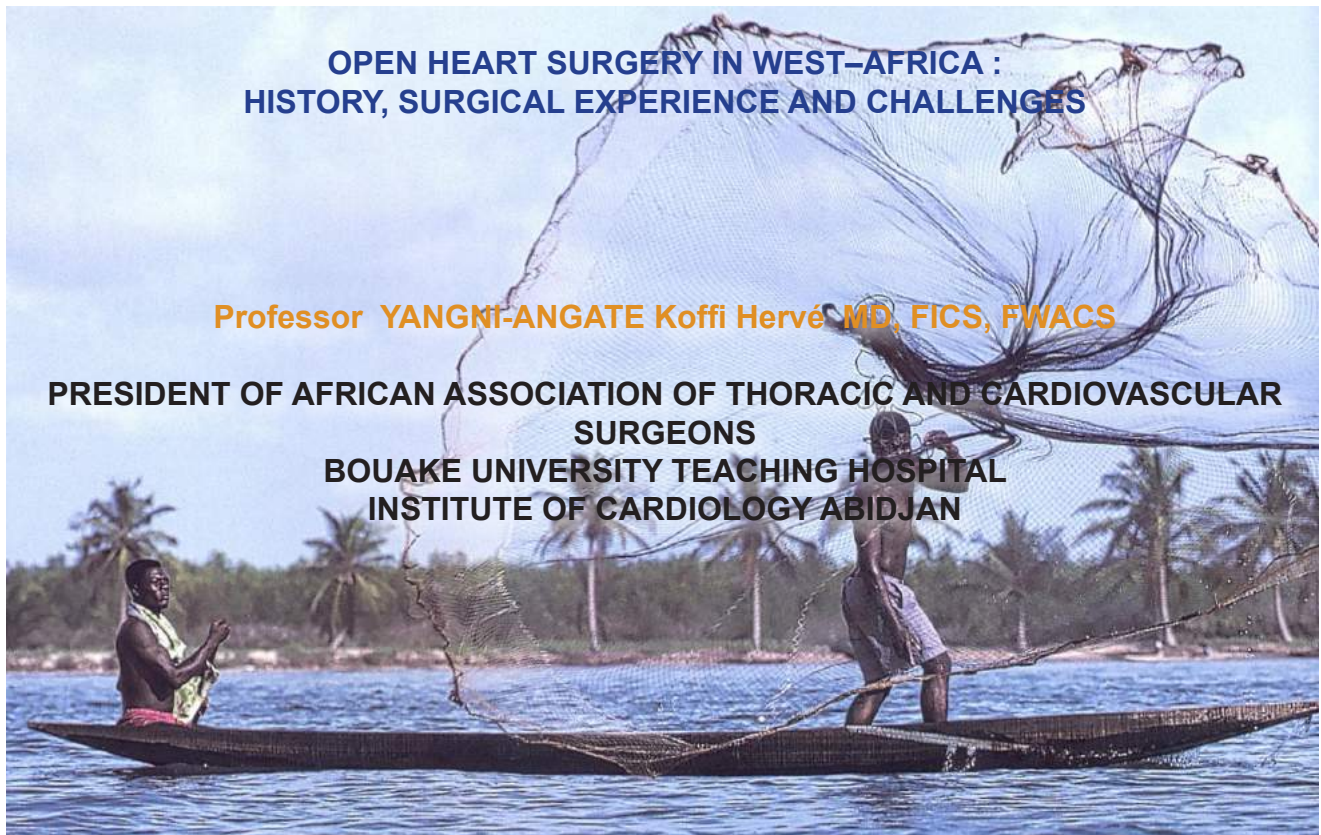
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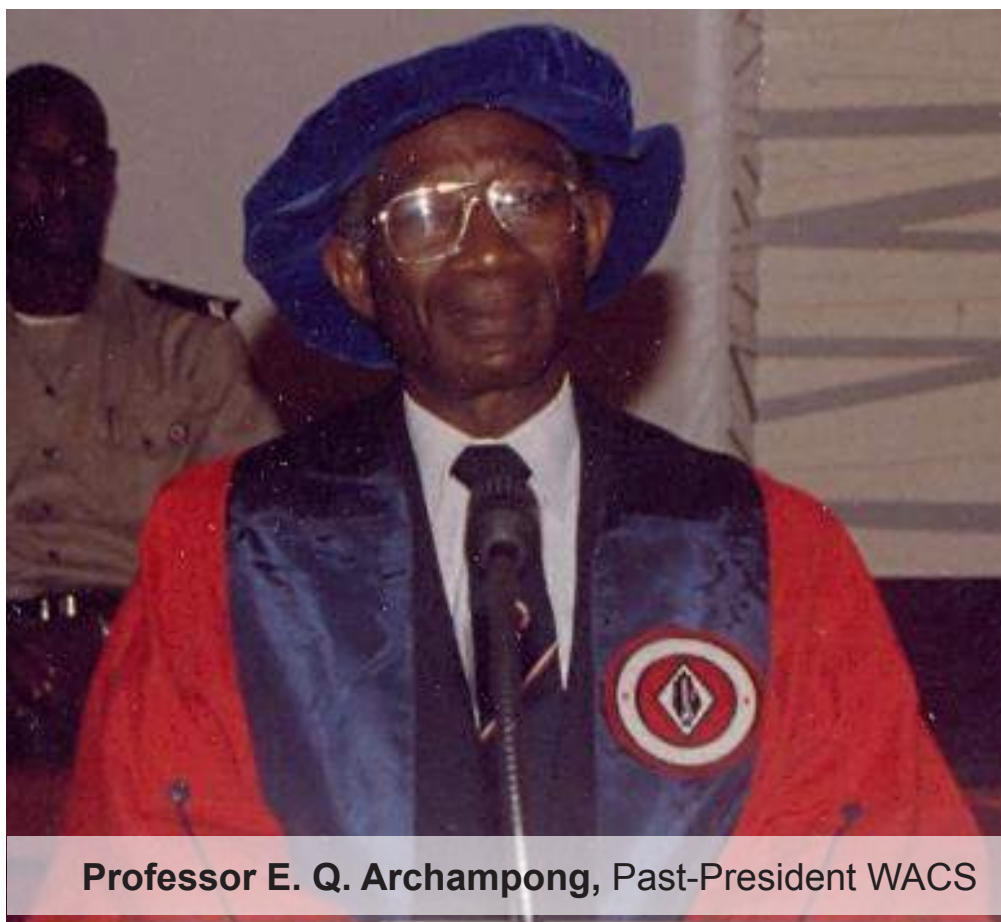
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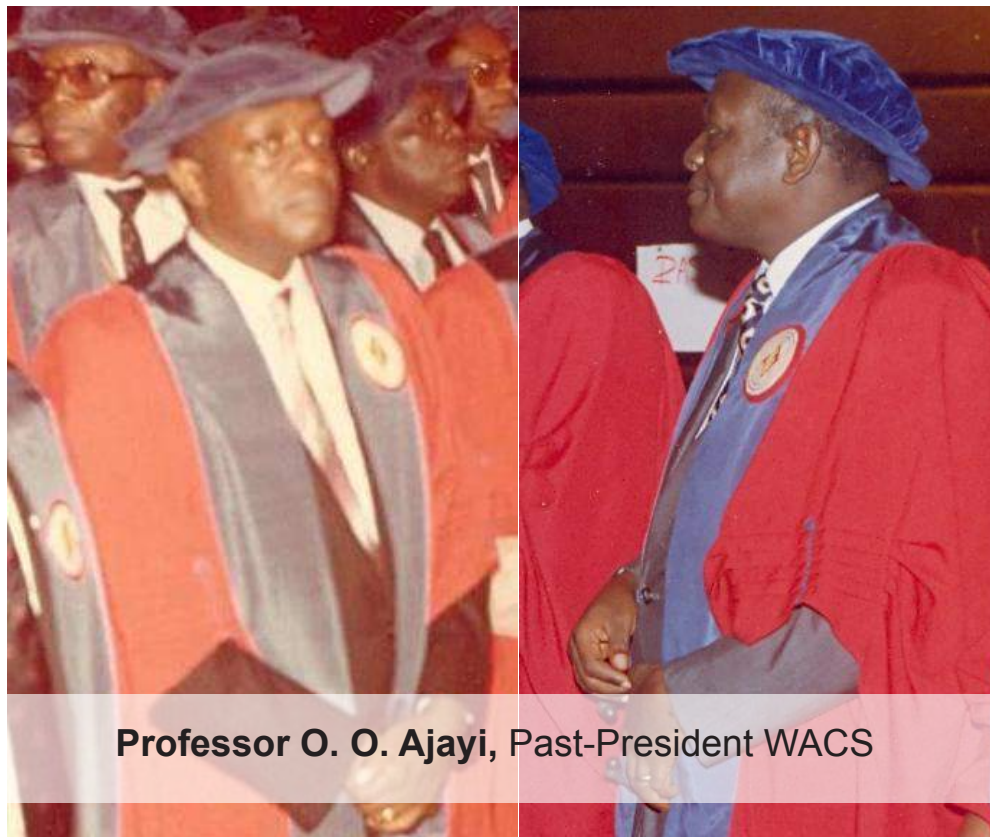
APPENDIX 1: Slides / Diapositives



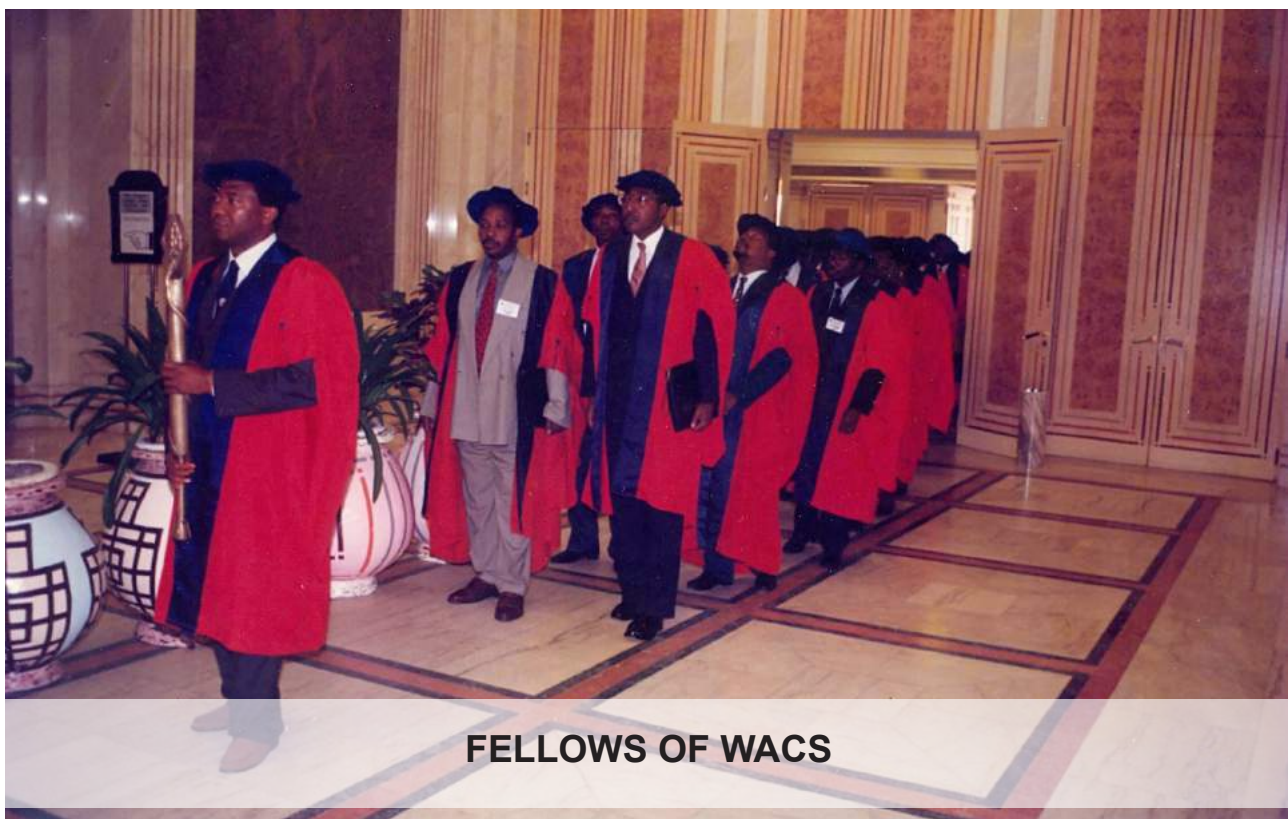
Slide / Diapositive 1



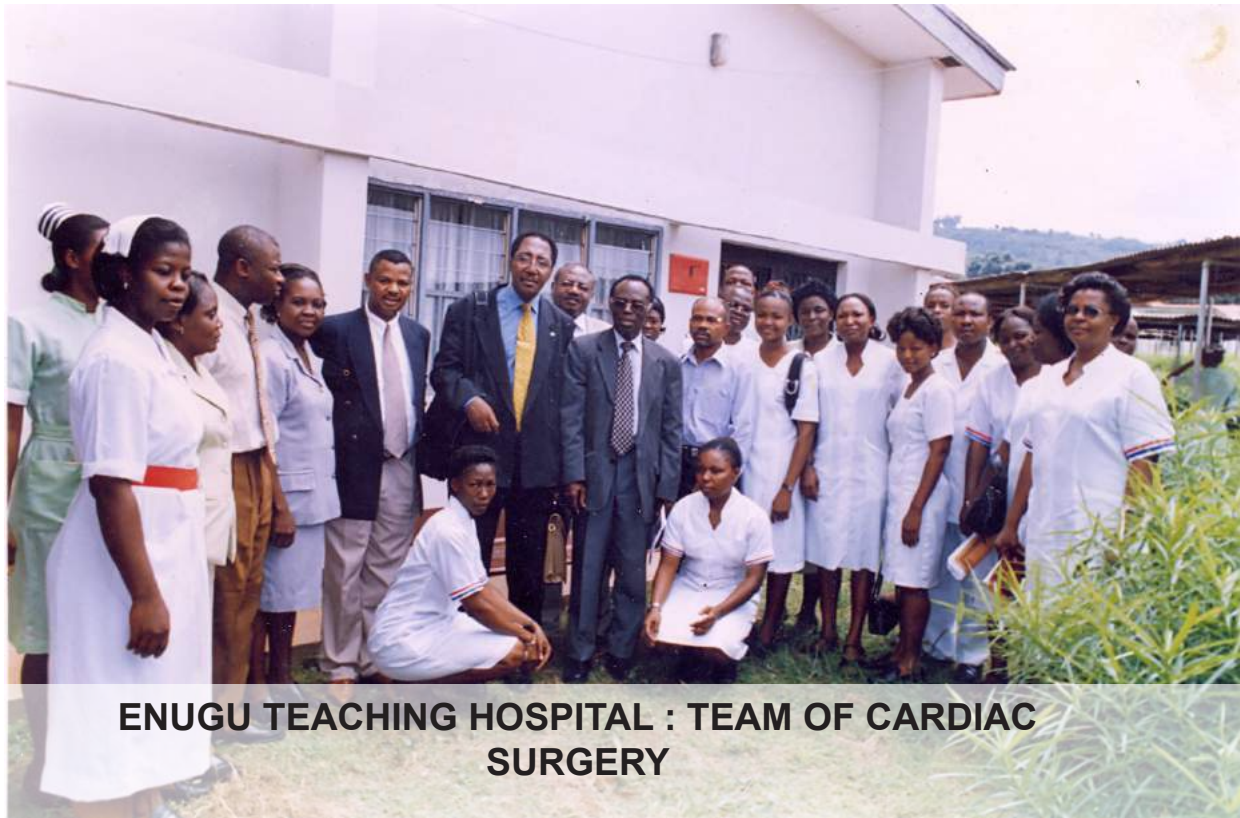
Slide / Diapositive 2



Slide / Diapositive 3



Slide / Diapositive 4



Slide / Diapositive 5

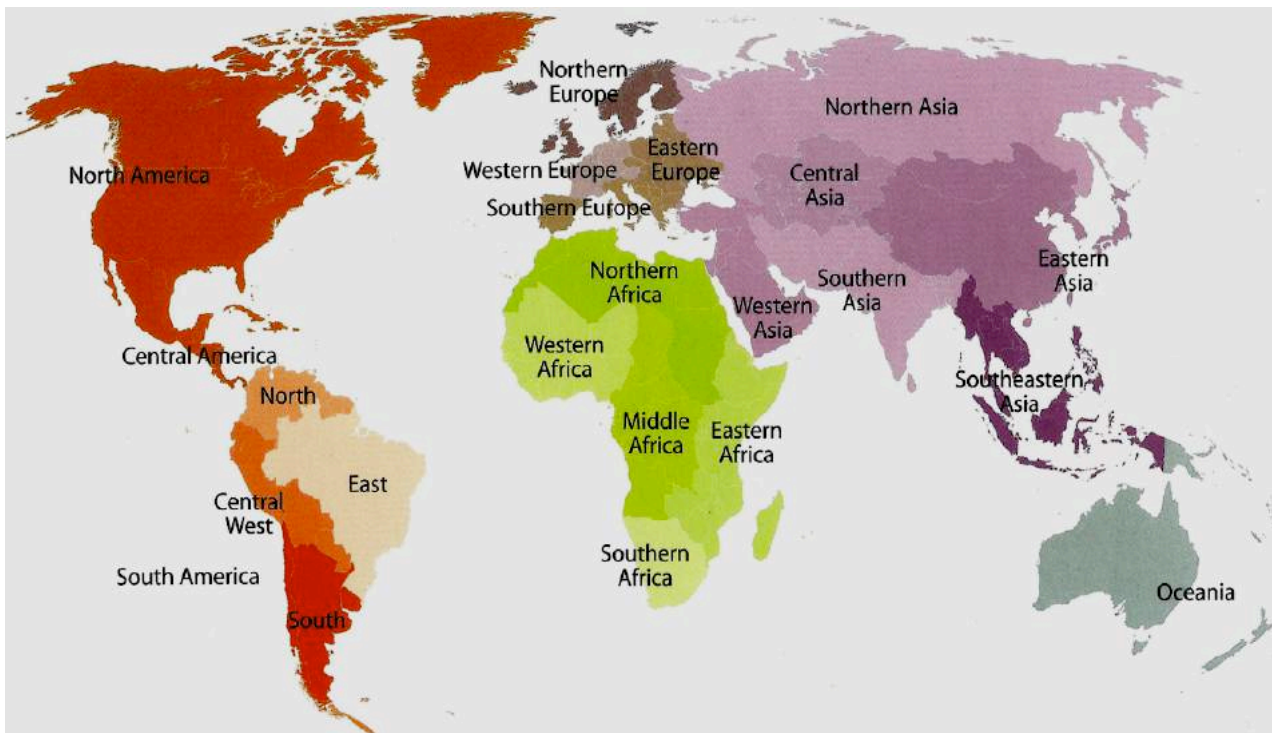


Slide / Diapositive 6 Map of Nigeria

AFRICA THAT FORGIVES



Slide / Diapositive 7



Slide / Diapositive 8

**AFRICA, BIRTHPLACE OF HUMANITY
CIVILIZATION, SCIENCES AND RELIGION**

THE ORIGINS OF MAN

How has modern man conquered the world ?

Tout d'abord, l'Homo habilis, notre plus vieil ancêtre identifié (3 millions d'années), est situé dans le berceau africain.



Il est suivi de l'Homo erectus qui a émigré une première fois de l'Afrique vers l'Asie. Autrement dit les Homo erectus évoluent vers l'homme moderne. Il y a 100 000 ans, c'est en Asie et au Moyen Orient que l'on trouve ce type d'évolution vers l'Homo sapiens

Slide / Diapositive 9

AFRICA, BIRTHPLACE OF HUMANITY



Dr. Leonard Jeffries

Slide / Diapositive 10

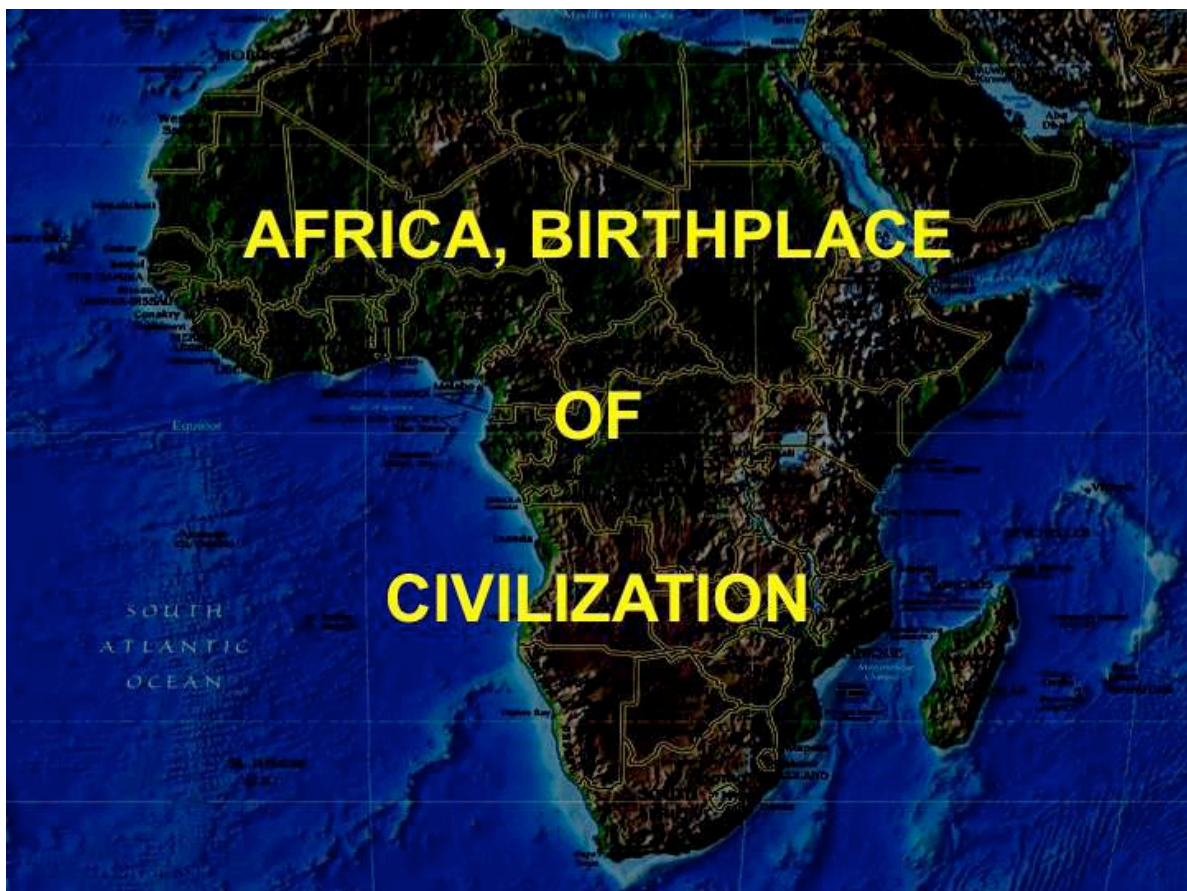
AFRICAN ORIGINS OF EARLY HUMANITY

by Dr. Leonard Jeffries

One of the oldest fossil finds of early man was made in Africa in 1960 by archaeologist L. S. B. Leakey. He named his find Zinjanthropus, meaning Eastern Man. It was found in Olduvai Gorge in northern Tanzania which is an archaeologists paradise.

Scientists at the University of California tested Zinjanthropus and believe that this early man was 1,750,000 years old.

Slide / Diapositive 11



Slide / Diapositive 12

AFRICA THE HOME OF HUMAN CIVILIZATION



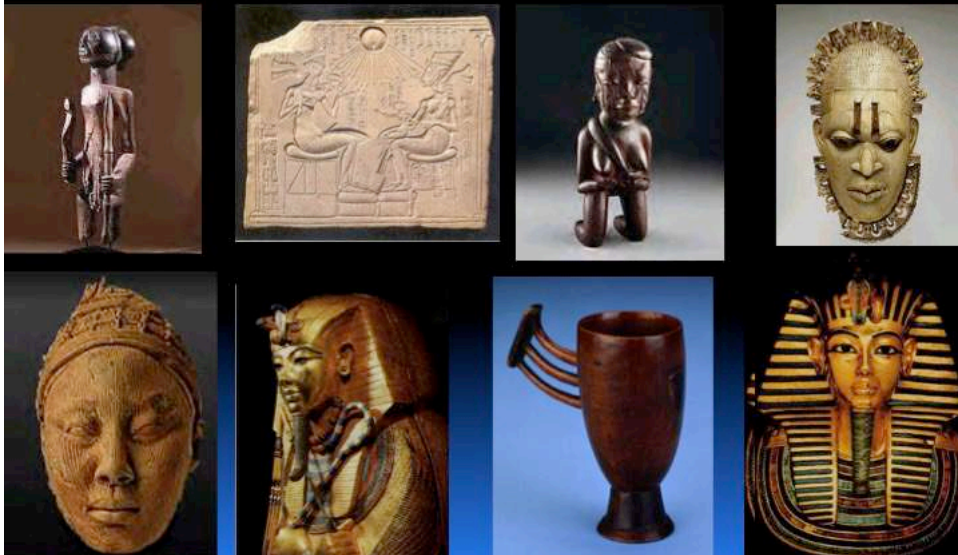
Ishango Bone
World's First Abacus

Africa provides a comprehensive and contiguous time line of human development going back at least 7 million years. Africa gave humanity the use of fire a million and half to two million years ago. It is the home of the first tools, astronomy, jewelry, fishing, mathematics, crops, art, use of pigments, cutting and other pointed instruments and animal domestication. In short Africa gave the world human civilization.

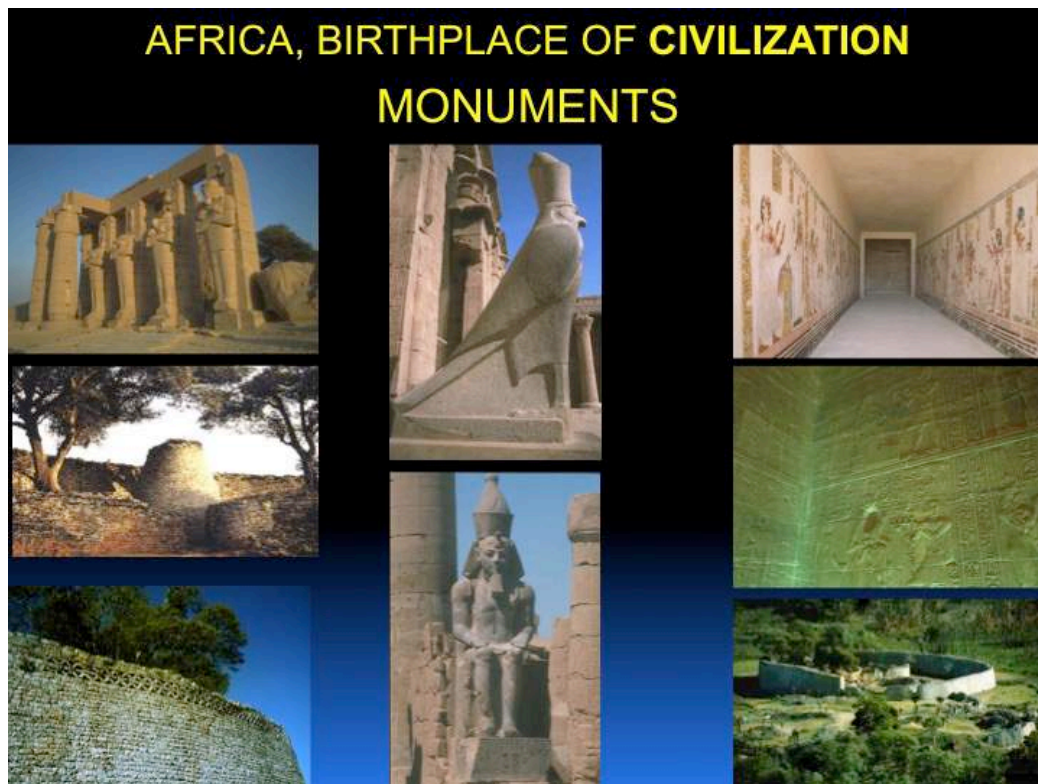
Slide / Diapositive 13

ARTWORK & ARTIFACTS

African art and artwork is among the most beautiful of the ancient and the modern world. The sculptures, masks and statues shown here speak to the glory of ancient African and the untapped potential of African people today.



Slide / Diapositive 14



Slide / Diapositive 15

AFRICA, BIRTHPLACE OF WRITING



Le Medou Neter écriture hiéroglyphique



"Écriture" dite cunéiforme

- **Africa is also the birthplace of writing**

Writing already existed in Sub-Saharan Africa 3,400 years B.C

Slide / Diapositive 16

AFRICA, BIRTHPLACE OF SCIENTIFIC KNOWLEDGE

« *Egypt has also been the birthplace of mathematical arts* »

Aristote, Métaphysique, A,1, 981, b23

Il n'est un secret pour personne que l'Egypte ancienne a su se constituer un savoir scientifique qui a rayonné pendant plus de deux millénaires sur le monde et notamment durant la période de l'Antiquité franchissant aisément le bassin méditerranéen pour influencer le savoir greco-romain

Slide / Diapositive 17

AFRICA, BIRTHPLACE OF RELIGIONS

The oldest monotheistic form of worship is the one made by Pharaoh Amenophis IV whose new name was Akhenaton

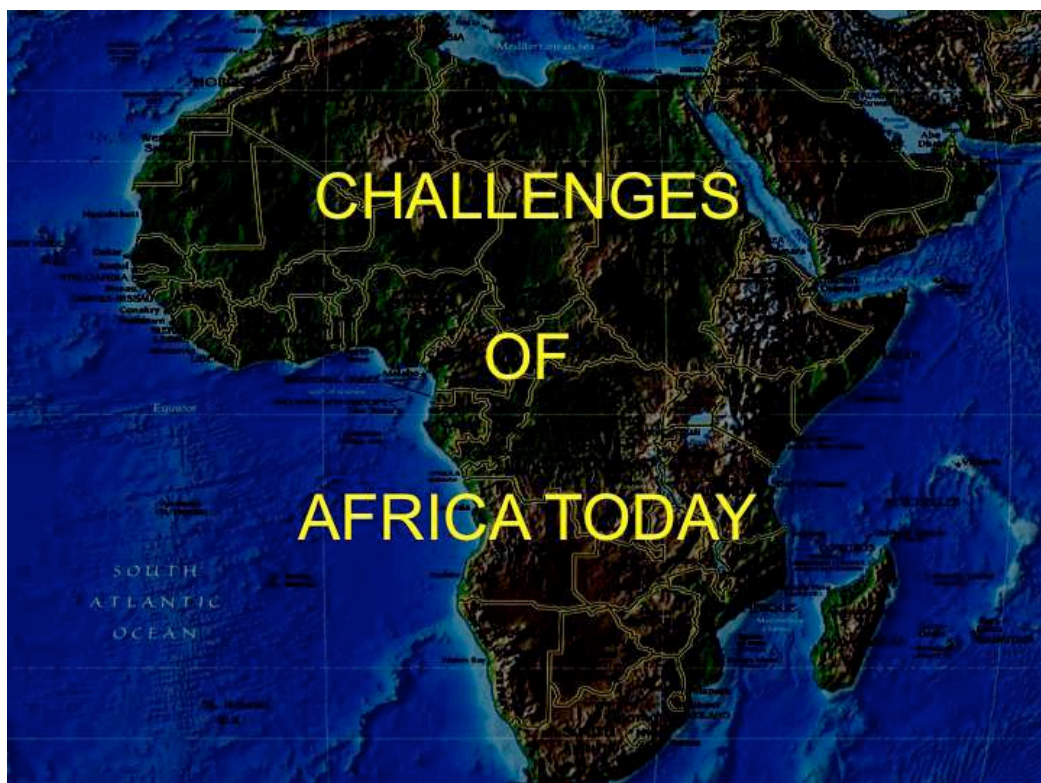
Slide / Diapositive 18

AFRICA, BIRTHPLACE OF HUMANITY CIVILIZATION, SCIENCES AND RELIGION

« So, Africa that Europe considers as a continent with no historic past, has known the oldest humanity guides on the civilization level ; they are the ones who created arts, religions, literature, medicine, architecture , agriculture, etc... at a moment when the rest of the world (Asia Europe, Greece, Rome) had sunk into barbarism... »

CHEICK Anta Diop

Slide / Diapositive 19



Slide / Diapositive 20



Fonds canadien pour l'Afrique

DEUXIÈME ÉDITION DE NOUVELLE VISION,
NOUVEAU PARTENARIAT

- **Africa takes over the controls**

« Sur tout le continent, les Africains déclarent qu'ils ne se laisseront plus conditionner par les circonstances. Nous déterminerons notre propre destinée et nous ferons appel au reste du monde pour compléter nos efforts. »

Slide / Diapositive 21



Fonds canadien pour l'Afrique

DEUXIÈME ÉDITION DE NOUVELLE VISION,
NOUVEAU PARTENARIAT

- **Challenges of Africa**

- One African out of two lives with less than \$ 1 us per day.
- 45 million African children don't attend school.
- More than 26.6 million people are VIH carriers.
- One African out of five is affected by a conflict.
- 14 countries are suffering from a lack of water, so will 11 others from now to 2025.
- About 500 million hectares of which 65 % are used for agriculture have been suffering from damage since 1950.
- Africa represents 13% of world population. Less than 1.6% of world trade and less than 1% of world investments.

Slide / Diapositive 22



Fonds canadien pour l'Afrique

DEUXIÈME ÉDITION DE NOUVELLE VISION, NOUVEAU PARTENARIAT

- **Le défi**
Pour la plupart des Canadiens, l'Afrique est un paradoxe : un continent en crise, mais un continent qui possède un énorme potentiel humain et en ressources naturelles qui pourrait, si on le cultivait, être la plus grande histoire de réussite du xxie siècle.
- **Une nouvelle forme de partenariat**
« We, African, consider the NEPAD as a catalyst that will propel Africa to the future. »
Abdoulaye Wade,
président du Sénégal et l'un des architectes du NEPAD

Slide / Diapositive 23



Slide / Diapositive 24



Slide / Diapositive 25



Slide / Diapositive 26

BLAIR UNVEILS 'AFRICA ACTION-PLAN'

The British government has launched an ambitious plan to analyse Africa's problems and submit potential solutions.

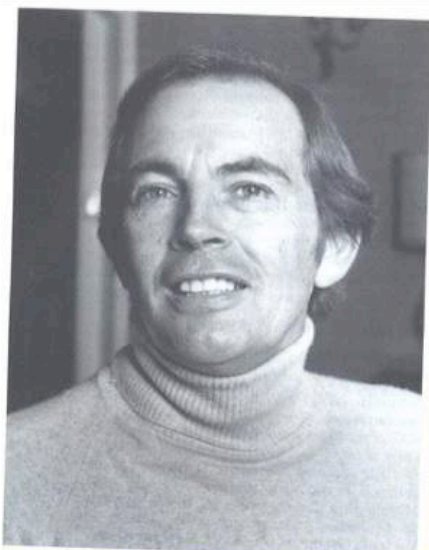
" Africa is the only continent to have grown poorer in the last 25 years " **Tony Blair**



Officials said the themes of the commission report are likely to include the economy, education, conflict resolution, health, the environment and HIV/Aids.

Slide / Diapositive 27

HISTORY OF CARDIAC SURGERY



Christian BARNARD (South-Africa)

Slide / Diapositive 28

Brief History of Open Heart Surgery World-Wide

- On May 6, 1953 Gibbon performed the 1st successful open heart surgery with heart lung machine on an 18-y.o. girl with ASD. The patient was kept on the heart lung machine for 26 minutes and survived the operation.

Slide / Diapositive 29

The 21st Century Heart Lung Machine

Mayo-Gibbon Heart-Lung Machine, 1953. The 21st Century Rolls Royce Heart Lung Machine

Heart-Lung Machine

Slide / Diapositive 30



Brief History of Open Heart Surgery World-Wide



- On December 3, 1967, Christian Bernard performed the first human-to-human heart transplant on Louis Washkansky at Groote Schuur Hospital, Cape Town, South Africa. The pt. died on the 18th post-op day of organ rejection.
- Since then, open heart procedures have become daily operation world wide.
- In 2004 over 500,000 coronary artery bypass grafts (CABG) were performed in the United States.
- About 300,000 open heart procedures are performed in UK every year.
- Today, more than 5 million open heart procedures are performed annually world wide.

Slide / Diapositive 31



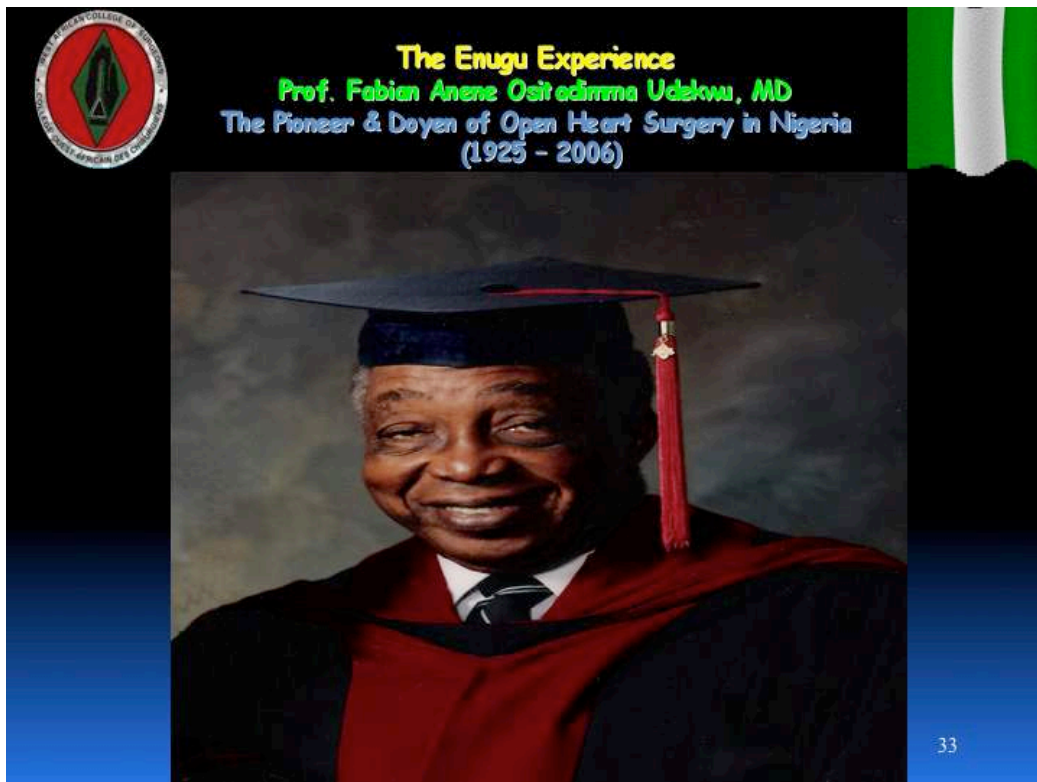
Professor Charles O. Easmon

2nd Past President of WACS (63-65)
Father of Cardiac Surgery in West Africa

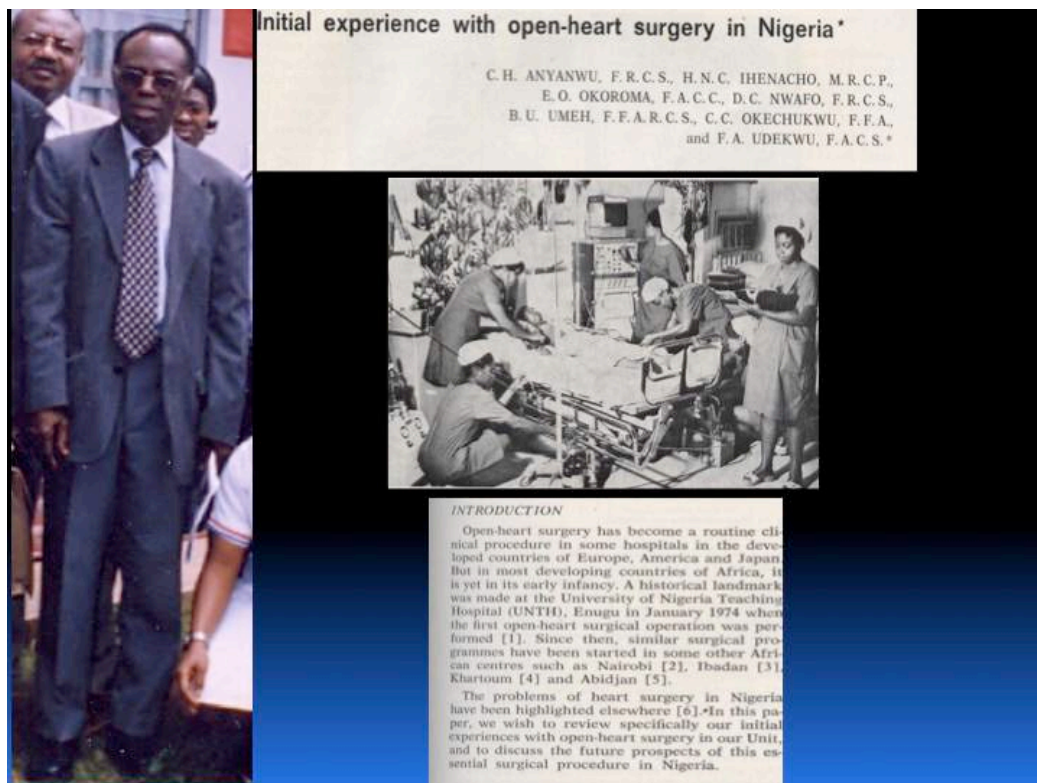


First West African to perform closed mitral commissurotomy in Ghana in 1960

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Slide / Diapositive 33



Slide / Diapositive 34



Development of Open Heart Surgery in West Africa: A Historical Perspective



Guest Lecture

By

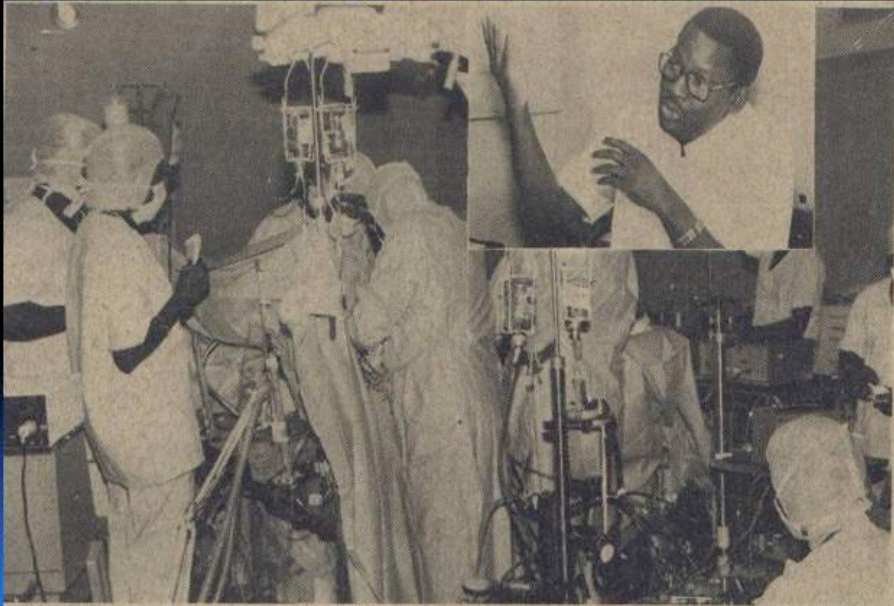
Samuel A. Adebonojo
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Wright State University Boonshoft School of Medicine
Dayton, Ohio, USA

48th Annual Scientific Conference
West African College of Surgeons
Freetown, Sierra Leone

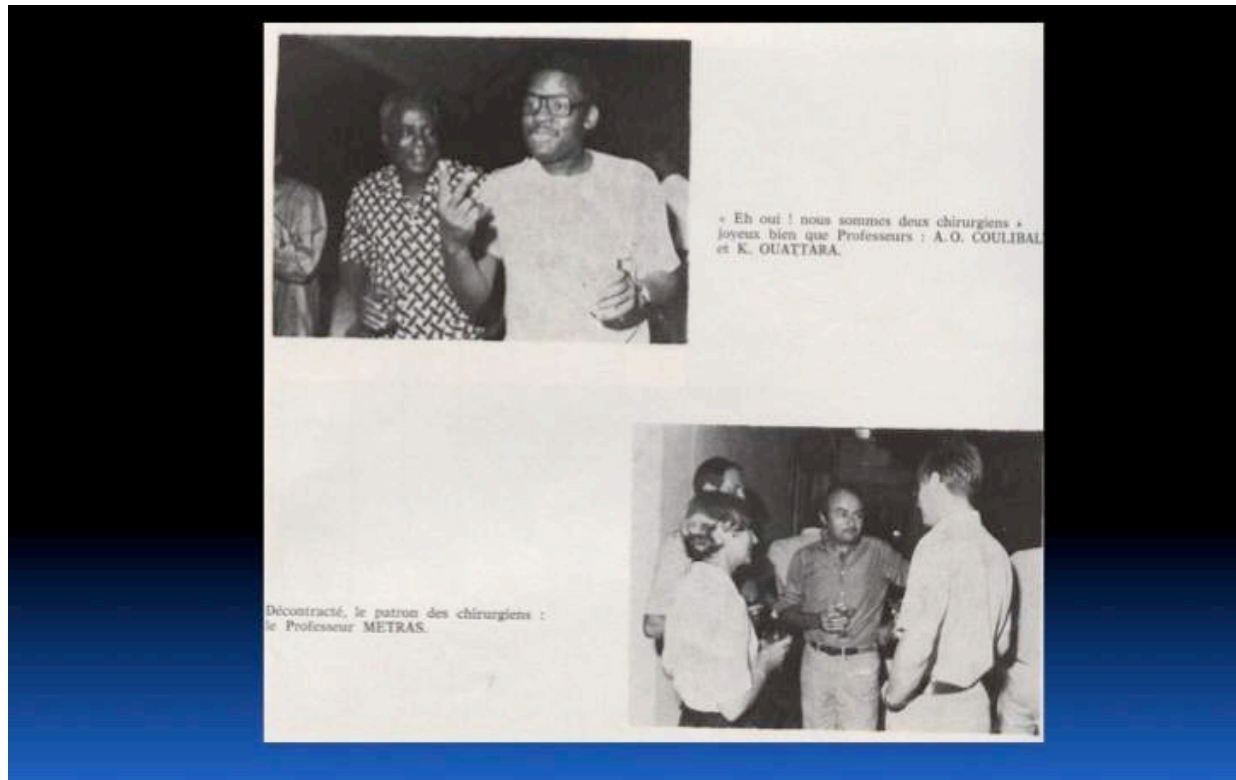
Slide / Diapositive 35



The 1st Open Heart Surgery in Cote D'Ivoire March 16, 1978



Slide / Diapositive 36



Slide / Diapositive 37



CHIRURGIE CARDIAQUE / CARDIAC SURGERY

CONFERENCES HOPITAL UNIVERSITAIRE AMINU KANO

CHIRURGIE A COEUR OUVERT EN AFRIQUE DE L'OUEST: HISTOIRE, EXPERIENCE CHIRURGICALE, ET DEFIS EN AFRIQUE DE L'OUEST

Partie 1: Afrique, berceau de l'humanité; défis de l'Afrique moderne; histoire de la chirurgie cardiaque

Par

Professeur Koffi Hervé YANGNI-ANGATE, MD,FICS, FWACS

Conférence donnée le 26 Novembre 2008 à l'auditorium de l'hôpital universitaire Aminu Kano, à Kano, Nigéria

1- Préambule (Diapositive 1)

Je voudrais vous remercier tous de l'honneur que vous me faites.

Parler de la «**Chirurgie à Cœur Ouvert en Afrique**» m'enthousiasme toujours. Je me souviens qu'à cette tribune sont intervenus des chirurgiens émérites, prestigieux dont les Professeurs E.Q. Archampong (Diapositive 2) et O.O. Ajayi (Diapositive3)

Monsieur le Professeur Ajayi, permettez moi de vous exprimer ma très grande admiration au regard de votre brillante carrière hospitalo-universitaire. Le Collège Ouest-Africain des Chirurgiens s'honore de vous compter parmi ces Past-présidents. Que ne faites vous pas pour ce Collège ? Merci de votre présence parmi nous.

Monsieur le Docteur Yakabu, Chef du Département de Chirurgie de l'Hôpital Universitaire de Kano, nos échanges épistolaires fréquents laissent transparaître votre sens de l'organisation et votre dévouement à l'avancée de la chirurgie dans votre pays. Il m'a été agréable de m'entretenir avec vous et souhaite longue vie à vos initiatives.

Il me paraît important d'associer à cet hommage les Fellows du Collège Ouest-Africain des Chirurgiens ici présents (Diapositive 4), les autorités hospitalières, universitaires, politiques et administratives de la région de KANO dont l'accueil a été chaleureux.

Je me souviens encore de ce premier contact avec les Hôpitaux Universitaires au Nigéria ; il se déroula au «Enugu Teaching Hospital» (Diapositive 5) ; j'y ai rencontré des Infirmières dévouées, des Médecins compétents et un personnel administratif responsable.

Je garde un souvenir vivace de ces interventions à cœur ouvert que le Professeur Aghayi et moi-même avons pratiquées au Centre d'excellence de Chirurgie cardiaque du «Enugu Teaching Hospital» .

Le Nigéria, votre pays est une Grande Nation (Diapositive 6) ; il est impressionnant par l'ardeur de ces habitants, leur combativité et leur foi immense en des lendemains plu radieux. Je partage ces espoirs avec vous car je crois en une Afrique conquérante, leader comme

jadis, du monde de demain ; une Afrique véhicule des valeurs humaines perdues ; une Afrique qui pardonne (Diapositive 7), une Afrique resplendissante, une Afrique ouverte à l'Etranger ; cette Afrique que nous chérissons n'est elle pas le «berceau de l'Humanité» ? le géniteur de la civilisation ? le berceau des Sciences ? la source première des religions ?

2- L'Afrique, Berceau de l'Humanité, de la Civilisation, de Sciences et des Religions (Diapositive 8)

a- Afrique, Berceau de l'Humanité

Pourquoi le continent africain est-il considéré comme berceau de l'Humanité ?

Selon **Goünter Brauer**, Paléoanthropologue de l'Université de Hambourg, l'homme «anatomiquement normal», l'ancêtre commun à tous les hommes, serait apparu il y a plus de 100.000 ans en Afrique Sub-saharienne (Diapositive 9). Puis, à partir de l'Afrique, cet homme serait parti à la conquête de l'Asie et de l'Europe. Cette donnée a été révélée grâce à la technique de l'ADN mitochondrial et des études de plus de 6000 crânes antiques provenant de toute notre planète. De là, il est unanimement reconnu que l'Afrique Sub-saharienne serait l'origine de notre Humanité (Revue «Nature» 19 juillet 2007).

Un autre auteur, **Dr Léonard Jeffries**, dans son article intitulé «**African Origins of Early Humanity**» (Diapositives 10 - 11) observe que l'homme le plus ancien appelé «l'Africain de l'Est» a été découvert en Tanzanie ; il aurait 1.750.000 ans. Ce même auteur, à partir de ses découvertes en Tanzanie, affirme aussi que notre Humanité aurait pris origine, il y a des millions d'années, en Afrique de l'Est et se serait répandue en Asie et en Europe emportant avec elle ses outils, science mathématique, et sa culture.

Une autre évidence de l'origine africaine de l'Humanité est la découverte des gravures les plus anciennes au monde dans la grotte de Blombus à 200 km du Cap en Afrique du Sud (environ 12.000 ans avant notre ère) faisant également de l'Afrique, le berceau de la civilisation.

b- Afrique, Berceau de la civilisation (Diapositives 12 - 16)

La civilisation aurait émergé en Afrique il y a au moins 7 millions d'années ; l'usage du feu et des premiers outils domestiques, la pêche, la chasse, l'astronomie, les mathématiques, l'écriture, l'art, la bijouterie auraient débuté en Afrique Noire. Autrement dit, l'Afrique serait le point de départ de la civilisation du monde et de son savoir scientifique.

c- Afrique, Berceau du Savoir Scientifique (Diapositive 17)

Pendant toute l'Antiquité, durant plus de deux millénaires, l'Egypte ancienne a rayonné au plan scientifique sur le monde entier. L'Egypte serait la source du savoir gréco-romain ; la géométrie, l'arithmétique, l'astronomie... proviendraient des savants égyptiens. Nombreuses sont les théories mathématique ou physiques dont l'origine serait égyptienne.

La philosophie grecque ou romaine tirerait ses origines des prêtres égyptiens, maîtres des grecs ou des romains en philosophie. Celle-ci serait d'abord africaine, les mathématiques et leurs théorèmes aussi, exception non faite de la géométrie, de la connaissance du cerveau, des lois fondamentales de la physique, et de la médecine dont une des célébrités fût Hippocrate, médecin grec, qui, pendant trois ans, aurait été initié à la connaissance des maladies par des maîtres médecins égyptiens.

d- Afrique, Berceau des Religions (Diapositive 18)

Du Polythéisme au Monothéisme, tel fût le chemin emprunté par les égyptiens. De la croyance en plusieurs divinités vécues dans les mondes égyptien, grecque et romain, les égyptiens auraient basculé à la croyance en un seul Dieu durant le règne du pharaon Aménophis IV qui se serait rebaptisé AKHENATON.

Pour conclure, nous citerons CHEICK ANTA DIOP ; «Ainsi l'Afrique que l'Europe veut faire passer pour un continent sans passé historique a abrité les plus anciens guides de l'humanité dans la voie de la civilisation ; ce sont eux qui ont créé les arts, les religions, la littérature..., la médecine, l'architecture, l'agriculture, etc... à une époque où le reste de la terre (Asie, Europe, Grèce, Rome) était plongé dans la barbarie...» (Diapositive 19)

3- Les Défis de l'Afrique d'Aujourd'hui ⁴⁻⁵ (Diapositives 20 - 27)

Hier Phase du monde, aujourd'hui, l'Afrique semble en perte de vitesse. «Africa is the only continent to have grown poorer in the last 25 years» disait Tony Blair ; de nombreux problèmes l'assaillent ; la pauvreté grandit ; la faim se généralise ; la jeunesse désespérée, l'éducation s'effrite, le nombre d'enfants non scolarisés est inquiétant, la mortalité materno-infantile reste préoccupante ; la décrépitude des infrastructures s'aggrave ; l'environnement naturel se dégrade continuellement, la pollution, la dégradation des sols s'étendent considérablement, le manque d'eau potable et d'électricité dans certaines régions est d'actualité, la marginalité de l'Afrique dans le commerce mondial et dans les investissements mondiaux et les guerres itératives persistent.

Cependant, les multiples maux de l'Afrique ne sauraient occulter les progrès accomplis que sont : l'implantation acceptée de la démocratie ; les réformes économiques dans de nombreux pays ; la collaboration plus grande des institutions panafricaines ; l'émergence de capacités humaines plus performantes ; l'appropriation remarquable des nouvelles technologies de l'information et de la communication par les Africains.

Face à ces défis, il importe de souligner que différentes initiatives au bénéfice de l'Afrique ont vu le jour ; la commission pour l'Afrique initiée par Tony Blair en 2004 en est un exemple. Sa mission était de mettre en place des stratégies de lutte contre la pauvreté, les conflits en Afrique ; de promouvoir des politiques en faveur de l'amélioration de l'éducation, de l'économie, de la lutte contre le SIDA, de la santé et de l'environnement. L'autre exemple est celui du Nouveau Partenariat pour le développement de l'Afrique ou New Economic Partnership for Africa's development (NEPAD) pour lequel Adboulaye WADE, Président du Sénégal disait, « nous, les Africains, nous voyons le NEPAD, comme un catalyseur qui propulsera l'Afrique vers l'Avenir».

En somme, en Afrique, les divers défis sont d'ordre politique, économique, social, environnemental, éducatif, sanitaire ; ces «challenges» ne sauraient cacher les nombreux progrès réalisés ou en cours et les grands espoirs suscités par des initiatives internationales. En outre, au rang de ces défis de

l'Afrique, nous ne saurions méconnaître la prise en compte de ces nombreux enfants et jeunes-adultes, moteurs de notre développement, qui souffrent de maladies cardiaques aiguës ou chroniques dont la cure requiert une chirurgie à cœur ouvert ; spécialité chirurgicale dont l'histoire dans le Monde et en Afrique remonte seulement à quelques décennies.

4- Histoire de la Chirurgie cardiaque dans le Monde et en Afrique ^{6,7,8,9} (Diapositive 28)

La chirurgie cardiaque à cœur ouvert s'ouvre au monde dès le 6 mai 1953 ; cette année John Gibbon, grâce à la machine cœur-poumon artificiel type Gibbon-IBM, ouvre l'ère de la chirurgie à cœur ouvert (Diapositives 29 & 30). A cette date historique la première cure chirurgicale d'une malformation intra cardiaque est réalisée avec succès. A sa suite, Lillehei entreprend une correction intra cardiaque le 26 mars 1954. Le développement de cette chirurgie s'accroîtra par la contribution de John W. Kirklin et ses collaborateurs de la «Mayo Clinic» grâce essentiellement aux innovations multiples, continues et technologiques dans la construction des machines cœur-poumon artificiels.

Ainsi, à la fin des années 50, se développent plusieurs programmes universitaires de chirurgie à cœur ouvert si bien qu'à ce jour plus d'un million d'interventions chirurgicales à cœur ouvert sont enregistrées dans le monde.

Devant la qualité croissante et la sécurité de plus en plus grande qu'offrent les machines cœur-poumon artificiels, les chirurgiens accomplissent de plus en plus fréquemment des corrections des malformations à complexité grandissante avec des résultats acceptables chez des patients à l'âge et au poids de moins en moins élevé. Ces interventions chirurgicales concernent la chirurgie valvulaire, coronarienne, des troubles du rythme ou encore des malformations cardiaques voire même la transplantation cardiaque.

C'est en 1967, en Afrique du Sud que Christian Bernard (Diapositive 31) pratiqua avec succès la première transplantation cardiaque au monde, signant ainsi les débuts de la période de la chirurgie à cœur ouvert en Afrique.

En Afrique de l'Ouest, la chirurgie à cœur ouvert connaîtra plusieurs pionniers, les Professeurs Easmon Charles (Ghana) (Diapositive 32),

Udekwu (Nigéria) (Diapositive 33), Anyanwu (Nigeria) (Diapositive 34), Adebajo (Nigeria) (Diapositive 35), Métras Dominique, Ouezzin-Coulibaly André et Ouattara Kouamé (Côte d'Ivoire) (Diapositives 36-37). Dans cette région ouest-africaine, les premières interventions à cœur ouvert se déroulèrent dans les années 70 ; Janvier 1974 à Enugu (Nigéria) (Diapositive 34), Mars 1978 à Abidjan (Côte d'Ivoire) (Diapositive 36), Décembre 1978 à Ibadan (Nigéria). Plus tard apparaîtront dans les années 90 de nouveaux centres de chirurgie cardiaque notamment au GHANA et au SENEGAL.

**Références: Voir Publication précédente:
 “Open heart Surgery in West-Africa: History,
 Surgical Experience and Challenges”**



CHIRURGIE CARDIAQUE / CARDIAC SURGERY

SURGICAL ASPECTS OF RHEUMATIC HEART DISEASE: PART 2

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Overview

The overall global growth or expansion of cardiac surgery favors the developing countries and emerging economies. At present, it is estimated that over 2 million open-heart operations are performed annually worldwide. It is also estimated that over 10,000 cardiothoracic surgeons, in over 3,000 centers, that include specialty clinics, hospitals or institutes, be that public, private or charitable, are involved in that effort. Well over one million of these operations are performed in North America and Europe. This represents ready access or availability for less than 700 million of the 7 billion global population. An estimated backlog of 15-20 million people with heart disease are in need of corrective cardiac surgery worldwide. Whereas coronary artery disease is the dominant indication for cardiac surgery in the developed countries, rheumatic and congenital cardiac diseases continue to be more prevalent in the developing countries or emerging economies. Yet coronary artery disease and degenerative valve disease are also increasing in these countries as the global population health and lifespan improves and rises. As the social, economic, environmental, political, and demographic conditions in these countries evolve, adapt, and advance, there will be a concomitant increase in cardiac services that include prevention, awareness, diagnostic evaluation, medical management, interventional treatment, surgical procedures, rehabilitation, and early, mid-term, and long-term follow-up.

Acute rheumatic fever (ARF) and rheumatic heart disease (RHD) remain a serious and prevalent international concern. The global prevalence of RHD is 12-15 million, of which >2.4 million are children 5-14 years of age. The annual incidence is >300,000, and the annual mortality >350,000. Rheumatic mitral valve disease is the most common condition, especially in children. The incidence is greater in females, and <25% give a history of prior ARF. This represents 30-40% of all cardiac hospital admissions in developing countries. In sub-Saharan Africa (SSA), the echocardiogram (ECHO) in clinically silent patients detects from 7.5 to 56.6/1,000, as opposed to the <1.0 to 14/1,000 prevalence in clinically detected RHD.

Regarding surgery, although open mitral valve repair has become the preferred procedure for degenerative and ischemic mitral valve problems, this procedure has not gained wide application for rheumatic disease, mainly because of complex pathology, technical difficulties, and debatable long term results, especially in children. Historically, mitral valve commissurotomy (MVC), both closed and open have been successful for rheumatic mitral stenosis, with excellent long term results. Presently, interventional percutaneous balloon valvuloplasty (PBV), when available and feasible, is the favored approach, despite higher cost than closed MVC. Open repair for rheumatic

mitral regurgitation, though durable in experienced centers, has mixed long term results in children < 20 years of age. Other approaches, including valve replacement with mechanical or bioprosthetic valves, mitral Ross II procedure, mitral homografts, and leaflet extension using autologous or non-autologous pericardial substitutes, have all been described and advocated. Interventional percutaneous and trans-cardiac approaches to the mitral and aortic valves are now available in advanced centers, yet remain in the clinical investigative phases. Access for testing, monitoring, and regulation of anticoagulation in low and middle income populations remains a formidable challenge, as does appropriate surgical considerations and options in child-bearing females. The decreased growth potential and reduced durability of bioprosthetic valves in young patients, with attendant cost and need for reoperation, are also major considerations.

The present part 2 review in a 5 part series highlights current medical and interventional treatment of predominate rheumatic mitral valve stenosis.

Key Words

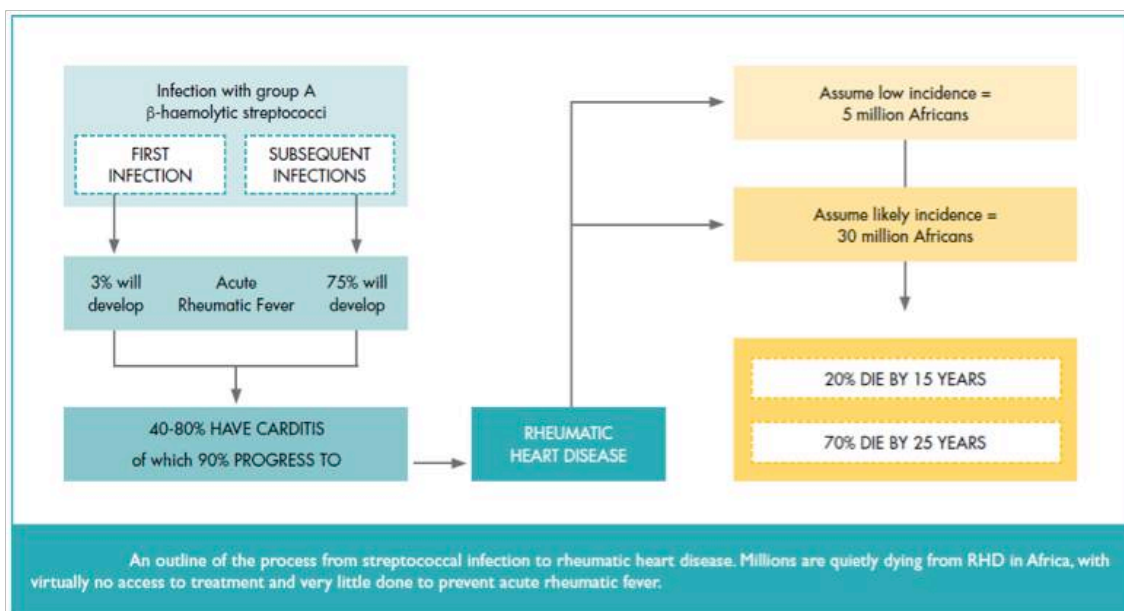
Acute Rheumatic Fever, Rheumatic Heart Disease, Mitral commissurotomy, Percutaneous balloon valvotomy, valve surgery, valve repair

Introduction

Incidence / Prevalence

It is difficult to ascertain the true global estimate of the incidence and prevalence of RHD, since ARF and RHD are usually reported together. As noted, the raw global estimate is that 10-15 million people have documented RHD¹. In the USA, the national prevalence of valve disease from all causes is 2.5% or >750,000 individuals². With virtually no RHD in that prevalence, the increase in cardiac valve related disease is secondary to increasing age and degenerative diseases, as predicted in the Gaziano report of epidemiological transition³. It is estimated that 70% of ARF will develop RHD, and that

70% of RHD involves the mitral valve. It is also estimated that >50% victims of RHD will require an interventional or surgical procedure during their lifetime. Table 1 summarizes the development of RHD from GAS⁴. In sub Saharan Africa (SSA), the incidence of clinically detected RHD is 14 per 100,000 per year, and the prevalence is 1-14 per 1,000. When 2D ECHO is used as a screening tool to detect clinically silent children, the prevalence in SSA, based on 31 surveys conducted in Mozambique, Uganda and in Senegal, increases to 7.5-56.6 per 1,000 children⁵.



The European Heart Survey of valvular heart disease evaluated the etiology of native valve disease and noted >90% rheumatic etiology for mitral stenosis, and >50% rheumatic etiology for multiple valve disease (6). Further time-course analysis of mitral stenosis and combined MS/MR revealed an increasing incidence after the second decade of life despite a decrease in rheumatic inflammatory activity (Figure 1) ⁷.

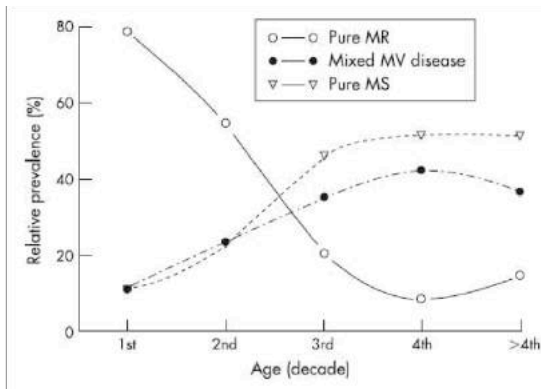


Figure 17: Time-course(by decade) of the relative prevalence of mitral valve(MV) disease, and pure mitral stenosis (MS). Reproduced from Marcus RH, Sareli P, Pocock WA, et al. The spectrum of severe rheumatic mitral valve disease in a developing country. Correlations among clinical presentation, surgical pathologic finding, and hemodynamic sequelae.

The annual number of cardiac valve operations from all causes, continues to increase in both the developed countries and emerging economies. Fifty nine per cent of all open heart operations at the Cleveland Clinic in 2011 were isolated or combined valve procedures⁸. This reflects the increase in degenerative valve disease in an aging population. At Fu Wai Hospital in Beijing, China 7,606 open heart operations were performed in 2008⁹. Of these, 2,189 (28.8%) were valve procedures, with the majority being congenital cases. More than 40% of valve procedures, though declining, were secondary to RHD. This is a reflection of the double burden of disease i.e. the persistent prevalence of RHD, which is a sequel of streptococcal infections, and the increasing incidence of degenerative valve disease, a non-communicable disease (Figure 2) ¹⁰. The severity of valve disease in China is high, given that 23.51% of the valve operations at Fu Wai Hospital were multiple valve procedures. In contrast, in the USA, 11% of all valve procedures performed from 1993 through 2007 were multiple valve procedures, and only 10.3% of the valve operations were for mitral stenosis¹¹.

Diagnosis

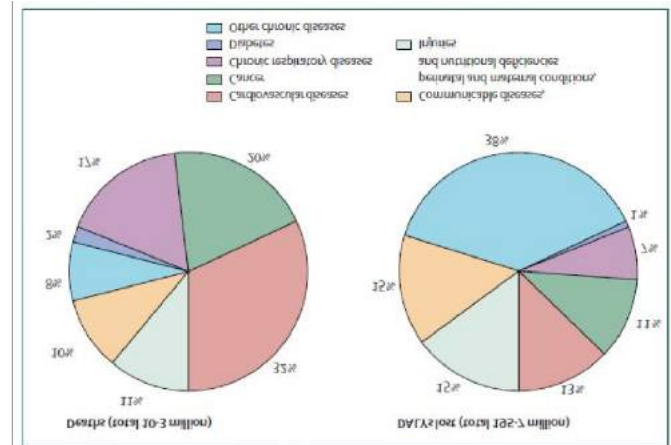


Figure 210: Estimated proportions of total deaths and DALYs lost for all ages in China, 2005

The diagnosis of RHD involves a detailed history and physical examination, with emphasis on a history of ARF or recurrent episodes of ARF. Yet, <25% can give an accurate or documented history of an ARF event. Many individuals either did not seek medical attention for initial GAS infection because of mild symptoms, or developed ARF without symptoms or associated clinical manifestations. Assessment of cardiac clinical symptoms utilize the New York Heart Association Functional Classification (Class I-IV), or the American College of Cardiology/ American Heart Association (ACC/AHA) Classification (Stage A-D) (Table 2, 3)^{12,13}. Hurst¹² has emphasized the importance of the complete NYHA classification that includes the etiology, anatomy, physiology, functional classification, and objective assessment of cardiac disease.

The major symptoms associated with valve disease are reflective of the extent of valvular and myocardial involvement which lead to right, left, or biventricular heart failure. They include fatigue, decreased exercise tolerance, dyspnea on exertion or at rest, chest pain, dizziness, and syncope. Dyspnea results from MV obstruction with subsequent decrease in lung compliance, and decreased vital capacity (VC) secondary to pulmonary vascular congestion and interstitial pulmonary edema. Clinical signs include heart murmurs, and evidence of right, left, or combined heart failure. These include neck vein distension, lung rales, hepatomegaly, ascites, or peripheral edema¹⁴.

also extends the diagnostic capability and accuracy for complex disease, and for interventional or operative scenarios. Table 4²⁰ summarizes complete ECHO evaluation criteria for aortic and mitral valve abnormalities. Real-time three dimensional echocardiography (RT3DE), where available, has become extremely helpful in planning operative strategies, as well as intraoperative assessment of valve repair or valve replacement (Figure6)²¹. It gives more information regarding the functional and anatomic properties of the cardiac structures in real time (especially post RMV assessment of extent of mitral commissural splits, leaflet lacerations, and degree of MR). RT3DE is also superior to 2D ECHO in chamber quantification and MVA assessment of mitral stenosis^{22,23}. Other diagnostic modalities for heart valve assessment include cardiovascular magnetic resonance (MR), and multi-detector row computed tomography (CT), though not readily available in LMIC's²⁴. MR is able to give accurate assessment of LV volumes and systolic function, whereas CT provides evaluation of coronary artery disease and spatial resolution for planimetry of stenotic heart valves.



Figure 5. Parasternal short axis view showing calcified doming of mitral valve orifice- "button-hole", "fish mouth". (Courtesy of Dr KM Cherian, Frontier Lifeline, Chennai, India)

Table 4. ^{20, 21} **Summary of ECHO findings**

Mitral Regurgitation severity

- Effective regurgitant orifice area (EROA): mild-<0.20 cm²; moderate-0.2-0.39; severe- >0.40.
- MR volume (mL/beat): mild->30; moderate- 30-90; severe >60.
- MR fraction: >55%.
- Jet area (central jets): mild < 3cm² or 20% of LA; moderate- 4-10cm²; severe->10cm² or 40% of LA.
- Jet density and contour: mild- soft and parabolic; moderate- dense, variable contour; severe- dense, triangular with early peaking.
- Vena contracta width (VC): mild <0.3; moderate- 0.30-0.69; severe- >0.40.
- Pulmonary vein systolic reversal of flow: mild systolic dominance; moderate systolic blunting; severe systolic reversal.

-Suggestive: LA size >55mm; color flow area >40% LA size

-MV leaflet tenting area: >6cm²

-Increased E velocity

-LVEDD >70mm

-LVESD >55mm

Mitral stenosis

MVA- Normal 4-6 cm²

-Mild 1.6-2cm²

-Moderate 1.1-1.5cm²

-Severe <1.0cm²

-Resting mean gradient >10mm Hg

-PHT >220 milliseconds

Aortic regurgitation

-LVDD >75mm/LVE

-Regurgitant jet width/LVOT diameter ratio >60%

-Vena contracta width >6cm

-AR PHT <250 milliseconds

Aortic stenosis

-Peak aortic velocity >4.5m/s (0.3m/s/year)

-Mean pressure gradient >50mm Hg

-AVA <0.75cm²

-LVOT: AOV/TVI <0.25

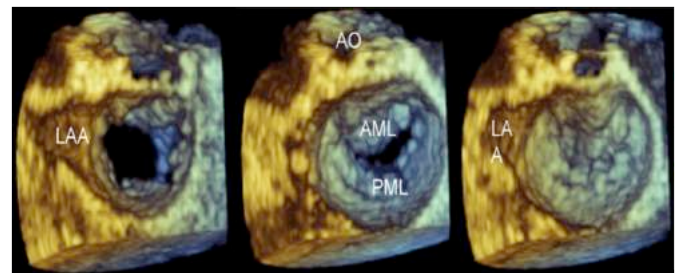


Figure 6. *3D ECHO of normal mitral valve.* From: Shiota T. 3D echocardiography: The present and the future. J Cardiology 2008;52:169-185.

Invasive cardiaccatheterization is not indicated for younger patients, but is recommended in patients > 40 years old to assess coronary anatomy. The hemodynamic changes are particularly important in patients with myocardial dysfunction, and suspected pulmonary hypertension^{16,25}. Carabello¹⁶ also stresses that pulmonary hypertension at the time of corrective intervention or surgery is a prognostic indicator of decreased long term survival.

The guidelines for the management of valvular heart disease have been well outlined, based on evidence based medicine, by the ACC/AHA, and the Task Force on the Management of Valvular Heart Disease of the European Society of Cardiology^{13,26,27}. Table 5¹³ summarizes the severity and classification of valve disease in the adult. These figures do not accurately assess mixed stenosis/regurgitation, or multiple valve involvement. The correlation of the clinical and objective diagnostic findings remains a challenge with regards to clinical management/treatment.

The progressive nature of RHD is important to understand. The latency period from ARF to asymptomatic and then symptomatic valve dysfunction ranges from 20-40 years in developed countries, yet is shorter in LMIC's (7). The symptoms of RHD are related to valve dysfunction and subsequent singular or combined effects on the LV, RV, or pulmonary vascular bed.

The associated clinical problems or sequelae related to mitral RHD include: enlarged LA enlargement, atrial fibrillation, cardiomyopathy induced tachyarrhythmias, LA clot, systemic emboli, stroke, elevated pulmonary artery pressure (PAP), endocarditis, functional TR, and RV/LV failure^{16, 25}. In LMIC's the major hospital admission problem is heart failure. The overall mortality of RHD

is due to atrial fibrillation with embolic stroke, and heart failure related to progressive mitral, aortic, and tricuspid valve dysfunction. In developing countries and emerging economies a major challenge is delayed recognition, as well as access and availability of care, and the ability to provide comprehensive evaluation and management.

Figure 5²⁶. Classification of the Severity of the Valve Disease in Adults

A. Left-sided valve disease			
Indicator	Aortic Stenosis		
	Mild	Moderate	Severe
Jet velocity (m/s)	Less than 3.0	3.0-4.0	Greater than 4.0
Mean gradient (mm Hg)*	Less than 25	25-40	Greater than 40
Valve area (cm ²)	Greater than 1.5	1.0-1.5	Less than 1.0
Valve area index (cm ² /m ²)			Less than 0.6
	Mitral Stenosis		
	Mild	Moderate	Severe
Mean gradient (mm Hg)*	Less than 5	5-10	Greater than 10
Pulmonary artery systolic pressure (mm Hg)	Less than 30	30-50	Greater than 50
Valve area (cm ²)	Greater than 1.5	1.0-1.5	Less than 1.0
	Aortic Regurgitation		
	Mild	Moderate	Severe
Qualitative			
Angiographic grade	1+	2+	3-4+
Color Doppler jet width	Central jet, width less than 25% of LVOT	Greater than mild but no signs of severe AR	Central jet, width greater than 65% LVOT
Doppler vena contracta width (cm)	Less than 0.3	0.3-0.6	Greater than 0.6
Quantitative (cath or echo)			
Regurgitant volume (ml/beat)	Less than 30	30-59	Greater than or equal to 60
Regurgitant fraction (%)	Less than 30	30-49	Greater than or equal to 50
Regurgitant orifice area (cm ²)	Less than 0.10	0.10-0.29	Greater than or equal to 0.30
Additional Essential Criteria			
Left ventricular size			Increased
B. Right-sided valve disease			
	Mitral Regurgitation		
	Mild	Moderate	Severe
Qualitative			
Angiographic grade	1+	2+	3-4+
Color Doppler jet area	Small, central jet (less than 4 cm ² or less than 20% LA area)	Signs of MR greater than mild present, but no criteria for severe MR	Vena contracta width greater than 0.7 cm with large central MR jet (area greater than 40% of LA area) or with a wall-impinging jet of any size, swirling in LA
Doppler vena contracta width (cm)	Less than 0.3	0.3-0.69	Greater than or equal to 0.70
Quantitative (cath or echo)			
Regurgitant volume (ml/beat)	Less than 30	30-59	Greater than or equal to 60
Regurgitant fraction (%)	Less than 30	30-49	Greater than or equal to 50
Regurgitant orifice area (cm ²)	Less than 0.20	0.2-0.39	Greater than or equal to 0.40
Additional Essential Criteria			
Left atrial size			Enlarged
Left ventricular size			Enlarged
	Characteristic		
Severe tricuspid stenosis:	Valve area less than 1.0 cm ²		
Severe tricuspid regurgitation:	Vena contracta width greater than 0.7 cm and Systolic flow reversal in hepatic veins		
Severe pulmonic stenosis:	Jet velocity greater than 4 m/s or maximum gradient greater than 60 mm Hg		
Severe pulmonic regurgitation:	Color jet fills outflow tract Dense continuous wave Doppler signal with a steep deceleration slope		

*Valve gradients are flow dependent and when used as estimates of severity of valve stenosis should be assessed with knowledge of cardiac output or forward flow across the valve. Modified from the Journal of the American Society of Echocardiography, 16, Zoghbi WA. Recommendations for evaluation of the severity of native valvular regurgitation with two-dimensional and Doppler echocardiography, 777-802. Copyright 2003, with permission from American Society of Echocardiography.

AR = aortic regurgitation; cath = catheterization; echo = echocardiography; LA = left atrium; LVOT = left ventricular outflow tract; MR = mitral regurgitation.

Rheumatic Mitral Valve Stenosis

Rheumatic mitral valve disease (RMVD) deserves particular attention since rheumatic mitral stenosis and/or insufficiency involve 65-75% of all RHD patients, and remains a significant problem in the developing world. It is also 2-3 times more common in women¹⁶. The natural history has been well studied⁷. Selzer and Cohn²⁸, in 1972, summarized previous studies which revealed that the latent period from acute carditis to symptomatic mitral stenosis averaged 19 years. They also highlighted a 40% incidence of atrial fibrillation that, presumably, was the result of left atrial enlargement and increased left atrial pressure. Atrial fibrosis and atrophy were postulated to be a deterrent to successful cardioversion, be

it medical, interventional, or surgical. The incidence of systemic emboli was 9-14%, with 60-75% of individuals having a stroke. Myocardial factor and bacterial endocarditis were not considered significant problems. They stressed the 3 distinct pathological types of mitral stenosis: 1. Focused commissural fusion; 2. Cusp or leaflet fibrosis with subsequent calcification; and 3. Chordal involvement with fusion, thickening, and shortening. Combinations of all 3 types could occur. This is of therapeutic significance since appropriate treatment options require an accurate anatomical description of the valve pathology, and lesion(s) specific corrections.

Management/Treatment Options for RMVD ²⁶

It is important to consider a number of issues when discussing management options in LMIC's where the prevalence of RMVD is greater. Access to cardiac services is difficult in both rural and even large urban areas. Long waiting lists and substandard evaluation compounds the problem. Cost is also a major issue given the cost of medications, and frequent hospitalizations.

In general, treatment should begin when symptoms develop. However, late presentation or late referral patterns remain a challenge. Government support may not be available or is limited. Patients usually have to pay for the valves, drugs, and disposables using "out of pocket" resources, given limited health insurance coverage, and meager funds from the charitable trust hospitals, or private centers. Poor patients have limited access to the private hospitals, since these facilities provide limited charity care, and only in a few countries is there mandated total or partial financial support from the private sector. The majority of the patients are children and adolescents (5-18 years of age), and have an aggressive form of RMVD. Percutaneous valvotomy, though less invasive than surgery, is expensive. The cost of each percutaneous balloon is >\$1,000. In many countries the balloons are reused at least 3 times to decrease cost. Disposables and medication for surgery average \$2-\$3,000 per patient. The remaining clinical issues remain debatable. These include valve repair, mechanical valve versus bioprosthetic valve, anticoagulation and monitoring, child bearing females, redo operations, and complications following surgery. The success of treatment is related to the NYHA functional status. For NYHA I medical treatment is adequate. However, for more advanced heart failure classification NYHA II-IV, interventional catheterization, or surgical treatment is recommended^{16,19}.

Medical Therapy

The overall medical management of RHD revolves around the anatomical valve sequelae (isolated MS, MR, AS, AR, or combinations), and the resultant pathophysiological dysfunction²⁶. The overall approach must

include the prevention of acute rheumatic fever (ARF), the prevention of infectious endocarditis, and the treatment of the sequelae of valve disease that includes heart failure, pulmonary hypertension, atrial fibrillation, thromboemboli, or endocarditis²⁶. This is a major challenge in LMIC's where late presentation or late referral is common. Single valve, mixed valve, and multiple valve involvement are the anatomical problems, and all of them can elicit one or more pathophysiological conditions. Medical management includes diuretics, decreased salt intake, digoxin, anticoagulation, beta blockers (avoid atenolol in pregnant patients), calcium channel blockers, potassium supplement, afterload reduction with ACE inhibitors (e.g. captopril or enalapril), pulmonary vascular dilators, and secondary antibiotic prophylaxis. With longstanding RHD, advanced heart failure requires aggressive management (Figure 7)²⁹.

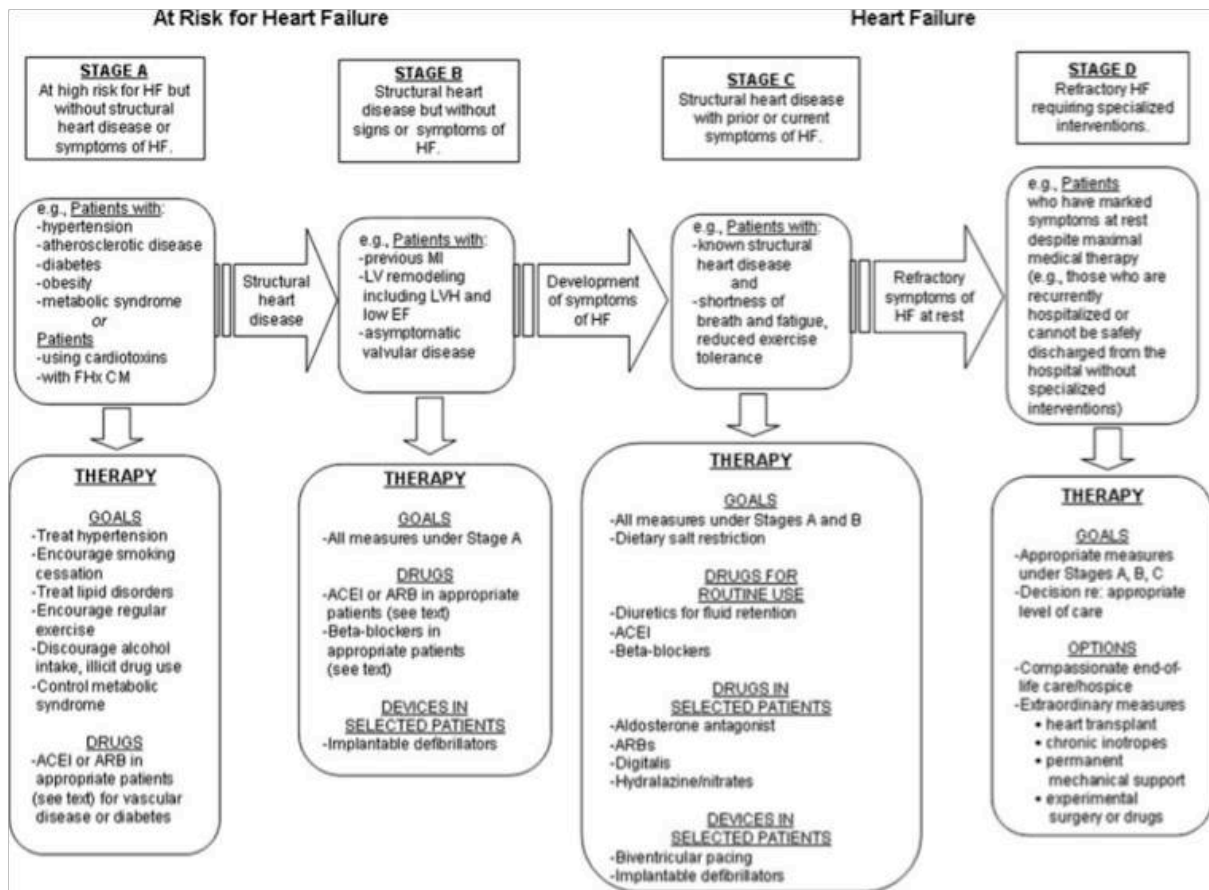
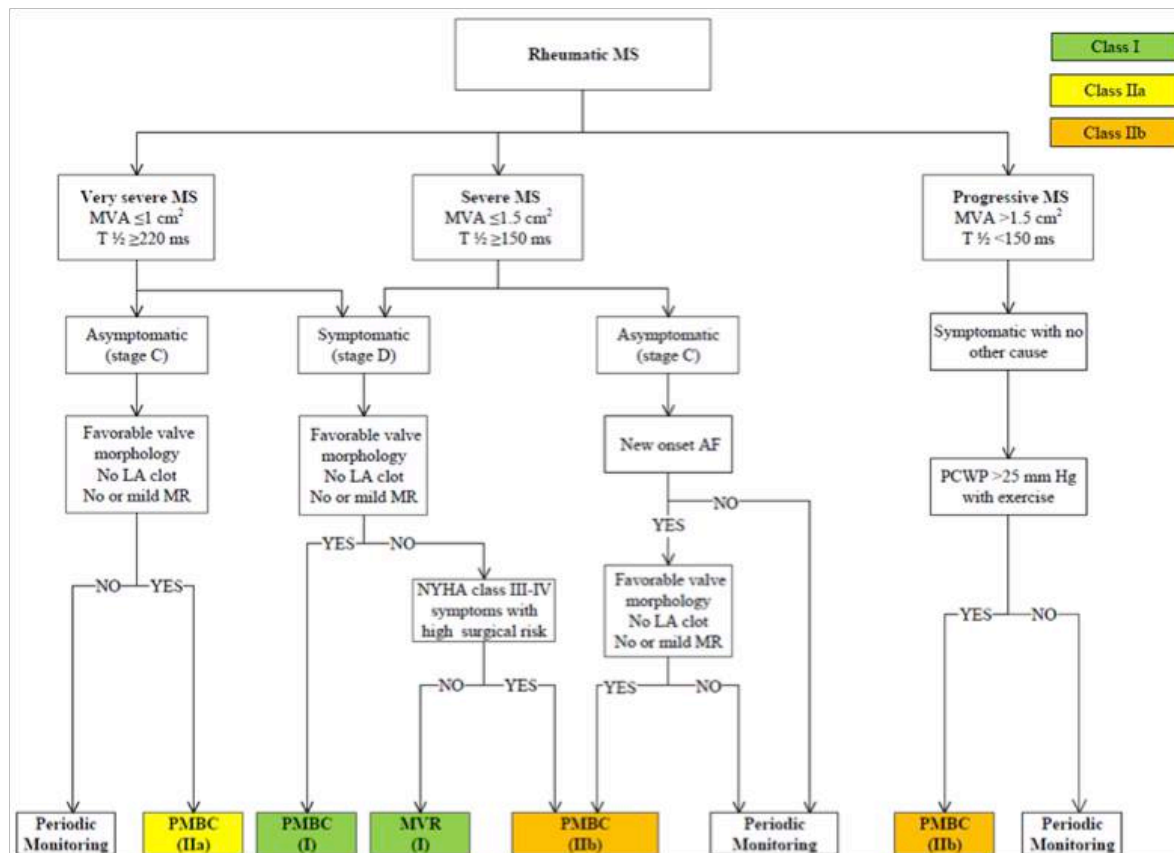


Figure 7. (<http://circ.ahajournals.org/cgi/reprint/CIRCULATIONAHA.109.192064>)



AF indicates atrial fibrillation; LA, left atrial; MR, mitral regurgitation; MS, mitral stenosis; MVA, mitral valve area; MVR, mitral valve surgery (repair or replacement); NYHA, New York Heart Association; PCWP, pulmonary capillary wedge pressure; PMBC, percutaneous mitral balloon commissurotomy; and T $\frac{1}{2}$, pressure half-time.

Figure 8. (26) Indications for Intervention for Rheumatic MS

Paroxysmal or chronic sustained atrial fibrillation is a significant problem that complicates >60% of RHD. The risk of systemic emboli and stroke with attendant morbidity and death, as well as risks associated with anticoagulation is significant¹⁶. This requires consideration for aggressive control that includes rate control with beta blockers and calcium channel blockers, as well as attempts with medical or electrical cardioversion. Long term anticoagulation is usually required³⁰. This will be discussed further in parts 3 and 4. The recommendations also apply to postoperative treatment of AF. Endocarditis complicates RHD in 14% of patients. Berkowitz³¹ noted a 9.7% incidence of endocarditis in children with RHD from 8 reviewed studies. Endocarditis will be discussed further in parts 3-5.

Interventional Therapy

Percutaneous Balloon Valvuloplasty (PBV)

With rheumatic mitral stenosis the most common mechanism is fusion of the commissures. This is the basis for catheter based procedures which have increased in recent years³²⁻³⁵. In the USA, >1,500 PBV's are performed per year. The global number is unknown, as is the global availability of PBV or surgery. Grading mitral valve disease and clinical management algorithms are summarized in Figure 8^{13,27}. Both the Wilkins and lung/Cormier morphology grading scores were developed to provide guidelines and patient selection for either catheter-based interventional or surgical treatment (Table 6, 7). An ECHO score of <8 provides an optimal outcome from PVB, whereas scores >11 are sub-optimal. Scores of 9 to 11 are not predictable. The lung/Cormier score gives a more quantitative assessment of the subvalvular apparatus (SVA). This may be more predictive of PBV success, though not documented in the literature (--). The overall target goal of PVB is to achieve a mitral valve area (MVA) of at least 1.5-2.0 cm² (Normal MVA is 4-6 cm²), minimal residual MR, preserved LV function, and varying degrees of decreased PAP. Although these echocardiographic features can predict the likelihood of immediate success, they do not identify the future risks of subsequent mitral regurgitation. Based on pathologic data from patients who developed

severe post-procedural MR, the Padial ECHO score was developed which included uneven distribution of thickness and calcification of both mitral leaflets, and the degree of commissural and subvalvular involvement (Table 8)³⁶. Other 2D ECHO scores have also been devised (Chen, Reid, and Nobuyoshi scores). Soliman et al. (37) have reported the RT3D-TEE modality developed by Anwar et al. (Table 9)³⁷.

This technique allows better evaluation of the functional valve, and both valvular and subvalvular morphology. It also helps define the valvular orifice area. This is especially true for better localization of the valve commissures and areas of calcification.

The percutaneous balloon valvotomy (PBV) technique or balloon mitral valvotomy (PBV) was introduced in 1984 by Inoue (Figures 9,10)³⁸. Subsequent early clinical series have documented the effectiveness of the procedure³⁹⁻⁴³.

Table 6. Wilkin's Mitral Valve Morphology Score*

Grade	Mobility	Valvular Thickening	Valvular Thickening	Subvalvular Thickening
	Highly mobile valve with only leaflet tips restricted	Leaflets near normal in thickness (4-5 mm)	Single area of increased echo brightness	Minimal thickening just below mitral leaflets
	Middle and base portions of leaflets have reduced mobility	Thickening of leaflet midportions, marked thickening of margins	Scattered areas of brightness confined to leaflet margins	Thickening of chordal structures extending up to one third of chordal length
	Valve continues to move forward in diastole, mainly from base	Thickening extending through entire leaflet (5-8 mm)	Brightness extending into midportions of leafletst	Thickening extending to distal third of chords
	No or minimal forward movement of leaflets in diastole	Thickening Marked thickening of all leaflet tissue (> 8-10 mm)	Extensive brightness throughout most of leaflet tissue	Extensive thickening and shortening of all chordal structures extending down to papillary muscles

**Total ECHO score is derived from an analysis of mitral leaflet mobility, valvar and subvalvar thickening, and calcification, and is graded from 0 to 4 according to the criteria given in the table. This yields a total score of 16.*

Wilkins GT, Weyman AF, Abscal VM, et al. Br Heart J 1988;60:299-308.

Table 7:

Anatomic scores predicting outcome after percutaneous mitral commissurotomy: Cormier's grading of mitral valve anatomy	
Echocardiographic group	Mitral valve anatomy
Group 1	Pliable non-calcified anterior mitral leaflet and mild subvalvular disease (i.e. thin chordae ≥ 10 mm long)
Group 2	Pliable non-calcified anterior mitral leaflet and severe subvalvular disease (i.e. thickened chordae < 10 mm long)
Group 3	Calcification of mitral valve of any extent, as assessed by fluoroscopy, whatever the state of subvalvular apparatus

*lung B, Cormier B, Dicimetiere P, et al. Functional results 5 years after successful percutaneous mitral commissurotomy in a series of 528 patients and analysis of predictive factors. *J Am Coll Cardiol* 1996;27:407-414.

Table 8 Padial Score³⁶.

Echocardiographic Score for Severe Mitral Regurgitation After Percutaneous Mitral Valvulotomy

I-II. Valvular thickening (score each leaflet separately)

1. Leaflet near normal (4-5 mm) or with only a thick segment
2. Leaflet fibrotic and/or calcified evenly; no thin areas
3. Leaflet fibrotic and/or calcified with uneven distribution; thinner segments are mildly thickened (5-8 mm)
4. Leaflet fibrotic and/or calcified with uneven distribution; thinner segments are near normal (4-5 mm)

III. Commissural calcification

1. Fibrosis and/or calcium in only one commissure
2. Both commissures mildly affected
3. Calcium in both commissures, one markedly affected
4. Calcium in both commissures, both markedly affected

IV. Subvalvular disease

1. Minimal thickening of chordal structures just below the valve

2. Thickening of chordae extending up to one-third of chordal length
3. Thickening to the distal third of the chordae
4. Extensive thickening and shortening of all chordae extending down to the papillary muscle

The total score is the sum of these echocardiographic features (maximum 16)

Table 9³⁷

New real time 3D ECHO (RT3DE) score for prediction of PVM outcome:

Each leaflet is divided into 3 scallops: Anterior leaflet- A1, A2, A3// Posterior leaflet- P1, P2, P3. The subvalvular apparatus is divided into 3 cut section of the anterior and posterior chordae at 3 levels: Proximal (valve level), middle and distal (papillary muscle level). Each MV scallop is scored as follows:

Normal thickness & mobility = 0

Abnormal thickness or restricted mobility = 1

No calcification = 0

Calcification in middle scallop (A2 or P2) = 1

Calcification of commissural scallops of both leaflets = 2

Scoring of subvalvular apparatus:

Chordal thickness normal = 0

Abnormal thickness = 1

Chordal separation (distance in between) > 5 mm = 0, < 5 mm = 1

Absence of separation = 2

The RT3DE score of leaflets and the subvalvular apparatus range from 0-31 points. Total score of mild MV involvement is < 8 points, moderate involvement 8-13 points, and severe involvement > 14 points.

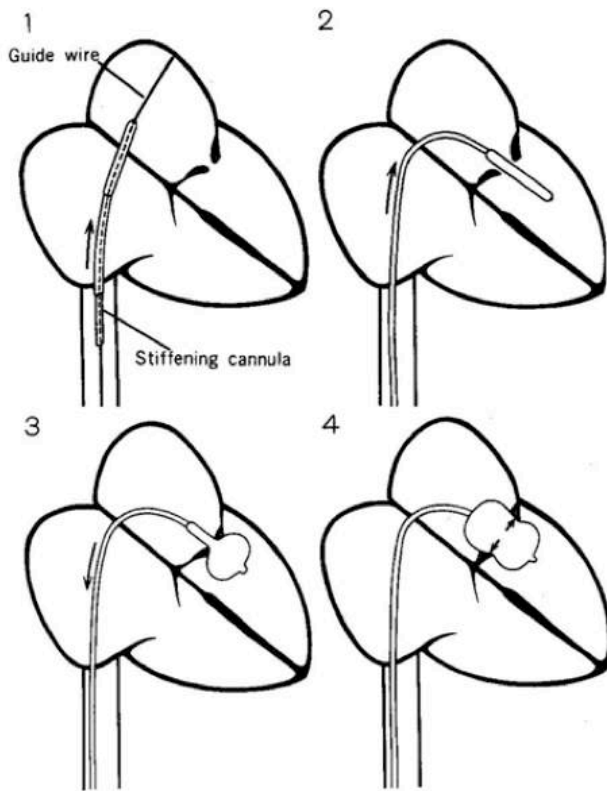


Figure 9³⁸ Manipulation of the balloon catheter. 1, The balloon catheter, with a stiffening cannula inserted, is advanced over the guide wire and pushed into the left atrium. Then the stiffening cannula is removed. 2, The balloon catheter is inserted into the left ventricle with the aid of its own specific curvature. 3, In the left ventricle, only the distal half of the balloon is inflated. It is pulled until some resistance is felt, to bring it into contact with the left ventricular side of the mitral valve. 4, With further infusion, the balloon is inflated to full extent at the mitral orifice and there by separates the fused commissures.

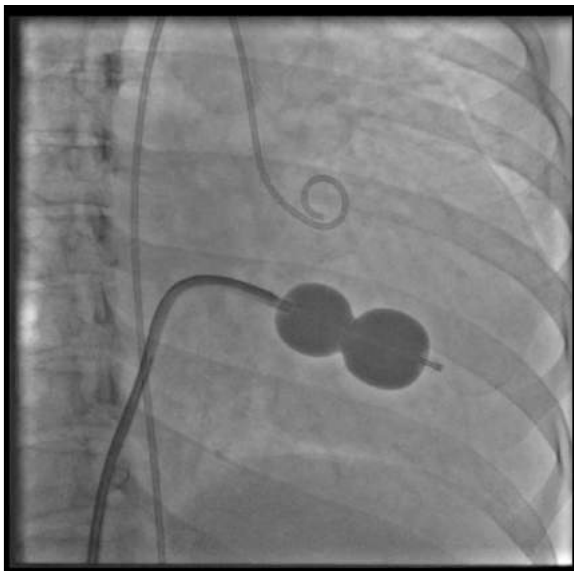


Figure 10. Inoue inflated balloon across mitral valve via trans atrial septal approach. (Courtesy of Dr KM Cherian, Frontier Lifeline Cardiovascular Center, Chennai, India)

The current indications and contraindications for PBV are summarized in Tables 10, 11

(13, 41). The majority of candidates are symptomatic. For asymptomatic patients, PBV may be indicated. This includes child bearing females, individuals requiring non-cardiac surgical procedures, or patients with severe MS and increased PAH at rest or with exercise (35). Patients with symptomatic MS, PAH, and heart failure may benefit from PBV as a bridge or destination therapy, especially when surgical correction is at high risk. Prophylactic PBV is not warranted for prevention of atrial fibrillation or systemic emboli (35). If a left atrial or left appendage thrombus is found, 3 months of anticoagulation with warfarin is usually recommended. If resolved, then PMB is performed. Otherwise surgery remains an option with or without resolution of the thrombus. Cost should be considered in situations where lower cost surgery is more readily available. Special situations include pregnancy and older patients. Pregnant females with MS usually develop symptoms in the 2nd trimester (mild- 26%; moderate- 38%; and severe- 67%) (35). PBV is usually recommended in the 22-36 week of gestation to minimize radiation. Older patients who develop severe or critical MS are at higher risk given associated comorbidity and other valve involvement, especially functional tricuspid secondary to pulmonary hypertension.

Table 10²⁶

Indications

Indications for PBV (American College of Cardiology (ACC) and the American Heart Association (AHA).

Class I recommendations:

- Percutaneous mitral balloon valvotomy is effective for symptomatic patients (New York Heart Association [NYHA] functional class II, III, or IV) with moderate or severe MS and valve morphology favorable for percutaneous mitral balloon valvotomy in the absence of left atrial thrombus or moderate to severe mitral regurgitation (MR) (level of evidence: A)
- Percutaneous mitral balloon valvotomy is effective for asymptomatic patients with moderate or severe MS and

valve morphology that is favorable for percutaneous mitral balloon valvotomy who have pulmonary hypertension (pulmonary artery systolic pressure > 50 mm Hg at rest or > 60 mm Hg with exercise) in the absence of left atrial thrombus or moderate to severe MR (level of evidence: C)

Class IIa recommendations:

- Percutaneous mitral balloon valvotomy is reasonable for patients with moderate or severe MS who have a nonpliable calcified valve, are in NYHA functional class III–IV, and either are not candidates for surgery or are at high risk with surgery (level of evidence: C)

Class IIb recommendations:

- Percutaneous mitral balloon valvotomy may be considered for asymptomatic patients with moderate or severe MS and valve morphology favorable for percutaneous mitral balloon valvotomy who have new onset of atrial fibrillation in the absence of left atrial thrombus or moderate to severe MR (level of evidence: C)
- Percutaneous mitral balloon valvotomy may be considered for symptomatic patients (NYHA functional class II–IV) with mitral valve area greater than 1.5 cm² if there is evidence of hemodynamically significant MS based on pulmonary artery systolic pressure greater than 60 mm Hg, pulmonary artery wedge pressure of 25 mm Hg or more, or mean mitral valve gradient greater than 15 mm Hg during exercise. (level of evidence: C)
- Percutaneous mitral balloon valvotomy may be considered as an alternative to surgery for patients with moderate or severe MS who have a nonpliable calcified valve and are in NYHA functional class III–IV (level of evidence: C)

Table 11^{34, 45, 46}

Contraindications (relative or absolute):

Mild MS MVA 1.5cm²
Moderate to severe MR

Persistent left atrial or left atrial appendage thrombosis
Massive or bicommissural calcification of fused commissures
Need for other open-heart surgery
Contraindications for transseptal catheterization
Severe associated aortic valve disease
Severe organic tricuspid stenosis or severe functional regurgitation with enlarged annulus

There are at least 4 techniques available for PBV: the traditional Inoue balloon³⁸; the double balloon^{41,42}; the multitrack system, which is a refinement of the double-balloon technique that employs a monorail system requiring only 1 guide wire and allows easier dilation than the standard technique⁴³, and the Cribier metallic commissurotome or valvulotome⁴⁴. The latter is practical insofar that the device is reusable, though it involves a more complex procedure.

The technical aspects of PBV have been well described^{38,45,46}. TEE is usually performed before and during the procedure to determine the presence of left atrial and left atrial appendage thrombus, guiding the catheter placement, as well as determining the suitability of PBV in the presence of commissural calcification. The presence of severe calcification of 1 or both commissures is an independent determinant of success. TEE can guide the catheter across the atrial septum during transseptal puncture at the level of the fossa ovalis, directing the catheter across the mitral valve, and to confirm that the balloon is properly seated across the mitral valve. Both retrograde (transarterial) and antegrade (transvenous/transseptal) approaches have been described. The retrograde approach eliminates the risk of atrial septal defect but carries the risk of potential arterial damage. At present, the antegrade approach with transseptal catheterization is used via the femoral vein or jugular venous route. Recently, RT3DE has been shown to enhance the visualization of the interatrial septum and the assessment of optimal location for puncture, as well as to assess degree of post PBV commissurotomy splitting, leaflet tears, and more accurate assessment of new or worsening MR³⁵. Intracardiac ECHO (ICE) is another useful imaging modality that can identify the fossa ovalis, guide placement of

the transseptal puncture sight at the limbus, and assess the left atrial appendage. The ICE catheter can also provide RT3DE images of the structures surrounding the catheter tip, resulting in improved imaging, and excellent spatial resolution^{45, 46, 47}.

The Inoue balloon technique has been the most commonly employed. After transseptal catheterization, a balloon-tipped catheter is advanced into the left ventricle. One or two exchange guide wires are advanced through the lumen of the balloon-tipped catheter and positioned at the apex of the left ventricle or, less frequently, in the ascending aorta. The balloon-tipped catheter is withdrawn over the guide wires, and the interatrial septum is dilated with the use of a peripheral angioplasty balloon. Finally, the valvotomy balloons are advanced over the guide wires and positioned across the mitral valve (Figure 9).

RESULTS / OUTCOMES

The criteria for the desired end point of PBV includes: MVA >1cm²/m²; complete opening of at least 1 commissure; appearance of increment of MR>1 in a 4 grade system; and the prediction of PBV success related to patient status, anatomy, and team experience¹³. Mortality of PBV is <1%. The complications of

PBV requiring urgent surgery or repeat PBV include acute cardiac tamponade, acute or worsening mitral regurgitation, or restenosis, whereas chronic progressive increases in mitral regurgitation requires consideration for elective surgical repair or replacement in 2.5% of cases^{34,45,46}. Other complications related to PBV include atrial septal shunting in <2%, and cardiac perforation with tamponade in <1%. The failure rates range from 1% to 17%. This usually results from unfavorable anatomy (e.g., severe atrial enlargement, subvalvular stenosis, or heavy calcification), but most failures occur as a consequence of an unsuccessful transseptal puncture or inability to position the balloon correctly across the mitral valve.

Restenosis after percutaneous mitral valvuloplasty is generally defined as a loss of more than 50% of the initial gain, with a valve area less than 1.5 cm². The incidence of restenosis after a successful procedure ranges from 2% to 40% at time intervals ranging from 3 to 10 years.

Recent studies have been encouraging, though there remains debate in terms of long-term results when compared to surgery. A reasonable approach to select either PBV or surgery is presented in Table 12¹⁶.

Table 12¹⁶

Patient Selection in the Choice of Intervention for Relief of Mitral Stenosis				
Procedure	MV Morphology Score	Severity of MR	Other Valve Lesions	Pulmonary Hypertension
Balloon mitral commissurotomy	<8 ideal <10 acceptable	≤2+	No other valve procedure needed	PA pressures improve postprocedure, even when severely elevated
Open surgical commissurotomy	<8 ideal <10 acceptable	≤2+*	May have other valve procedures or CABG	
Mitral valve replacement	Valve may be calcified and deformed; score not predictive of outcome	MR may be severe	May have other valve procedures or CABG	Higher risk with PA systolic pressure >60 mm Hg

CABG, coronary artery bypass grafting; MR, mitral regurgitation; PA, pulmonary artery.

*Or annuloplasty ring if >2+.

The immediate or early, mid-term, and long-term results or outcomes for PBV have been well recorded^{13,26,35,46}. The National Heart, Lung, and Blood Institute (NHLBI) PBV registry report, in 1992, noted the results in 738 patients that underwent PBV. At 30 day follow-up 4% of the patients required mitral valve surgery, 3% died, and 83% were clinically improved. Yet, fewer patients with multivalve disease became asymptomatic. In other studies, the immediate or early results have shown that the MVA increases from a stenotic MVA of 0.7 to 1.1, to a MVA of 1.9 to 2 cm²^{32,35}. Vahanian et al.⁴⁶ reported 2,773 patients with a mean age of 47 +/- 15 (range 9-86 years). 71% were NYHA class III or IV, and 41% had AF. MR was mild in 39% and moderate in 2%. 27% had calcified leaflets. All underwent the antegrade approach. The MVA increased from 1.0 to 1.9cm². MVA <1.5cm² or MR >2 occurred in 11.5%. Technical failure occurred in 1.2%. Mortality was 0.4%. MR>3 occurred in 4.7% with 84% of them requiring subsequent surgery (0.7% urgently). Results at 10 years were: 85% alive, 61% no further procedures, and 56% good functional condition (NYHA I/II). Lung et al.⁴⁸, in 1996, reported five-year actuarial rates for global survival with no cardiac-related deaths, and no need for surgery or repeat dilation. The composite endpoint of good functional results were: 93 +/- 4%, 97 +/- 3%, 84 +/- 6%, and 76 +/- 6% respectively. Fawzy et al.⁴⁹, in 2009, noted event free survival: 10 years 88%; 15 years 60%; and 19 years 28%. Multivariate analysis identified ECHO scores <8, and post MVA <1.8 as predictors of restenosis, and ECHO scores >8, with preexisting AF as predictors of combined events.

Palacios et al. (50) observed the predictors of unfavorable PBV long-term outcomes to include: ECHO scores >8; increasing age; prior surgical commissurotomy; NYHA functional class IV; higher post PBV PAP; pre-procedure MR>2; or postprocedure MR >3. Zimmet et al. (51), in 2006, also noted severe MR, and higher ECHO scores as independent predictors of failed PBV, and requiring surgery. Bouleti et al.⁵² developed a 13 predictive point score system to assess late functional results up to 20 years after a good immediate result. The factors included age, sex, heart rhythm, valve anatomy, and final mean mitral gradient (mm

Hg). The lower the score the better the result. Song et al.⁵³, in 2010, looked at long-term outcomes of open cardiac surgery versus PBV. Over a median follow-up of 109 months the observed (unadjusted) event-free was similar in both groups (OHS-159 patients/ 402- PBV patients). The long-term event-free adjusted survivals were better with OHS, especially with ECHO scores >8⁵⁴⁻⁵⁶.

Repeat PBV or PBV after previous surgical commissurotomy requires an individualized approach since the anatomic morphology varies⁴⁵. Turgeman et al.⁵⁷ reported that patients with mitral restenosis caused by symmetrical commissural refusion obtain better results from repeat procedures compared with patients with restenosis secondary to subvalvular abnormalities, unilateral commissure fusion or bilaterally split commissures.

In summary, PBV is the preferred procedure for patients with moderate to severe MS, non-calcified mitral leaflets, symptomatic or asymptomatic with PAH, and no LA appendage thrombus, scores <8, and no MR >2. The RT3DE score may well be the most predictive modality to employ for valve and subvalvular morphology, residual or worsening MR or overall outcome. Ultimately surgical procedures may be indicated since PBV is primarily a bridge procedure, especially in younger patients with ongoing rheumatic activity and subsequent fibrosis and calcification of the mitral valve leaflets and subvalvular apparatus. The innovative interventional and surgical advances for valve repair and replacement for MR will be discussed further in parts 3 and 4, as well as surgery for the other valve conditions⁵⁸.

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CHIRURGIE VASCULAIRE / VASCULAR SURGERY

OUTCOMES OF ABDOMINAL AORTIC ANEURYSM REPAIR IN IMMUNODEFICIENCY VIRUS (HIV) POSITIVE PATIENTS

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Summary

Background: HIV-infected patients are at an increased risk for accelerated vascular disease. Abnormal endothelial function and aneurysmal dilation of the large arteries have been described; however, data is lacking on the outcomes of HIV-infected patients undergoing abdominal aortic aneurysm (AAA) repair on a national level.

Methods: This study is a retrospective analysis of hospital discharge data using the Nationwide Inpatient Sample Database from 2001 – 2009. HIV-infected patients undergoing abdominal aortic aneurysm repair were included.

Results: From 2001 to 2009, we identified 23 HIV-infected patients who underwent abdominal aortic aneurysm repair, with a mean age of 56 (± 12). Of these, 14 (61%) had open repair, while 9 (39%) had endovascular repair; four of the open repair patients presented with

ruptured AAA. There were two postoperative deaths after open repair (9% mortality), 1 death from the ruptured AAA open repair group and 1 death from the non-ruptured open repair group. Three cases in the ruptured open group had sepsis, and one patient had both respiratory and graft complications. In the non-ruptured open group, one patient developed sepsis and cardiac complications. There were no mortalities in the endovascular group, although 1 patient developed sepsis and 2 had cardiopulmonary complications.

Conclusions: Perioperative outcomes appear to be similar for HIV positive patients who undergo open and endovascular AAA repair compared to HIV negative patients.

Keywords: abdominal aortic aneurysm, repair, HIV

Introduction

More than 35 million people worldwide are currently living with HIV, and approximately 2 million people were newly infected with HIV in 2014.¹ As highly active antiretroviral therapy (HAART) continues to prolong the lives of HIV-infected patients, cardiovascular disease (CVD) has emerged as an increasingly significant cause of morbidity and mortality in this patient population.^{2,3} CVD appears more prevalent in HIV-infected patients at a younger age, possibly due to accelerated atherosclerosis from traditional lifestyle risk factors, as well as immune activation and endothelial dysfunction related to HIV infection.^{2,4,5} Peripheral arterial disease, which is typically associated with elderly patients, affects HIV-infected patients at an average age of 48 years.⁶ Aneurysmal disease also been identified in HIV-infected patients, affecting 22% of patients who presented with vascular disease in one survey.^{7,8,9} The etiology of aneurysmal disease in patients with HIV, though inconclusive, appears to be distinct from HIV negative patients. The literature on the treatment of HIV positive patients with abdominal aortic aneurysm (AAA) is limited, and there is minimal data describing the clinical outcomes of HIV-infected patients undergoing AAA repair.² The purpose of this study is to describe the outcomes of AAA repair in this patient population on a national level.

Material and methods

This study is a retrospective analysis of hospital discharge records using the United States of America's Nationwide Inpatient Sample (NIS) Database from January 2001 to December 2009. This cohort of patients was identified using the International Classification of Disease, Ninth Revision, Clinical Modification (ICD-9-CM) procedure code for either an open (38.44) or endovascular (39.71) AAA repair. Patients diagnosed with HIV infection (042, 079.53) and ruptured aortic aneurysms (441.1-441.9) were then identified. Inclusion criteria consisted of adult patients who underwent an open or endovascular AAA repair. There were no exclusion criteria.

Basic demographic characteristics of gender, age, year of procedure, and the presence of

comorbidities were investigated. Preoperative comorbidities were defined as: cardiac, which included history of myocardial infarction (410.0-410.92, 412), congestive heart failure (428.0-428.43, 428.9), coronary artery disease or previous CABG or PCI (414.0- 414.3); renal, which included chronic kidney disease including dialysis dependent failure (585.1-585.9); diabetes mellitus type 1 and 2 (250.0-250.73, 250.4-250.63); and pulmonary, which included chronic obstructive pulmonary disease (490-506.4).

Postoperative outcomes such as mortality and postoperative complications were also determined. Postoperative cardiac (997.1), renal (997.3), respiratory (997.3), wound (998.32), and graft complications (996.1, 996.7) were included, as well as severe sepsis (995.92) or septic shock (785.52).

Results

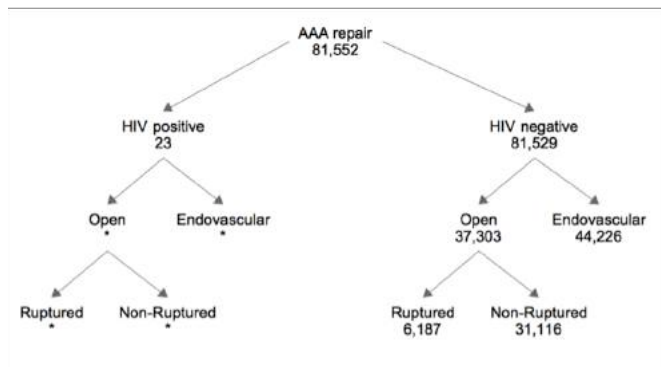
From January 2001 to December 2009, the NIS identified 81,552 adult patients who underwent repair of an abdominal aortic aneurysm (Figure 1). Twenty-three patients (0.02%) were identified as HIV positive. Of these patients, 14 (61%) were managed with open repair and 9 (39%) with endovascular repair. Four patients (28.6%) in the open group presented with a ruptured aneurysm. There were no ruptures in the endovascular group. Patient demographics for HIV positive and HIV negative patients are shown in Table I. Both patient populations were predominantly male with 83% in the HIV positive group and 78% in HIV negative group. HIV positive patients undergoing AAA repair presented at a mean age of 56 years (± 10), compared to a mean age of 72 years (± 10) for the HIV negative group. Despite their younger age, HIV positive patients had multiple cardiac (22%) and pulmonary comorbidities (17%). However, in comparison, nearly half of the patients in the HIV negative group (47%) had cardiac comorbidities, and a third (33%) had respiratory comorbidities.

The mortality rate for HIV positive patients was 9%, compared to 7% in HIV negative patients. In the non-ruptured open AAA group (n=10), one patient suffered sepsis and cardiac

complications and died post-operatively. In the ruptured open AAA group (n=4), three cases were complicated by sepsis, one patient had respiratory complications and one patient died. Of the nine patients in the endovascular group, one developed sepsis, one had cardiopulmonary complications, and one had a graft complication.

There were no deaths in the endovascular group. Table II compares of the outcomes of AAA repair for all HIV positive and all HIV negative patients. Unfortunately, the small sample size of the HIV positive group does not allow for meaningful statistical comparisons. Outcomes of non-ruptured open AAA repair (Table III) and non-ruptured endovascular AAA repair (Table IV) are also listed.

Figure 1. Patients who underwent AAA repairs from January 2001 to December 2009



*Fewer than 10 patients; in accordance with NIS user policies, we are unable to report the actual number

Table I. Demographics of HIV positive and HIV negative patients

	HIV positive (n= 23)	HIV negative (n= 81,529)
Mean Age (years)	56	72 (±10)
Male Gender	83%	78%
Cardiac Comorbidities	*	47%
Renal Comorbidities	*	5%
Pulmonary Comorbidities	*	33%
Diabetes Mellitus	*	14%

*Fewer than 10 patients; in accordance with NIS user policies, we are unable to report the actual number

Table II. Postoperative Outcomes of All Patients

	HIV positive (n= 23)	HIV negative (n= 81,529)
Mortality	*	7%
Cardiac Complications	*	5%
Respiratory Complications	*	3%
Renal Complications	*	3%
Graft Complications	*	4%
Wound Complications	*	6%

*Fewer than 10 patients; in accordance with NIS user policies, we are unable to report the actual number

Table III. Postoperative Outcomes of Non-ruptured Open AAA Repair

	HIV positive (n= 23)	HIV negative (n= 6,187)
Mortality	*	6%
Cardiac Complications	*	7%
Respiratory Complications	*	6%
Renal Complications	*	4%
Graft Complications	*	2%
Wound Complications	*	7%

*Fewer than 10 patients; in accordance with NIS user policies, we are unable to report the actual number

Table IV. Postoperative Outcomes of Non-ruptured Open AAA Repair

	HIV positive (n= 23)	HIV negative (n= 44,226)
Mortality	*	2%
Cardiac Complications	*	2%
Respiratory Complications	*	1%
Renal Complications	*	1%
Graft Complications	*	6%
Wound Complications	*	4%

*Fewer than 10 patients; in accordance with NIS user policies, we are unable to report the actual number

Discussion

The management of patients with HIV has evolved significantly over the past three decades with life expectancies approaching that of the general population.¹⁰ Cardiovascular disease, including cardiomyopathy, endocarditis, vasculitis and aneurysm formation, has emerged as a primary source of morbidity and mortality, with increased rates seen amongst HIV positive patients compared to age-matched HIV negative patients.^{2,8,11,12,13}

Despite several clinical investigations suggesting the possibility of accelerated atherosclerosis in patients with HIV, the exact molecular and cellular mechanisms of HIV-mediated vascular disease are poorly understood at this time.¹⁴ Traditional risk factors such as smoking remain important to the development of CVD in this population.¹² Additionally, other factors may contribute to the increased incidence of CVD at a younger age that is seen in this patient population.⁶ Antiretroviral therapy is known to cause a variety of metabolic changes, including dyslipidemia, insulin resistance, and lipodystrophy, which may contribute to the development of CVD, with an increased proportion of HIV-infected patients with hypertension, diabetes mellitus, myocardial infarction.^{15,16} In particular, the toxicity of protease inhibitors have been implicated in causing cardiovascular injury leading to

increase atherosclerotic progression.^{4,17} Finally, HIV infection itself may cause an immune reaction and inflammation, leading to endothelial dysfunction.¹⁸

In addition to accelerated atherosclerosis, HIV-associated aneurysms have also been observed. These HIV positive patients tend to be younger than the general population, with atypical locations of aneurysms, and distinctive arteritic features.^{13,19} HIV-associated aneurysms demonstrate involvement of adventitia and infiltration by acute and chronic inflammatory cells, and with sparing of the media and intima. The absence of atheroma and marked intimal thickening in aneurysm disease in young HIV positive individuals is suggestive of a possible infective or immune-mediated etiology.²⁰ The virus may directly enter the aortic adventitia, injuring and directly infecting fibroblasts, similar to the interaction of HIV with T-cells.²¹ HIV associated leukocytoclastic vasculopathy within the vasa vasorum of large elastic vessels may ultimately lead to arterial wall damage and aneurysm formation. Children with vertically transmitted HIV infection have also been observed with aneurysmal dilations of the aortic root, as well as the cerebral artery, supporting the idea that vasculitis from infection or inflammation may be a key factor in the development of aneurysmal disease.^{22,23}

Data on the management and outcomes of HIV positive patients with aneurysms is limited. Open aortic surgery in HIV positive patients appears to carry high perioperative morbidity and mortality rates, with reported postoperative complications in 33% of patients and in-hospital mortality rate of 15%.^{2,7} Low baseline CD4 lymphocyte count and reduced serum albumin are risk factors for postoperative complications.² Patients with HIV/AIDS with lower CD4 counts also appear more likely to require an urgent operation and experience a complication with increased mortality.²⁴ However, in one series, HIV positive patients with multiple aneurysms of the thoracic and abdominal aorta were effectively treated using open surgery as well as endovascular techniques, suggesting that HIV-infected patients with long life expectancies can be treated with the same guidelines as patients without HIV.⁸ The results of our study reinforce this, with no in-hospital mortalities in the endovascular AAA repair group.

There are several limitations to our study. The low number of reported HIV positive patients who underwent an AAA repair between 2001 and 2009 did not allow us to perform any meaningful statistical analysis to compare these patients to the HIV negative population. It is possible that, as a limitation of the NIS database, all patients with HIV infection who underwent AAA repair were not captured. The NIS database uses ICD-9 codes that are entered based on patient procedures, comorbidities, and in-hospital diagnoses. If the correct ICD-9 codes were not properly inputted during the patient's hospitalization, then the patient would not be identified for inclusion.

Additionally, since the NIS database provides hospital discharge data, we were unable to obtain more specific details about the patients. For example, we cannot estimate disease progression based on CD4 lymphocyte count, which may predict postoperative complications in HIV patients undergoing aortic operations.² Long-term follow-up data is also not available from this database, thus any data after discharge, including rupture, re-operation, graft failure, or mortality, is not available. This information may have been helpful in understanding our data and correlating with the risk for postoperative outcomes.

In this study, there was a higher number of open to endovascular repairs (14 versus 9) performed from 2001 to 2009, with 8 out of the 9 endovascular repairs performed after 2005. The high number of open repairs could be due to the earlier time frame chosen for the study, which was prior to the increased use of endovascular abdominal aortic aneurysm repair. It is possible that, given the significant decrease in operative morbidity and mortality with contemporary endovascular techniques, perioperative outcomes for HIV-infected patients would also improve.²⁵

Perioperative outcomes appear to be similar for HIV positive patients who undergo open and endovascular AAA repair compared to HIV negative patients. HIV positive patients with aneurysmal disease are younger than the general population. Our study suggests that patients with HIV and abdominal aortic aneurysmal disease undergoing endovascular intervention may have less morbidity and mortality compared to open surgery. Further

prospective studies that include clinical predictors of surgical outcome in HIV patients with abdominal aortic aneurysmal disease are needed.

Conclusion

Perioperative outcomes appear to be similar for HIV positive patients who undergo open and endovascular AAA repair compared to HIV negative patients. Additional prospective studies are needed to optimize disease management and surgical outcomes for HIV positive patients.

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CHIRURGIE VASCULAIRE / VASCULAR SURGERY

DIFFICULTIES IN THE MANAGEMENT OF CIVILIAN PERIPHERAL VASCULAR TRAUMA AND THEIR COMPLICATIONS AT THE UNIVERSITY TEACHING HOSPITAL OF YAOUNDE, CAMEROON

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Summary

Background. The incidence of peripheral vascular lesions remains undetermined in Cameroon. The objective of this study is to report our experience with the management of peripheral vascular trauma in civil life at the University Teaching Hospital of Yaoundé.

Patients and methods. We have reviewed retrospectively all the cases of peripheral vascular trauma treated at the Yaoundé's University Teaching Hospital between 2008 and 2010. We excluded all patients with crushing members or traumatic amputations. Case notes were reviewed for demographic factors, nature of trauma, vascular injury observed and treatment applied.

Results. We found 12 patients on 2,436 trauma giving a prevalence of 0.5%. There were 11 men and one woman, mean age was 28.5 (18-55) years. All patients were victims of a penetrating wound. Nine patients were received at the stage of complications from 6 weeks to 2 years after the trauma: 5 of them had an arteriovenous fistulas and the other four presented with pseudo aneurysms, they were all operated successfully. Three patients came in emergency at the time of the injury and they

presented lesions to the popliteal vessels, brachial and radial arteries. They were amputated after a failed attempt revascularization performed beyond 6 hours after trauma.

Conclusion. Vascular injuries are usually overlooked in our environment, and we would recommend a vascular exam in patients with penetrating injuries to the limb to avoid missing them.

Keywords. Penetrating injury - peripheral vascular trauma - pseudo-aneurysm-arteriovenous fistula.

Résumé

Introduction : L'incidence des lésions vasculaires périphériques au Cameroun et très probablement en Afrique Centrale reste indéterminée car peu d'études ont été consacrées au traumatisme des vaisseaux dans notre environnement.

Matériel et méthodes : nous avons recensé rétrospectivement tous les cas de traumatisme vasculaire traités au centre hospitalier universitaire de Yaoundé de 2007 à 2010. Ont été exclus tous les patients avec des écrasements de jambes et des amputations traumatiques. Les dossiers ont été analysés pour les facteurs démographiques, la nature du traumatisme, la lésion vasculaire observée ainsi que le traitement appliqué.

Résultats : nous avons retrouvés 12 patients sur 2436 traumatismes donnant une incidence de 0,5%, parmi lesquels 11 hommes et une femme, l'âge moyen était de 28,5(18-55) ans. Tous les patients ont été victimes d'une plaie pénétrante. Neuf patients ont été référés au stade de complication après une latence de 6 sem à 2 ans après le traumatisme. Les trois patients vus en urgence présentaient des lésions des vaisseaux poplités et des artères brachiale et radiale, ils ont du être amputés à cause du retard de la prise en charge et du manque d'équipement adéquat. Cinq patients présentaient une fistule artério-veineuse, 4 patients des pseudos anévrismes tous opérés avec succès.

Conclusion: Les traumatismes vasculaires sont souvent méconnus et nous attirons l'attention de tous les médecins dans notre contexte sur l'importance de l'examen vasculaire en urgence en cas de plaie pénétrante au niveau des membres.

Mots clés : traumatisme- pénétrants - vasculaire- pseudo-anevrisme- fistule artério-veineuse-périphérique

Introduction

Peripheral vascular injuries are very common and result most often from penetrating wounds¹⁻³. The management of these lesions is a big challenge for practitioners because it requires urgent action to preserve vital prognosis and reduce morbidity. In addition, some severe lesions present only with occult symptoms and signs and are often overlooked, manifesting later by signs of vascular insufficiency, pseudo-aneurysm or arteriovenous fistula¹⁻³. Vascular lesions are readily combined with other injuries or enrol in a context of multiple injuries. Other lesions, often impressive, then mask the vascular wound with a consequent increase in morbidity and mortality. The actual incidence of these lesions in Cameroon and Sub-Saharan Africa is unknown because few studies have been published on this topic. However, the increase of criminality in Cameroon with common increasingly use of firearms and bladed weapons has increased the incidence of vascular lesions⁴.

Like in most developing countries, Cameroon lacks effective resources for the management of emergencies, especially trauma related emergencies, the result being late arrival of these patients in health centres and moreover, we lack qualified human resources. Some vascular lesions, often obvious, thus pass unnoticed. Effective management of vascular lesions must be immediate and involves early recognition of these lesions. To these shortcomings, are added the existence of traditional caregivers who attract a large number of patients and the lack of health insurance, which often delay the care of these patients even when the diagnosis is made early. These diagnostic and therapeutic delays result in the production of irreversible ischemic lesions that can lead to functional impairment or amputation⁵. The aim of this study was to report our experience in the management of peripheral vascular traumatic lesions and to describe the symptoms and signs that may raise suspicion about the existence of a vascular injury in our environment where infrastructures and qualified medical resources are often lacking.

Patients and Methods

From July 2008 to December 2010, we

retrospectively reviewed the medical records of all patients admitted for a penetrating peripheral vascular trauma in civil life at the University Teaching Hospital of Yaoundé. We included in the study all patients with traumatic injury of peripheral vessels with or without associated lesions and whatever the delay occurred. Patients with crushing injuries or patients who required amputation at admission were excluded. The diagnosis was essentially clinical: pulselessness, coldness of the extremity, pain, paresthesia, paralysis, pulsatile mass, bruit or thrill, wound in the anatomical region of the vessels, important bleeding and a non-healing wound with bloody discharge without signs of infection. All patient underwent open surgery and vascular repair consisting of direct suture in case of lateral wound, anastomosis when the defect was less than 2 cm and beyond, we realised an inverted saphenous graft interposition for larger defects. The non-vital vessels were ligated. In case of associated lesions, vascular repair preceded the treatment of other injuries. Large veins were always repaired. Postoperative follow-up was essentially clinical.

Case notes of all the patients were reviewed for demographic profile (age, gender), time to admission, mechanism and location of injury, types of lesions, associated injury, repair techniques and results of treatment. Statistical analysis was performed using SPSS 9.0 software and the study received approval from the Ethics Committee of the University of Yaoundé I

Results

Demographics

From July 2007 to December 2010, we identified 2,436 trauma patients including 12 with penetrating peripheral vascular injury of the civil life giving a prevalence of 0.5%. There were 11 men and one woman with a sex ratio of 11. The mean age was 28.5 (18-55) years.

Mechanism of injury and time to consultation

All patients were victims of a penetrating wound of a peripheral vessel: 4 by gunshots and 8 by bladed weapons. The consultation periods ranged from 1 day to 2 years (Table I). Only three patients were seen at the moment of

the trauma in acute situation, the other 9 were received after complications have occurred (Table II).

Sites and types of vascular injury

Four (33.33%) patients had an injury to the upper limb, 7 (58.33%) patients to the lower extremity and one (8.33%) patient had an injury to the temporal region. There were 5 femoral lesions, 2 brachial, 2 popliteal and one lesion each of radial, ulnar and temporal arteries (Table 1). Eight patients had associated venous lesions including 5 cases of arteriovenous fistulas and 3 cases of venous lesions accompanying arteries. Four of the five femoral lesions were associated with an arteriovenous fistula between the femoral vein and deep femoral artery and complicated with a pseudo aneurysm at the bifurcation. A 22-year-old man had an arteriovenous fistula between the brachial artery and the vein comitans associated with a giant pseudo-aneurysm of the vein comitans (Figure 1). Patients seen at the stage of complications had a pulsatile mass of variable diameter (pseudo-aneurysm) sometimes associated with a tremor (thrill) in the case of arteriovenous fistula and sometimes chronic bleeding without signs of infection.

The 3 patients seen immediately after the accident (from 20h to 48h after the injury) showed obvious signs of ischemia: pain, coldness, pulselessness, paraesthesia and paralysis, in addition to massive bleeding.

Associated injuries

Nerve lesions were found in a patient in the upper limb (median and radial nerves at the elbow) and two patients with popliteal lesions had comminutive fractures of the femoral condyles.

All other patients with complications had isolated lesions.

All diagnosis were done clinically: duplex ultrasound scanning is available in some places in Yaoundé but not in an emergency setting and it is expensive, so very few patients can afford to pay for it.

Treatment

Reconstructive surgery was performed for all lesions of large vessels (Table III). Regarding

arterial lesions, we used a saphenous vein interposition in 3 cases, repair (suture and anastomosis) in 5 cases and a ligation was performed for isolated lesions of radial, ulnar and temporal arteries. All large veins were repaired.

At the femoral level, we had in one case to tie the deep femoral artery because of bleeding and difficulties during surgery but the femoral vein was repaired. This ligation had no impact on the limb irrigation.

In patients with acute lesions, two had combined lesions of the popliteal artery and vein with communitive fractures of the femoral condyles secondary to gunshots. The repair took place respectively 20 and 96 hours after the trauma. We used saphenous vein taken from the opposite side in both cases to repair the popliteal artery with a simple repair of the vein. Not having been able to realize a thrombectomy due to lack of Fogarty catheter, we refrained to perform a fasciotomy.

Outcomes

We had no deaths. Nine patients with chronic complications had a favourable evolution with a mean length of hospital stay of 3 days duration. All three patients seen acutely were amputated and the mean length hospital stay was 2 weeks. The two patients with popliteal lesion associated with femoral condyle fractures developed wet gangrene requiring amputation respectively four days and one week postoperatively. A patient with a partial amputation secondary to a machete had a transection of the brachial and radial arteries associated with a lesion of the median and radial nerves at the elbow and had an amputation two days after a failed attempt revascularization performed 24 hours after the trauma. This give an amputation rate of 100%.

Table I. Demographics of HIV positive and HIV negative patients

consultation	patients	
0-2days	03	25%
< 1 month	01	8,33%
1-3months	06	50%
3months-1 year	01	8,33%
>1year	01	8,33%
Total	12	100%

Table II: Mecanisms of injuries

Mecanism	Number of patients	percentage
Gunshot	04	33,33%
Bladed weapons (knife, machete, rasor)	08	66,66%
Total	12	100

Table III: Type, location of lesions and type of surgical treatment

Type of lesions	Number of cases	Location	Procedure
Isolated pseudoaneurysms	3	Temporal, radial and ulnar arteries	Ligation
Multiple pseudoaneurysms	1	Superficial femoral	Resection and saphenous interposition
Pseudoaneurysm with arteriovenous fistula	4	Deep femoral artery - common femoral vein	Repair of both deep femoral artery and femoral vein
Arteriovenous fistula and venous pseudoaneurysm	1	Brachial artery - vein comitans	Resection of venous pseudoaneurysm and artery repair
Artery and vein wounds	3	Brachial and radial vessels (1), popliteal vessels (2)	Amputation after attempt revascularization



Figure 1. Posttraumatic arteriovenous fistula between the brachial artery and the vein comitans with a large pseudoaneurysm and massively distended superficial veins;

Discussion

Very few studies have been devoted to vascular trauma in Sub-Saharan Africa in general and in Cameroon in particular and peripheral vascular lesions are often overlooked in this sub-region [1]. Male predominance due to the predominance of trauma in general in men compared to women is the same as in the literature^{1-4,6-8}. The young age of our patients is also found in several studies^{1-4,6-8}. All vascular lesions identified in this study are the results of penetrating wounds. This is consistent

with literature data where penetrating injuries represent more than 2/3 of injuries in the limbs ¹⁻³. Mommsen et al. ⁶, however, found penetrating wounds in only 31.8% of cases and Jawas et al. ⁷ reported stab lesions in 57% of cases. These findings in our series, although in the line with that of many authors, could be explained by the increase in criminality in our country associated to an increase use of firearms (4 cases) and bladed weapons (8 cases). There is a preponderance of the lower limb lesions as reported in the literature ^{2,6,7,9,10}. We have found only 3 cases associated with bone and nerve lesions.

Bone and nerve lesions have been the most commonly reported associated lesions in several publications ^{1,2,7,8}. Aduful et al. in Ghana ¹ found further significant muscle injuries in 21.2% of cases.

We collected a large number of late complications (9 cases) with respect to acute vascular injuries (3 cases). If these findings have become rare elsewhere, they reflect the weakness of our health system where signs and symptoms of vascular diseases are not well recognized by unqualified personal. All these patients have consulted at the time of the injury in an emergency basis and 7 out of 9 patients who presented with late complications have been transfused 2 to 4 units of blood at the time of accident without raising suspicion about the possibility of a vascular injury. Patients were referred to us when a complication became visible and troublesome (Figure 1) and in most cases there were bleeding pseudo aneurisms. This late diagnosis has been described by Aduful et al. in Ghana ¹ and is due to unavailability of vascular surgeons in our country where there are few specialists all concentrated in the only city of Yaoundé.

Of the 5 patients with femoral lesions, 4 had an arteriovenous fistula just after the division of the common femoral artery between the deep femoral artery and the femoral vein; lesion rarely reported in the literature. One of the patients in this serie have been reported an unusual case of giant pseudo-aneurysm of the vein comitans following a posttraumatic arteriovenous fistula between this vein and the brachial artery with distension of all the superficial veins and painful swelling of the upper limb ¹¹. We found a reported case of arteriovenous fistula between brachial

artery and vein comitans with an expansion of the artery rather than the vein as in our case ¹². Venous pseudo-aneurysms are rarely reported in the literature ¹³.

Given the lack of appropriate and complex infrastructures such as arteriography, MRI angiography and the fact that CT angiogram and doppler ultrasound are not always available in emergency, our diagnostic approach was essentially based on clinical, in particular, the six P's of ischemia: pain, pulselessness, pallor, paraesthesias, poikilothermia and paralysis. The existence of these signs reinforces the diagnosis, but they are not always present. Clinical signs of vascular injuries can be divided into hard signs, for which predictive positive value of vascular injury is close to 100% ¹⁴ and soft signs with possibility of arterial injury. Hard signs include distal cold ischemic extremity, absent pulses, bruit or thrill, expanding or pulsatile haematoma and pulsatile bleeding. Soft signs are made up of nonexpanding haematomas, paraesthesia/paresis, shock (unexplained by other injuries), decreased pulses and proximity of penetrating wound to major vascular structures. In these clinical signs of vascular disease which were frequently found in our patients, we have added limb isolated penetrating wound, major bleeding requiring transfusion, and persistence of haematic drainage at the level of a penetrating wound beyond ten days and in the absence of obvious infectious signs. Complementary investigations whenever possible and affordable may be done in some centres in chronic lesions with arteriovenous fistula or pseudo-aneurysm, in acute settings and in the presence of major signs of vascular injury, these examinations whose contribution is not always important in therapeutic decision urgently, have no interest. They could further delay an urgent lifesaving treatment procedure. Although we can recognize with some authors that angiography is useful to locate the vascular lesion in case of multiple external injuries ¹⁵, however, clinical examination has proved its primacy on diagnostic arteriography in the diagnosis of acute vascular lesions as reported in some studies ¹⁶⁻¹⁷.

All patients were operated by open surgery. If endovascular techniques (embolization, stenting) are widely used in the Western world

for some vascular injuries¹⁸, open surgery keeps a place of choice for many authors with good results^{1,2,6-9}. However, endovascular techniques in properly selected patients offer many advantages. They reduce operating time and blood loss, limit dissection of bruised or injured tissues by the initial trauma and allow access to hard-to-reach areas with good safety and acceptable efficiency¹⁰. In cases where the final repair is not possible, they allow control of bleeding or damage and facilitates the surgical procedure¹⁹. Our results were satisfactory with 9 cases of favourable outcome after surgical repair of damaged vessels. However, we noted 3 cases of amputations in the 2 patients with popliteal lesions and the patient with brachial artery injury. The rate of amputation was 100% in acute setting very far from the one reported in the literature^{1,3,8,10,11}. Revascularization procedure failed because patients came in late, they were operated more than 20 hours after the injury, there was no Fogarty catheter to remove distal clots. These patients had associated injuries, bone lesions for the first two and nerve for the third and were operated beyond the recommended time. The association with other lesions, particularly bones and nerves and the delay of treatment are the main risk factors for amputation found in the literature^{1,3,8,10,12}. Some lesions as popliteal artery injury have a high risk of amputation that may exceed 50% in the study of Li et al.¹⁰. To the reported risk factors of amputation in the literature, we can add local risk factors such as poverty which often prolongs the time of consultation and treatment, ignorance of acute injury by unskilled medical staff and lack of adequate equipment. In this environment where expertise and technical resources are lacking, the focus should be on popularization of vascular surgery which involves teaching and funding by the government to improve the management of trauma in general and vascular injuries in particular.

Conclusion

Peripheral vascular injuries are often overlooked and most patients are received at the stage of complications despite the often obvious clinical signs and this because of poverty and lack of skilled human resources. The management

faces the same difficulties that adds technological backwardness. Despite these failures, the management of these injuries can be performed in Cameroun with results closed to those reported in the literature. Hope lies in the creation of a sub specialization in vascular surgery.

Competing interests

The authors declare no competing interests

Author's contribution

All persons designated as authors above, qualify for authorship, they took active part in the management of these patients and write up of this manuscript. All authors have read and agreed to the final manuscript.

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CHIRURGIE THORACIQUE / THORACIC SURGERY

OUTCOME OF FEEDING ENTEROSTOMY FOR NUTRITIONAL REHABILITATION IN DYSPHAGIA

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Summary

Background: feeding enterostomy is used to build up patients with dysphagia by definitive surgery. **Objective:** to evaluate the achievement of nutritional goals in dysphagia patients and to suggest management protocols. **Methodology:** A retrospective study of feeding enterostomies for dysphagia over 4 years. The preoperative, post-operative weights and progression to definitive esophageal replacement were analyzed. **Results:** There were 34 patients, records were available for 29 patients, ages ranged from 1.5 to 90 years, mean age was 29.7 years, and male to female ratio was 3:7. The causes of dysphagia were corrosive esophageal stricture-12, esophageal cancer-13, pharyngeal tumor-3 and mediastinal mass 1. The duration of symptoms ranged from 3 weeks to 106 weeks (mean 26.4 weeks). Preoperative weight ranged from 6.2 – 68 kg (mean 24.1 kg), postoperative weight was between 7 – 65 kg (mean 25.7 kg); follow up period ranged from 0.5 to 12 months (mean 3.2 months), weight gain was negative for those who had their last weight check by 6 weeks post op (p value 0.057). 15 patients (52%) proceeded to have definitive esophageal replacement surgery. **Conclusion:** Feeding enterostomy was successful in nutritional rehabilitation of dysphagia patients and 6 weeks may be required to appreciate positive weight gain. There is a need for standard protocols for better management and follow-up of these patients.

Key-words : Feeding enterostomy, Dysphagia, Outcome, Rehabilitation.

Résumé

Contexte: la gastrostomie d'alimentation est utilisé pour la rééquilibration nutritionnelle des patients atteints de dysphagie en attente de la chirurgie définitive. **Objectif:** évaluer l'atteinte des objectifs nutritionnels chez ces patients atteints de dysphagie et de proposer des protocoles de prise en charge. **Méthodologie:** étude rétrospective concernant tous les patients atteints de dysphagie ayant bénéficié d'une entérostomie d'alimentation sur une période de 4 ans.

Résultats: vingt-neuf patients ont fait l'objet de notre étude. L'âge moyen était de 29,7ans (1.5-90), M : F- 3:7. Les causes de la dysphagie étaient ; sténose caustique de l'œsophage (n=12), cancer de l'œsophage (n=13), tumeur du pharynx (n=3) et masse médiastinale (n= 1). Le poids moyen en préopératoire était 24,1kg (6,2 - 68) et de 25,7kg (7 - 65) en post-opératoire. Avec un recul moyen de 3,2mois (0,5 -12) le gain pondéral était négatif pour ceux qui ont eu leur dernière pesée a 6 semaines postopératoire (p=0,057). Le remplacement définitif de l'œsophage avait été réalisé dans 52% (n=15) des cas. **Conclusion:** L'entérostomie d'alimentation permet la réhabilitation nutritionnelle des patients atteints de dysphagie. Un délai de six est nécessaire pour apprécier le gain pondéral. L'établissement de protocoles standards améliorerait la prise en charge et le suivi de ces patients.

Mots clés : enterostomie d'alimentation, dysphagie, résultat, réhabilitation.

Introduction

Feeding enterostomy is a stoma created between the gastrointestinal tract and the skin for the purpose of providing enteral nutrition. It is useful for long term nutritional support. Patients with dysphagia awaiting definitive surgery are usually well served by feeding enterostomy, especially when there has been significant weight loss. Achieving the goal of nutritional rehabilitation in dysphagia patients may depend on the disease process, feeding protocol and the occurrence of complications. Preoperative feeding enterostomy has featured scantily in surgical literature.

The aim of this study was to investigate the achievement of the nutritional rehabilitation goals in patients with dysphagia, and to identify the presence or otherwise of a standard feeding and follow-up protocol in the management of these patients

Material and Methods

A retrospective study was conducted over a 4-year period between 2012 and 2015. The medical records of all patients who had feeding enterostomy during the study period were collected and reviewed. The patients' demographics, preoperative and postoperative assessments, weight changes and progress towards eventual esophageal replacement surgery were reviewed and analysed.

Results

Thirty-four patients had feeding enterostomy during the study period, but records were available for 29 patients. Their ages ranged between 1.5 – 90 years (mean 29.7 years), with male to female ratio of 3: 7. Duration of symptoms was between 3-106 weeks (mean 26.4 weeks). Etiology of dysphagia, is mentioned on Table I.

Table I: Etiology of Dysphagia

Diagnosis	n (%)
Esophageal cancer	13 (45%)
Caustic esophageal stricture	12 (42%)
Pharyngeal tumor	3 (10%)
Mediastinal mass	1 (3%)
Total	29

The average waiting time between admission and feeding enterostomy surgery was 3.8 days (0.5 - 12 days). The Stamm's technique for construction of the feeding enterostomy was used in all patients, with gastrostomies performed in 26 (90%) patients, and jejunostomies in 3 (10%) patients. Complications included feeding tube dislodgement, tube blockage and peristomal skin erosions. Weight loss was noted in patients who had their last weight check within 6 weeks post feeding enterostomy compared to those who were follow-up for longer than 6 weeks ($p = 0.057$). Among the patients who had positive weight gain, 83% had dysphagia due to benign causes and 25% due to malignant causes (p value = 0.191). Mean changes in measured parameters in feeding enterostomy are expressed on Table II.

Table II: Mean changes in measured parameters in feeding enterostomy

	Pre-feeding enterostomy	Post-feeding enterostomy
Weight - kg	24.1 (6.2-68)	25.7 (7-65)
Hematocrit	-%33.6 (26-42)	34 (27-42)
Serum urea- mmol / L8	(1.4 to 19.1)	6.3 (3.4 -1)

Definitive esophageal replacement surgery was achieved in 15 patients (52%), consisting of 11 corrosive esophageal strictures and 4 esophageal carcinomas. Esophageal replacement was done with colonic interposition in 12 (80%) patients and gastric interposition in 3 (20%) patients. Of the remaining 14 patients who did not have definitive esophageal replacement surgery, 4 (14%) had palliative radiotherapy and 10 (34%) were lost to follow up. The average duration between feeding enterostomy and definitive esophageal replacement surgery was 5.8 months (3-13 months). Complications of esophageal replacement surgery were 4 anastomotic leaks (3 cervical and 1 abdominal), 1 peritoneal adhesions. No standardized feeding and follow-up protocol was observed. Serum albumin was not measured for any patient.

Discussion

Dysphagia needing surgical consultation is frequently caused by both neoplastic and other non-neoplastic conditions like corrosive, foreign body or traumatic strictures. Corrosive esophageal strictures are common in the low socioeconomic class¹. In children it is usually accidental², but suicidal or psychotic in adults³. Patients typically present late.

The frequency of feeding enterostomy surgery depends on the indications for which it is undertaken in any centre. In hospitals where gastrostomies are done for cerebrovascular accidents, cerebral palsy, degenerative diseases and chromosomal diseases⁴; we will expect a higher number of such procedures. In our centre, essentially all enterostomies are done for structural obstructive esophageal diseases like tumors and corrosive strictures. Most patients with neurological conditions opt for nasogastric tube feeding, with its attendant risk of aspiration. Parenteral nutrition is costly, has significant risk of complications and is usually unsuitable in these patients who may need nutritional support for several months⁵.

Our patients had different levels of hemodynamic and metabolic derangements at presentation, which necessitated resuscitation to ensure safety for feeding enterostomy surgery. This period of resuscitation explains the wide range of the waiting time between presentation and eventual feeding enterostomy. Other factors that affected waiting time were delay in giving consent for surgery and operating space availability.

Feeding enterostomy is now preferably being performed laparoscopically⁶⁻⁷, and in some cases by image guidance⁸. The absence of such skills in our centre meant all our patients were operated on by the open approach. Laparoscopic enterostomy may need more time between presentation and surgery; Jenkinson reported¹⁰ weeks waiting time⁹ compared to a mean waiting time of 3.8 days in our study. We use the Stamm's technique as it allows the placement of large bore feeding tubes, through which high fibre feeds can be used. Financial limitations make patients to resort to blenderised feeds in preference to elemental feeds. A witzel technique in contrast would have required fine bore tubes which would have been easily

blocked by the high fibre feeds. Matino JJ et al demonstrated better outcomes with the Stamm's technique compared to the Witzel technique¹⁰. Percutaneous endoscopic enterostomy was contraindicated in our patients because of total pharyngeal or esophageal obstruction¹¹. A gastrostomy allows easier management and tolerance of varied types of feed with less complications¹², hence its preferred use in our centre.

Pre- and post- feeding enterostomy weight, hematocrit and biochemical parameters were recorded at different periods for each patient, not following any standard protocol. This reflects the difficulty encountered with the management of these patients in resource challenged centres and the absence of standard protocols. However there were slight improvements.

The weight loss found in those who only had their weights checked in the first six weeks post feeding enterostomy may be difficult to explain. These patients may have gotten inadequate caloric and protein input. Caloric and protein requirements should be achieved early post feeding enterostomy, usually by the third day¹³. Rapid and careful progression of caloric and protein requirements may mitigate this observation.

A standard protocol post feeding enterostomy should include anthropometric and biochemical measurements at regular intervals, standard feeding regimen and a dietician should be involved in the management of these patients¹⁴⁻¹⁵.

Fifty-two percent of our patients achieved definitive esophageal replacement surgery and a further 14% went for chemoradiotherapy; showing that 66% of our patients achieved successful nutritional rehabilitation. The remaining 34% that were lost to follow up, further reflecting the challenges posed by socioeconomic factors in the management of such patients in centres like ours.

Conclusion

Feeding enterostomy was successful in nutritional rehabilitation of dysphagia patients. A 6-week duration may be required to appreciate positive weight gain depending on protocol. There is a need for standard protocols for better management and follow-up of these patients especially in our locality.

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