The day began with the Opening ceremony at Protea Hotels, Nike Lake Resort, Enugu. The Special Guest of Honour, the Executive Governor of Enugu State, Dr. Chimaraokae Nnamani arrived punctually by 10am to declare the Conference open. His keynote address was preceeded by the welcome address of the Chairman, LOC, Dr. A.C. Onuh. Then followed the opening remarks of the ARAWA President, Dr. I.J. Okoye. (Full text in appendix I below).

The Governors keynote address was focused on the need for radiologists to ‘sit up’ in order to quell the upsurge of quacks in the profession. He welcomed all of us to his State and then officially recognized the ‘doyens’ who had worked and contributed diligently to the development of Radiology in West Africa- Prof J.T. Duncan immediate past president of ARAWA, Prof. S.B. Lagundoye and Prof. B.C. Umerah. The Governor now led the tour of the exhibition stands set up by First Foundation Medical Engineering Company, PPC Medical Systems (Philips), Schering Diagnostics and Fourth Dimension Technologies Limited.

Dr. Tosin Ajayi, the Executive Director of First Foundation Medical Engineering Company, gave an inspiring and unforgettable performance in his presentation, 'Information Technology: The Solution for Healthcare Performance in Africa'. As a way to showcase telemedicine, the First Foundation exhibition during the lecture was able to facilitate audio-visual conferencing with Canada. There, then, ensued rewarding interactive session on Continuing Medical Education between the participants at the conference with Professor Michael Rosengarten at the McGill University, Canada. He was able to answer many questions from the conference participants, with respect to Information Technology.

After the tea break there was a presentation by the Guest Lecturer, Prof. Herve Koffi Yangni-Angate, a Cardiovascular Surgeon from Ivory Coast, whose lecture was titled ‘Open Heart Surgery in Cote d’Ivoire: A 20-year Experience’. (Text in appendix II below). He was able to describe how the Cardiology Institute of Abidjan has been able to improve the lives of people born with cardiac defects, with progressive reduction in post-surgical morbidity and mortality.

Schering Diagnostics made a short presentation on their array of imaging products with special emphasis on Ultravist and Magnevist. This was followed by a presentation by Philips (PPS Medical Systems) on their ultramodern imaging facilities which included the nouvelle 4-dimensional ultrasound scanner.

A second Guest Lecturer, Prof. R. Ndoma-Egba of the University of Calabar Teaching Hospital gave a presentation on ‘Diseases of the Digestive System: Diagnostic challenges to the Surgeon and Radiologists in the West African sub-region’. (Full Text in appendix III).

The Annual General Meeting (AGM) of ARAWA and WAMUS took up the last hours of the evening.

ARAWA was hosted to a Cultural Night at Hotel Presidential, courtesy of the Enugu State Government.
DAY II

Activities moved over to the Casino Hall of Zodiac Hotels, Enugu. The Guest Lecture titled 'Sustainability of Radiological Practice in Nigeria: The NNRA Factor', was given by Prof. S.B. Elegba, the Director-General of the NNRA. (Full text in appendix IV).

Activities went ahead with a multidisciplinary symposium on two broad topics:

- Modern Imaging in Cerebrovascular Accidents
- Radiotherapy and Nuclear Medicine in the Current Technology Age

Contributors included:

- Prof. S. Ohaegbulam: A Neurosurgeon’s Perspective on the value of CT in CVA
- Dr. Ifeoma Ulasi: A Neurologist’s Perspective on the value of CT in CVA
- Prof. D. Nzeh: Evaluating Arterial Health in CVA by Sonography
- Dr. A.O. Adeyinka: CT Angiography/Interventional Procedures in CVA
- Dr. Remi Ogunseinde: MRI and MRA in CVA
- Prof. E.A. Durosinmi-Etti: An Overview of the Current Situation in Radiotherapy in the West African Sub-region

(Full text in appendix V)

The afternoon was taken up by Scientific Paper Presentations. Contributors included:

1. Eze K. C. et al
2. Imo et al
3. Campbell et al
4. Obikili et al
5. Marchie et al
6. Adeyinka et al
7. Adewuyi et al
8. Erinle et al
9. Ajekigbe et al
10. Mgbor et al.

(Full text in appendix VI)

Prof. Uche Megafu, an honorary member of ARAWA made a brief presentation on ‘Cloning’.

At night was the Dinner at Zodiac Hotels Ltd. The Conference was declared closed by Prof. B.C. Umerah.


Presentations

1. There was an extensive deliberation on the conference theme ‘Radiology in the Information Age: Impact on Healthcare Delivery’. This was kicked off by a guest lecture given by Dr. Tosin Ajayi, MD and CEO, First Foundation, Nigeria followed by an interactive teleconferencing session between the assembly in Enugu and Professor Michael Rosengarten of McGill University, Canada on Continuing Medical Education. The dimension that such a facility, if available, could introduce...
into the health care delivery was outstandingly apparent and a lot of excitement was expressed at the prospect of introducing Telemedicine-Teleradiology into the healthcare system of the sub-region.

2. Another power-packed academically stimulating guest lecture was given by the invited Special Guest Lecturer of ARAWA, Professor Herve Koffi Yangni-Angate, a cardiovascular surgeon and chairman of Cardiovascular Department, University of Bouake, Cote D’ivoire. He took the delegates/invited guests through 24 years’ outstanding experience of open heart surgery in Cote D’ivoire.

3. Guest Lecturer, Professor Rowland Ndome Egba, a gastrointestinal surgeon also gave a lecture on the 'Importance of Multidisciplinary Co-operation in Patient Management'.

4. Two other Guest Lectures were given on Day 2 of the conference by:
   a. Professor Elegba, the Director-General of Nigerian Nuclear Regulatory Authority (NNRA) and;

5. A 'Multidisciplinary Symposium on Cardiovascular Accidents (Stroke)' and 'Current Trends in Radiotherapy' also took place on Day 2.

Observations and Recommendations

1) The body commended the recent efforts of the Federal Government of Nigeria to modernize eight Teaching Hospitals in Nigeria and associates itself fully with the dedication of 80% of the budgetary allocation for provision of modern 'state-of-the-art' radiological equipments.

2) They encouraged the Government to ensure that now it has set the pace on moving radiological practice forward, the other West African countries in the sub-region should be encouraged by ARAWA through her member Radiologists to borrow a leaf from Nigeria.

3) The association deliberated on how the radiologists practicing in these eight Teaching Hospitals can best optimize the modern diagnostic/therapy equipments that will soon be installed.

4) ARAWA resolved that the best way of facilitating this development was to ask the Government to install uniform Teleradiology facilities in these hospitals so as to enhance manpower development, capacity building and equipment maintenance.

5) ARAWA was strongly of the opinion that these observations were imperative for the success of VAMED PROJECT.

6) The body expressed its gratitude to the First Foundation Medical Company Nigeria (representatives of the German Siemens Medical Company) on their magnanimity in putting up an extensive exhibition on Teleradiology during the conference at Protea Hotel, Nike Lake Resort, Enugu. Their exquisite and highly informative exhibition showcasing their integrated radiology suite- SIENET went a long way in convincing ARAWA that TELERADIOLOGY is the way to go if Radiologists in the West African Sub-region desire to take the required 'frog-leap' which will enable them to be at par with their Western counterparts.

7) The association reiterated that the quality of health care services in the West African sub-region would experience an unprecedented upsurge if Teleradiology is incorporated in the services provided by the VAMED PROJECT.
8) ARAWA wishes to observe that the success of running effective radiological services in Nigeria is hinged on allowing Radiologists to decide and choose equipments that can be sustainably maintained in Nigeria.

9) ARAWA would like the regulatory bodies like the NNRA to be encouraged in each member country and would want radiologist to be fully incorporated in the activities of the regulatory body.

10) ARAWA resolved to influence the political thrust of government of their different countries in ensuring that only competent professionals are appointed into boards of Teaching Hospital and councils of Universities.

11) The quality of multimedia package used at the conference was commended and declared that it met with international standards.

12) ARAWA resolved that, henceforth, Continuing Medical Education (CME) credits will be awarded to participants that attend their annual conference. This decision would be conveyed to the Medical Councils of the different member countries.

13) ARAWA thanked the Enugu state governor, Dr. Chimaroke Nnamani for partnering with us at this conference. We also extended our appreciation to Governors of Rivers, Anambra, Ebonyi and Bayelsa States, Deputy Governor of Enugu State, Phillips Medical Systems, Mobil Producing, Havard Trust Savings and Loans, FEGNO press, May and Baker PLC, Hardis & Dromedas, Scherring, NNPC and several other companies for their various contributions in kind and cash.

SIGNED

Dr. Okoye I. J President
Prof. L Gordon-Harris Vice President
Dr. Kofo Soyebi Secretary
Dr. Emeka Nwankwo Treasurer
APPENDICES.

Appendix I:

Address Delivered By Dr. (Mrs) Okoye I. J., President, Association of Radiologists Of West Africa at the 42nd Annual Scientific Conference held at Enugu, Nigeria between 27th and 28th May, 2004.

Your Excellency, the Executive Governor of Enugu State, Representatives of the Governors of the S.E., Representative of the Minister for Health Prof. Lambo, Chief Medical Directors and Medical Directors of the various Teaching Hospitals and Federal Medical Centres, Professors, Deans of Faculties, Provost of the College of Medicine UNEC, Heads of Departments of UNTH and UNN unit, My Lords Spiritual and Temporal, Fellow Colleagues, Ladies, and Gentlemen.

You are all welcome. We really appreciate your creating the time to be with us at this 42nd annual conference and memorable day.

ARAWA is the umbrella organization holding together all Radiologists practicing in the West African Sub-region. Radiologists are made up of Medical Practitioners who have specialized in Radiodiagnosis or Radiotherapy and Interventional Radiology.

The entire effort of this year’s ARAWA is to make the statement that ‘Radiology Has Came of Age in West Africa’. Last year, one of the Elder statesmen of Radiology, Prof. S. B. Lagundoye sounded a warning through a critical question ‘The radiology train is on the move, are we in the West African Sub-region going to be left behind?’ We feel that warning was timely as Nigeria, the disputed Giant of Africa and undisputed Giant of W. Africa, appeared to suddenly wake up from a long drawn out slumber and began blazing the trail in bridging the wide gap or is it tavern? between Radiology in West Africa and Radiology in developed countries.

The re-think and awakening has resulted in the resolution and subsequent effort to modernize 8 teaching hospitals. Inevitably, the Nigerian Government, realizing the tremendous and invaluable role of Radiology to Medicare, decided to devote up to 70% of the revenue voted for this modernization, to provision of state of the art radiological facilities.

Why would we regard this apparent partiality to the Radiology discipline as inevitable? Well all over the world, the quality of health care delivered by a hospital is evaluated on the state of its radiological services, in-fact an adage exists that says, ‘A hospital is as good as its radiological services’.

Again, why is this so?

In the past decade, radiology has stepped out of its traditional game of shadows with conventional imaging into a realm where medical engineering has pushed high technology to its limits? With increased detailed resolution, non-ionizing modalities, shorter scan times, sophisticated image post-processing capabilities resulting in greater ease of use,
and now as we are showcasing at this conference, efficient networking solutions - TELERADIOLOGY.

If I were to step out of this technical language and enumerate the unprecedented clinical capabilities/applications that have been made available by these innovative radiological breakthroughs, am sure I will leave my audience ‘awe-struck’. But permit me to tease you a bit with visual images of what has been made possible. Feast your eyes on the power point whilst my voice maintains the hold on your ears.

Such giant steps have been made in the area of interventional radiology that the radiologists is threatening not only the bank account of the surgeon but wanting to eclipse the role of the surgeon.

We need Government and the general public to know that the answer to effective health care delivery rests on assisting this body (ARAWA) to overcome the primary problem that has ordered the snail pace of radiology in the sub-region. This is the critical and simple issue of 'let my people go!' Allow Radiologists as the main stakeholders to rudder the critical and absolutely important issue of 'Equipment choice, Negotiation, Purchase and Maintenance.' If this is allowed to happen by policy makers, the pace of radiological imaging in the sub-region will take an unprecedented turn.

A grasshopper seems insignificant as it leaps across the lawn. But when it joins forces with other grasshoppers, the resulting swarm can soon devour all the vegetation in its path. Grasshoppers demonstrate the power of community. What they cannot do by themselves, they can accomplish together. In the book of proverbs, the wise man Agur observed, “the locusts have no king yet they all advance in ranks” (30:27). We, in ARAWA can learn a lesson from these little creatures.

ARAWA has come of Age! The Radiology train ... according to our elder statesman, Prof. S. B. Lagundoye is on the move. Are we going to join in ? Radiologists can make far greater impact for 'Our cause' when we come together, think together and act together. That is why the effort of ARAWA 2004 was to garner all Radiologists together. ARAWA wishes today to recognize three great ARAWANS! OUR TTANS! Who by their dogged determination and contribution have been responsible for the success story of ARAWA. We have craved the indulgence of His Excellency to do the honors for us.

The history of ARAWA cannot be written without acknowledging some Medical equipment groups especially First Foundation Medical who have been with us as we rode the rough waters and are constants at ARAWA conferences. Others who have made contributions are Phillips Medical systems, who are here today, General Electric and Watson.

Fellow ARAWANS, Together we can constitute a considerable force to be reckoned with, a veritable organ that can effectively sensitize our different governments and influence and impact their political will to transform the pace of Healthcare delivery in West Africa.

What I see for ARAWA is a situation where
- we are all interconnected in our different tertiary centers through Teleradiology
- By consulting daily with one another we enable tremendous advances in our manpower development and establish powerful capacity building through networking with one another in our various practices 'Iron sharpeneth Iron'
- we influence the political will of our different governments to be committed to work hand in hand with us right from the policy stage to equipment choice, purchase and maintenance

I see ARAWA dictating the tune of growth of Radiological practice in the West African sub-region till we are abreast with the state of the art status of developed nations like
Europe, Canada and America and even then forge ahead relentlessly to out pace them. Who says we can’t do it, who says Africa can only follow the West. One could say we are dreamers, but dreamers have always had great visions and when you dare to dream big dreams, God steps in to make them came true.

- Black American activist Martin Luther King said, ‘I have a dream…’
- Nelson Mandela had a dream for South Africa…..
- America was built on a dream.

We need one other to achieve this. We can only achieve this feat through building a strong association. Let us reach out and enjoy the strength and fellowship available in a UNIFIED BODY OF RADIOLOGISTS

APPENDIX II:

OPEN HEART SURGERY IN COTE D’IVOIRE
A TWENTY-TWO YEAR EXPERIENCE (1978-2000) by YANGNI-ANGATE KOFFI HERVE MD, Pr, FWACS, FICS

APPENDIX III:

DISEASES OF THE DIGESTIVE SYSTEM: CHALLENGES TO THE SURGEON AND RADIOLOGIST IN THE WEST AFRICAN SUB-REGION.
PRESENTED BY: DR ROWLAND NDOMA-EGBA, FRCS, FWACS FICS. UNIVERSITY OF CALABAR

INTRODUCTION:

- The West African region is roughly bounded in the north by latitude 25degreesN, in the east by longitude 15 degrees E, in the West and South by the Atlantic ocean.
- Countries in the sub-region include: Nigeria, Benin, Togo, Ghana, Cote’ d’Voire, Liberia, Sierra Leone, Guinea, Guinea-Bissau, Senegal, The Gambia, Mauritania, Mali, Mali, Upper Volta(Burkina Faso), Niger and so-called Off-shore Islands.
- West African Health Community includes Cameroon even though geographically not a member
- Politically, broadly divided into Franco-phone and Anglo-phone following the Berlin Conference. Cape Verde Islands and Guinea-Bissau are Portuguese
- Economically, belongs to the SOUTH. Also classified as UNDER-DEVELOPED or euphemistically as DEVELOPING! Most of the economies are dependent on subsistent agriculture or mono-product exports. Per capita is low most of the population subsisting on less than one US dollar a day.
- Health-wise, played by high population growth ranging from 2%-4% per annum. Still plagued by high infant and maternal morbidity largely due to preventable causes like childhood fevers and malaria. Falling agricultural production and rural-urban migration complicate the situation. The emergence and rapid spread of HIV/AIDS has added a rapidly devastating complexion to the dismal picture.

THE DIGESTIVE SYSTEM:

Pharynx
Oesophagus
Stomach
ANATOMY AND PHYSIOLOGY

OESOPHAGUS:
● Connects the oro-pharynx to the stomach
● Structurally divided into upper 1/3, middle 1/3 and lower 1/3
● Upper1/3 lined by squamous epithelium, middle 1/3 lined by mixture of squamous and columnar epithelium, lower 1/3 by mainly columnar epithelium
● Upper1/3 composed of striated muscle while lower 2/3 is composed of smooth muscle
● Connecting pharynx to oesophagus is the upper oesophageal sphincter. Connecting lower oesophagus to the stomach is the lower oesophageal sphincter and ring
● 25cm in length, has important relations: Trachea and thyroid gland; Carotid vessels and recurrent laryngeal nerve in the cervical portion. lies posteriorly. In the chest it closely related to the aorta, left bronchus and the left atrium. It enters the abdominal cavity through the oesophageal opening in the diaphragm. Blood supply from descending aorta, bronchial artery and ascending branch of the left gastric artery. Veins follow the arteries.
● Nerve supply is from the vagus and oesophageal plexus

STOMACH
● Hollow viscus 1000ml-1500ml
● Extends from oesophageal orifice T10-L1 lying horizontally
● Two surfaces, anterior and posterior united by the lesser and greater curvatures.
● The main stomach is the body, the distal-most portion of the gastric cavity designated pyloric antrum with its terminal 2-3cm forming the pyloric canal
● Relationships: Antero-superior portion related to the left diaphragm and left lobe of the liver. Body and tail of the pancreas lie posterior to the stomach and cross the hilar region of the left kidney which is bounded medially by left suprarenal gland superolaterally by the spleen( 'stomach bed'). Lesser omentum encloses the right and left gastric vessels. The greater omentum fuses the greater curvature to the transverse colon and contains the right and left gastro-epiploic vessels.
● Blood supply: Arterial supply from Coeliac Trunk. 3 major branches: left gastric anastomosis with the Right gastric a branch of the common Hepatic. The Splenic artery gives origin to the short gastric to the upper part of the greater curvature; branch of the left gastro-epiploic anastomosis with the right gastro-epiploic branch of the gastroduodenal supplying the greater curvature and greater omentum. Venous drainage follows the arteries.
● Lymphatic Drainage: Four main groups of nodes: Left gastric; Pancreaticosplenic; Right gastroepiploic and Pyloric
● Nerve supply: Both sympathetic and parasympathetic: Freely anastomose to form the Auerbach’s and Meisner’s plexuses from both vagi.
● Structure: Four layers: Mucosa, submucosa, muscular and serosa
SMALL AND LARGE INTESTINE:

- Small intestine begins from the pylorus to the ileocaecal valve a length of 20-22ft.
- 3 parts: Duodenum; jejunum; ileum.
- Duodenum: 4 parts and mainly retroperitoneal except first part approximately 2.5 cm. Head of the pancreas is surrounded by the 2nd, 3rd, and 4th parts. Blood supply from the coeliac trunk and superior mesenteric artery. Venous drainage follows the arterial supply. Lymphatics go to the pyloric and periaortic nodes. Innervation is same as the stomach.
- Jejunum and Ileum: Attached to posterior abdominal wall by a mesentry 15-20cm long across the horizontal duodenum the inferior vena cava, and aorta to end in the right iliac fossa. Arterial supply from the superior mesenteric artery. Lymphatics comprise 3 groups of nodes drain into preaortic nodes and ultimately into cisterna chyli. Innervation by sympathetic and parasympathetic supplied via the vagus nerves.
- Structure: All small intestine composed of 4 basic layers:

Large Intestine: 150 cm in length. Consists of caecum and attached appendix; the ascending colon; the transverse colon; the descending colon with the sigmoid; the rectum and anal canal. Most of the large intestine is retroperitoneal. Transverse and the sigmoid are freely suspended on double fold of mesentery. Blood supply from superior and inferior mesenteric vessels. Branches from the internal iliac complete the arterial supply. Venous drainage follows the arterial supply. Nerve supply from the vagus nerves via sympathetic and parasympathetic plexuses.

HEPATO-BILIARY AND PANCREAS:

- Liver structure and function dependent on vasculature. Divided into lobes: Left lobe; Right lobe; Quadrate lobe and Caudate lobe. Blood supply mainly from right and left hepatic artery. Portal vein also supplies oxygenated blood.
- Gallbladder receives supply from the cystic artery whose origin from the hepatic arteries is variable.
- Biliary tree consists of the right and left bile duct joining to form the common bile duct. The cystic duct joins the common duct and opens into the small intestine via the ampulla of Vater.
- Pancreas both endocrine and exocrine. Blood supply from both superior and inferior pancreaticoduodenal vessels. Head buried in C- curvature of the 2nd, 3rd, and 4th parts of the duodenum. Body and tail lie in the stomach bed in close relationship with the hilum of the spleen anterior to left kidney and suprarenal gland.

DIAGNOSIS OF DISEASES OF THE DIGESTIVE SYSTEM:

- History
- Examination
- Investigations
  - routine investigations
  - radiological investigations
  - special investigations
  - others
HISTORY:
- Principal complaints
- Progress of symptoms including change in character
- Past medical history
- Past treatment and results
- Review of systems
- Family history
- Occupation and travel information

CLINICAL EXAMINATION:
- General examination
- Specific examination
- Special examination including outpatient procedures

ROUTINE INVESTIGATIONS:
- Full Blood Count & ESR
- Urinalysis +/- C&S
- Stool Microscopy
- BPR
- Others

RADIOLOGICAL INVESTIGATIONS:
- Plain x-rays
- Contrast studies with/without fluoroscopy
- Ultrasonology
- Computerised tomography
- Isotopic scanning
- Magnetic resonance imaging
- Others

PLAIN X-RAYS
'The eye perceives best what it is actively looking for'

- GASEOUS DENSITIES:
  Free intra or retroperitoneal gas: Bowel obstruction; Abscess with gas forming organisms; Gas in organs that do not normally have gas e.g. Gallbladder, Bile ducts.

- FAT DENSITIES:
  Lipomas, sebaceous filled dermoids, Abnormal accumulation of fat

- SOFT TISSUES DENSITIES: Ascites; organomegaly (liver, spleen, etc); soft tissue masses(cysts, neoplasms, haematomas, etc)

- CALCIFIC DENSITIES: Calculi( gallbladder, common bile duct); vascular calcifications(arteriosclerosis, aneurysms.); Neoplasms; Dystrophic calcifications; Metastatic calcification; Foreign bodies; Osseous abnormalities.
CONTRAST STUDIES:
CLASSIFICATION OF LESIONS OF THE DIGESTIVE TRACT:

- **OBSTRUCTING LESIONS**: Benign or Malignant
- **MASS LESIONS**: Benign or Malignant: Maybe- Intraluminal; Mucosal; Intramuscular; Extrinsic
- **EXTENSION OF THE LUMEN**: Ulceration (Benign or Malignant); Diverticulosis, Sinus tracts or fistulae; Perforation (intra or retroperitoneal)
- **ABNORMALITIES OF POSITION**: Displacement by abdominal mass; Hernias; Malrotation; Postoperative changes.
- **ABNORMALITIES OF MOTILITY**: Increased motility > inflammatory, psychogenic, drug induced Decreased motility > Impaired innervation, vascular insufficiency, granulomatous diseases, Drug induced, Fatigue

ULTRASONOLOGY

- Broadly operator dependent
- Very good at distinguishing cysts and solids
- Hepato-biliary: As good or better than CT with prediction level of 90% Able to distinguish benign from malignant in 88% against 63% by CT. Very reliable in cholelithiasis although small duct stones in distal biliary tree may be difficult
- Where adequate skill and experience exist, US renders cholangiography and other tests superfluous

CT SCANNING & MRI

- Not readily available
- Experience not widely available
- Maintenance may be difficult
- Very useful for retroperitoneal lesions

OTHER SPECIALISED INVESTIGATIONS:

- Endoscopy: rigid or flexible
- Percutaneous transhepatic cholangiography (PTC)
- Endoscopic retrograde cholangiography (ERC)
- Cytology and biopsy

THE FUTURE:

- Recommended for all teaching hospitals: X-ray machines including mobile units
- Ultrasound: multipurpose, high density, linear/convex sector scanners, biopsy kit, doppler, etc
- Computerized axial tomography latest generation
- Magnetic resonance imaging
- Interventional radiology
Our region is poor
Our people are poor and hungry
Our hospitals are full of out-dated equipment
Specialists are few
The digestive system is anatomic and pathologically complex
History and clinical examination will remain the mainstay of diagnosis for a long time to come!
Success will depend on the collaboration and cooperation between the surgeon and the radiologist

APPENDIX IV:

SUSTAINABILITY OF RADIOLOGICAL PRACTICE IN NIGERIA: THE NNRA FACTOR
By Professor. S. B. Elegba, Director-General/CEO
NIGERIAN NUCLEAR REGULATORY AUTHORITY
An Invited Guest Lecture presented at the 42th Annual Scientific Conference of the ASSOCIATION OF RADIOLOGISTS OF WEST AFRICA
Protea Hotel, Nike Lake Resort, Enugu
25th 28th May 2004

CONTENTS

• Introduction
• Uses
• Act 19 of 1995
• The NNRA
• Survey Of Medical Uses
• Radiation Protection Audit Of Radiology Practices
• Nigerian Basic Ionizing Radiation Regulations 2003 (Birron)
• Sustainability Guidelines

USES OF NUCLEAR AND RADIATION MATERIALS

• Health Sector
• Petroleum Industry
• Manufacturing Sector
• Mining Sector
• Education and Research
• Agriculture and Water Resources
• Research Reactor Operation

NUCLEAR SAFETY AND RADIATION PROTECTION ACT 1995

• Nine parts and 49 sections
• A 14-member Board of Governors
• Establishes
NIGERIAN NUCLEAR REGULATORY AUTHORITY (NNRA) in 2001
“With the responsibility for nuclear safety and radiological protection regulations in Nigeria”

Responsibilities
(section 4)

- Regulating the possession and application of radioactive substances and devices emitting ionizing radiation;
- Ensuring protection of life, health, property and the environment from the harmful effects of ionizing radiation, while allowing beneficial practices involving exposure to ionizing radiation;
- Performing all necessary functions to enable Nigeria meet its national and international safeguards and safety obligations in the application of nuclear energy and ionizing radiation;
- Advising the Federal Government on nuclear security, safety and radiation protection matters;
- Liaising with and fostering co-operation with international and other organizations or bodies concerned having similar objectives;
- Regulating the introduction of radioactive sources, equipment or practices and of existing sources, equipment and practices involving exposure of workers and the general public to ionizing radiation.

Powers (Section 6)

- Categorize and license all activities involving exposure to ionizing radiation, in particular, the possession, production, processing, manufacture, purchase, sale, import, export, handling, use, transformation, transfer, trading, assignment, transport, storage and disposal of any radioactive material, nuclear material, radioactive waste, prescribed substance and any apparatus emitting ionizing radiation;
- Establish appropriate register for each category of sources or practices involving ionizing radiation;
- Issue codes of practice which shall be binding on all users of radioactive and prescribed substances, and of sources of ionizing radiation;
- Review and approve safety standards and documentation;
- Protect the health of all users, handlers and the public from the harmful effects of ionizing radiation;

Powers (section 47)

- With the approval of Mr. President make regulations prescribing anything required to be prescribed under the Act.

HEALTH SECTOR

- Diagnostic Radiology
- Nuclear Medicine
- Radiation Therapy
INVENTORY
- Over 3000 X-ray machines
- Six Radiation Therapy Centers using Cobalt-60, Cesium-137 sources and a Linear Accelerator
- About 12 CT Scanners
- About 5 Nuclear Medicine Units

STATUS OF RADIATION SAFETY IN MEDICAL APPLICATIONS
- 2001 - Survey of Users of Ionizing Radiation in Medicine
- 2002 - Audit Inspection of Radiotherapy Centers
- 2003 - Audit Inspection of Major Diagnostic Centers
- 2003 - National Workshop for Senior Managers on Radiation Safety
- 2004 - National Seminar on Duties and Responsibilities

RADIATION PROTECTION AUDIT REPORT OF RADIOTHERAPY PRACTICE
- Personnel
- Equipment and Machines
- Premises
- Procedure
- Management

Personnel
- Inadequate number of cadres
- Oncologists/Medical Physicist/Radiographers
- Inadequate level of competence
- High patient-to-expert ratio in radiotherapy

MANPOWER PROFILE OF R/T CENTRES
Equipment and Machines
- Obsolete
- Second hand, without manuals or parts
- Poorly maintained
- Unaccredited maintenance group
- Lack of accessories as against spare parts

EQUIPMENT PROFILE OF R/T CENTRES
Premises
- Location
- Little or no shielding materials
- Re-configuration without drawings
- Lack of records

Procedure
- Lack of Operational Manual
• Lack of Radiation protection programme
• Lack of Quality Assurance Manual
• Lack of Radiological Emergency Plan

Management
• Lack of structured communication channel between management and the operating unit
• Lack of program for equipment maintenance and replacement
• Lack of financial plan budget for the operation and maintenance of the facilities
• Lack of commitment from management to radiation protection and safety
• Inadequate communication between management and facility owners.

LEGISLATIVE INFRASTRUCTURE
• The Medical and Dental Practitioners Act Cap 2221 of 1990 amended by Decree 78 of 1992.
• Radiographers Registration Board of Nigeria Decree 1987.
• Nuclear Safety and Radiation Protection Act 1995
• Nigerian Basic Ionizing Radiation Regulations 2003 (BIRRON)
• Medical Physicists Act 200?

BASIC IONIZING RADIATION REGULATION OF NIGERIA (BIRRON)
NIGERIA BASIC IONIZING RADIATION REGULATIONS 2003
BIRRON implements international best practices as contained in the International basic Safety Standard for Protection against Ionizing Radiation and for the Safety of Radiation Sources (BSS) and the provisions of the Act

OBJECTIVES
BIRRON and the supporting Guidance and Codes of Practice to be issued under it are to:
• Establish a Framework for Ensuring that Occupational Exposure to Ionizing Radiation, whether Natural or Man-Made, and from External Radiation (e.g. X-Ray Set) or Internal Radiation (e.g. Inhalation of Radioactive Substance)

OBJECTIVES (contd.)
• Ensure that Exposure to Ionizing Radiation is kept As Low As Reasonably Achievable (ALARA Principle) and
• Ensure that Exposure to Ionizing Radiation does not Exceed Dose Limits Specified for Individuals

ORGANIZATION OF BIRRON
The 87 Regulations are divided into:
• 8 Parts: Each Part is made of a number of Regulations
• 11 Schedules, providing important explanations on major subjects; and
• 1 Appendix, dose estimates from external radiation
THE PARTS

- Part I: General
- Part II: General Principles and Procedures
- Part III: Arrangements for the Management of Radiation Protection
- Part IV: Designated Areas
- Part V: Classification and Monitoring of Persons
- Part VI: Provisions Relating to the Control of Radioactive Substances, Articles or Equipment
- Part VII: Duties of Employees and Miscellaneous
- Part VIII: Offences and Penalties

THE SCHEDULES

- First Schedule: Work not Required to be Notified
- Second Schedule: Particulars to be provided in a Notification
- Third Schedule: Additional Particulars that the Authority may Require
- Fourth Schedule: Dose Limits
- Fifth Schedule: Matters in Respect of Which Radiation Safety Adviser Must be Consulted by a Radiation Employer

SCHEDULES

- Sixth Schedule: Particulars to be entered in the Radiation Dose Record
- Seventh Schedule: Particulars to be contained in the Health Records
- Eighth Schedule: Quantities and Concentration of Radionuclides
- Ninth Schedule: List of Nuclides in Secular Equilibrium
- Tenth Schedule: Limits on Intake and Exposure for Radon Progeny and Thorium Progeny
- Eleventh Schedule: Guidelines for Intervention Levels and Action Levels in Emergency Exposure Situations

PART I: General

- Definitions

PART II: General Principles

- 4: Authorization of practices
- 6: Right of appeal
- 7: Notification of certain works (28 days)
- 13: Justification of practices
- 14: Restriction of exposure, PPE
- 15: Dose constraints
- 17: Pregnant/breast-feeding employees
- 19: General responsibilities of radiation employer

Regulation 12:

Prior risk assessment etc

(1) Any radiation employer shall, prior to commencement of any new activity involving work with ionizing radiation, undertake a suitable and sufficient assessment of the risk to any employee and other person for the purpose of identifying the measures required to be taken to restrict the exposure of that employee or other person to ionizing radiation.
Regulation 13: Justification of practices
(1) The Authority shall not authorize any practice under these Regulations unless such practice is capable of producing sufficient benefit to the persons exposed to radiation or to the society in such a manner as to offset the radiation harm that it might cause, taking into account social, economic and other relevant factors.

Regulation 14: Restriction of exposure
(1) Every radiation employer shall, in relation to any work with ionizing radiation that he undertakes, take all necessary steps to restrict so far as is reasonably practicable the extent to which his employees and other persons are exposed to ionizing radiation.

Regulation 15: Dose constraints
- Except for medical exposure, the optimization of the radiation safety measures associated with a given practice shall satisfy the condition that the resulting doses to the individuals of the groups do not exceed dose constraints which are equal to the dose limits of 20mSv/a for >18a employee; 6mSv/a for <18a trainee

Regulation 19: General Responsibilities
(1) A radiation employer or licensee shall bear prime responsibility for the safe management and security of radioactive sources.
(2) A radiation employer or licensee shall take all necessary measures to minimize the likelihood of a loss of control and in the event of a loss of control, it shall be reported to the Authority within 48 hours.
(3) Any radiation employer or licensee who is engaged in activities that involve or could involve occupational exposure shall be responsible for the protection of these workers against any occupational exposure, which is not excluded from this Regulation.
(4) A radiation employer or licensee shall ensure, for all workers engaged in activities that involve or could involve occupational exposure, that-
  a) occupational exposures are limited as specified in Schedule 4
  b) radiation safety is optimized in accordance with Regulation 14
(5) Every radiation employer or licensee shall ensure that workers are informed of their obligations and responsibilities for their own protection and the protection of others against radiation and of the safety of sources.
(6) Every radiation employer or licensee shall record any report received from a worker that identifies any circumstances that could affect safety conditions or compliance with the requirements of this Regulation and shall take appropriate remedial actions.
PART III: ARRANGEMENTS FOR THE MANAGEMENT OF RADIATION PROTECTION

(Duties of the Radiation Employer)
- 27: Radiation employer to consult radiation safety adviser
- 29: Information, instruction and training
- 30: Information for female employees who may become pregnant or start breast-feeding
- 31: Co-operation between employers to protect their employees from ionizing radiation

PART IV
DESIGNATED AREAS
- 32: Designation of controlled area (>6mSv/a)
  - Physical demarcation
  - Signs and placards
  - Controlled entry
  - Provision of personal protective equipment
- 33: Designation of supervised area (>1mSv/a)
- 34: Local rules and radiation safety supervisors
- 42: Monitoring of designated areas

PART V
CLASSIFICATION AND MONITORING OF PERSONS
- 45: Designation of classified persons
  - > 18yrs
  - Medically fit
- 47: Dose assessment and recording
- Authorized dosimetry service provider
- Submission of dose records to the Authority
- 59: Investigation and notification of overexposure
- Notify the Authority, the employment Medical Adviser and the person affected
- Investigate

PART VI
PROVISIONS RELATING TO THE CONTROL OF RADIOACTIVE SUBSTANCES, ARTICLES AND EQUIPMENT
- 61: Sealed sources and articles containing or embodying radioactive substance
- 63: Accounting for radioactive substances
- 64: Keeping and moving of radioactive substances
PART VI (contd.)

66: Notification of certain occurrences

67: Duties of suppliers, vendors etc of articles for use in work with ionizing radiation

68: Critical examination by installer or erector

69: Equipment used for medical exposure

70: Provisions of a quality assurance programme for the equipment

73: Investigation of Incidents

74: Offence relating to sources of ionizing radiation

PART VII
DUTIES OF EMPLOYEES AND MISCELLANEOUS

75: Duties of employees

Proper use of PPE

Report of defects

Medical surveillance

Use of personal dosimeters

78: Waste disposal

79: Return of sources to supplier

80&81: Decommissioning to be licensed

83: Exemption certificates

84: Fees, etc

PART VIII
OFFENCES AND PENALTIES

Offences and Penalties

Offences by body corporate

SCHEDULES

Schedule 1 Work not required to be notified under article 6

Schedule 2 Particulars to be provided in a notification under article 6(2)

Schedule 3 Additional particulars that the Authority may require

Schedule 4 Dose limits

Schedule 5 Matters in respect of which a radiation safety adviser must be consulted by a radiation employer

Schedule 6 Particulars to be entered in the radiation dose record

Schedule 7 Particulars to be contained in a health record

Schedule 8 Quantities and concentrations of radionuclides

Schedule 9 List of nuclides in secular equilibrium as referred to in note 2 of this Schedule

RADIOThERAPY PARADIGM

Availability of Patients

Affordability of Service
• Consumer Satisfaction
• Sustainability of Practice

**SUSTAINABILITY**

• What are the Guidelines and Indicators for the Establishment of Sustainable Practice?
• Why do we need a sustainable practice?
• What is sustainability?
  What is sustainability?

*Meeting the needs of the present generation without compromising the needs of future generations*

*Intragenerational justice, intergenerational justice, environmental protection and respect for life*

*The triple bottom line: economic, social, environmental*

Sustainability of a Practice
*The ability to remain functional and relevant, with an agreed level of dependence on government support and the capacity to adapt to changes in the external environment*

How do we plan for sustainability?
• Assessment of the practice:
  • SWOT analysis
  • Consult with stakeholders

Formulate a Strategic Action Plan (SAP)
• Implementation of the SAP
  • Develop business plans
  • Develop human resources
  • Secure funding
  • Establish physical facilities
  • Establish legal framework

Implementation of SAP (cont.)
• Build partnerships
• Involve stakeholders
• Develop marketing plans
• Improve public relations
• Establish business mechanisms

Dimensions of sustainability
• Legislative
• Institutional
• Physical facilities
• Financial resources
• Human resources
Legislative sustainability
- Enabling act
- Rule of law
- Ability to draft legislation
- Ability to implement agreements

Institutional sustainability
- Strategic Action Plan
- Corporate governance
- Capacity for planning
- Information and communication
- Mobilising support
- Cooperation
- Ability to undertake commercial activities
- Logistical infrastructure

Sustainable physical facilities
- Adequate Physical infrastructure
- Ability for maintenance and repair
- Capability for upgrading and renewal
- Nuclear safety and security capacity
- Capability for environmental monitoring
- Operational Quality management system

Sustainable financial resources
- Adequate Government/Investors budget consistent with the SAP
- Ability for income generation
- Demonstrated financial management capability
- Ability to mobilise funds
- Operational Business and marketing processes

Sustainable human resources
- Adequate Personnel
- Available development and succession plans
- Human resource management strategy
- Knowledge development and preservation
- Occupational health and safety plans
- Healthy Labour relations

Using the sustainability indicators
- Agree on the need for sustainability!
- Understand the terminology
- Understand the methodology sheets
- Select appropriate indicators from all dimensions
- Measure for your institution

Using the indicators (cont.)
- Encourage discussion and debate
- Assess the usefulness of the indicators
- Supply a feedback report to the Board
- Exchange experience with other operators
- Set targets and measure over time

CONCLUSION
Can these indicators assist in achieving sustainable radiology practice in Nigeria through radiation safety regulations?

- If not, let us improve them.
- If yes, let us use and still improve them.

*We manage what we measure!*

THANK YOU

APPENDIX V:

A NEUROSURGEON'S PERSPECTIVE ON THE VALUE OF CT IN CVA BY PROFESSOR S. OHAEBGULAM, DIRECTOR, MEMFY'S NEUROSURGERY CLINIC, ENUGU.

- The brain was a dark continent in which they could descry neither path nor guide capable of leading them to a particular diseased area and did they attempt to reach it, it could only be by groping in the dark. .......Macewen 1888

- It is impossible to cure a severe attack of apoplexy and difficult to cure a mild one.........Hippocrates

BRAIN ATTACK
- Stroke Team
- Rapid identification of stroke victim
- Emergency stroke treatment Ischaemic stroke
- CT for diagnosis
- Emergency Carotid Endarterectomy
- Intracranial Embolectomy
- Thrombolysis-tPA (tissue plasminogen activator)
- EC/IC Bypass
- Decompressive Procedure

- External
- Internal
  Cerebellar Infarction
- CT to determine the size and site
- Suboccipital craniotomy & decompression
- Resection of infarcted brain
- Ventriculostomy
Intracerebral Haemorrhage
- CT for diagnosis
- Early surgery to prevent subsequent haemorrhage and avert the cascade of secondary damage.
- Microneurosurgery and Stereotactic surgery for deep lesions

Cerebellar Haemorrhage
- CT for diagnosis
- Follow up CT for hydrocephalus
- Surgical evacuation is very rewarding

Aneurysmal SAH
- CT for diagnosis of SAH
- This has replaced LP
- CT Angiography to locate aneurysm
- CT post up for complications

Meningiomas presenting as CVA
Haemorrhage from AVM
Resolving ICH
Ventriculomegally after SAH
Occipital ICH
P C A Infarct
MCA Infarct
Massive pontine hemorrhage
Basal ganglia AVM
Basal ganglia AVM
Basal ganglia AVM: Contrast CT
Right frontal haemorrhage
Sites of Arterial Occlusions
MCA Stroke
Ant Co Aneurysm
Ant Com Aneurysm
PCA mycotic aneurysm
PCA mycotic aneurysm
Subcortical Haemorrhage
Thalamic Haemorrhage with IVH
Vermian Haemorrhage
NEUROLOGIST'S PERSPECTIVE ON THE VALUE OF COMPUTED TOMOGRAPHY IN CEREBROVASCULAR DISEASES
BY
DR IFEOMA I. ULASI, FWACP
CONSULTANT PHYSICIAN
SENIOR LECTURER
DEPT OF MEDICINE,
COLLEGE OF MEDICINE, UNIVERSITY OF NIGERIA, ENUGU CAMPUS

Introduction: Definition and Types
• Definition: CVD is defined as abrupt onset of nonconvulsive and focal neurologic deficit.
• Types:
  Ischaemic infarction:
  thrombotic and embolic
  Haemorrhagic

Importance of Cerebrovascular Diseases
• High prevalence
• Affect mostly people in middle/late years of life i.e. ‘golden years’
• Modifiable risk factors
  • Hypertension
  • DM
  • Cardiac disorders
  • Atherosclerosis
  • Cigarette smoking
  • hypercholesterolaemia
• High morbidity and mortality which can be reduced with prompt diagnosis and appropriate intervention. CVD causes about 200,000 deaths per year in the USA, as well as considerable neurological disability.

Natural history of CVD
• Approx. 1/3 are fatal. Age of patient, size of lesion, location, degree of deficit and underlying cause all influence outcome.

Immediate outcome:
• Haemorrhage mortality ~70%
• Infarction <25%. Embolic fair better than thrombotic.

Long term outcome:
• Variable depends on underlying disease.

CT in the Management of Cerebrovascular Disease
• Ideally, all patients with CVD should have CT done. But this is rarely possible even in the
Brain imaging remains the most important acute test once a stroke has occurred. It rules out other causes of stroke-like syndromes such as intracranial tumour, metabolic encephalopathy, migraine.

The extent and location of infarction in the supratentorial fossa can be assessed including small 0.5 to 1.0cm lacunar infarcts. It can also detect the surrounding oedema.

The first goal in managing acute stroke is to prevent or reverse brain injury. It is important that the clinician must rapidly differentiate between ischaemic infarction and haemorrhage as the line of emergency treatment depends on type. For example in ischaemic infarction thrombolytic therapy maybe given to reopen the vessel to restore blood flow to the penumbra and it therefore prevents progression.

Confirms diagnosis of subarachnoid haemorrhage.

Blood maybe evident in the sylvian & interhemispheric fissure, basal cisterns, tentorium cerebelli, ventricular system and hemispheral surface.

Identifies site of aneurysmal rupture.

Identifies other associated lesions/complications: hydrocephalus, intracerebral haematoma, tumour, a-v malformations.

E. g. CT can be used to predict the incidence, location, and severity of cerebral vasospasms after SAH especially when middle and anterior cerebral artery territories are involved. It is less reliable in predicting vasospasms in the vertebral, basilar or post cerebral arteries.

Shortcomings of CT
- It cannot detect most cerebral infarctions for at least 24 to 48 hours.
- It does not reliably identify infarction of the cortical surface gray matter at any age.
- Infarctions of the vertebral and basilar territories cannot be reliably identified because of bones and motion artifacts and also because of the small size of the infarcts.

MRI IMAGING IN CVA

BY
DR [MRS] A. O. OUNSEYINDE. [FMCR]
UNIVERSITY COLLEGE HOSPITAL,
COLLEGE OF MEDICINE IBADAN.

INTRODUCTION
- Can be defined as a clinical event that consists of sudden onset of neurologic symptoms and cause by CVA.
- Stroke 2nd leading cause of death leading cause of permanent disability. One of the most common indication for diagnostic imaging of the brain.
4 MAJOR TYPES.
- Cerebral infarction 85%
- Primary ICH
- SAH Aneurysms, AVMS
- Venous occlusion

RADIOLOGICAL INVESTIGATIONS
Radiological diagnosis viz:
- CT, MRI, MRA
- Recently MRI - BOLD [Blood oxygen level dependence]
- Perfusion MRI - measures regional blood flow
- DWI - measures random movement of H2O molecules.
- MRI Spectroscopy - measures metabolites non-invasively.

MRI in CVA
- Knowledge of changes that occur can be useful in understanding the image findings
- Also the histo-pathologic changes that occur in few days and weeks after stroke will also aid the understanding of the image findings.
- Pathophysiology in Ischaemic Stroke

A. **Ischaemic cytotoxic oedema**
- Regional cerebral flow (CBF) is decreased (15-18 ml/gram per minute), and glucose decrease
- Decreased production of ATP adenosine triphosphate. This leads to Na⁺/K⁺ ATPase failure, loss of ions homeostasis.
- Metabolic acidosis and extracellular glutamate accumulation.

- Ischaemic cascade
- Cell membrane integrity is lost, cell death, edema, and mass effect
- Selective vulnerability of cells particularly in the hippocampus, cortex, and basal ganglia.
- Ischaemic areas
- Densely ischaemic areas - cell damage is irreversible and typically progresses to frank infarction
- Less dense peripheral ischaemic penumbra - cells remain viable for several hours. Salvage therapies are directed at rescuing these at-risk areas. These are the causes of the MRI changes seen in acute ischaemic stroke.

- A diminished difference in the density between gray and white matter.
- Best seen in the cortical region and base of the brain
- An overall decrease density in the region of the brain.
- Water has longer T₁ and T₂ relaxation times than for normal brain on MRI, T₁ and T₂.
relaxation times of the involved tissue $T_1, T_2$ prolongation. Changes not well seen on T1

- The changes are better appreciated on T2W images.
- On convectional MRI scan, earliest signs of CVA are therefore regions of increase signal intensity on long repletion with TR images.

C. **Sub acute Infarction**

- About 3/52 after initial insult
- The initial hyper intensity regresses on T,W $W_1$. Fogging
- ? due to macrophages activities and decrease edema.
- Will show enhancement on T,W images after gadolinium injection

D. **Chronic Oedema**

By 4 weeks

- All changes of reparation and resorption are completed.
- Normal tissue is replaced by glial scars, areas of cystic necrosis
- Volume loss ie enlargement of adjacent sulci, cisterns and ventricles
- Prolonged T, and T2
- Areas of gyri increased density and signal on T, weighted images may represent areas of Ca$^+$ in areas of cortical necrosis.

II **Haemorrhagic Stroke** Can be

- "cerebral haemorrhage or
- Haemorrhagic infarct or transformation.
- It is important to differentiate both:
  - (a) - MRI and angiography
  - (b) echocardiography and carotid USS
  2 main types of haemorrhage seen
    - Petechial or space-occupying.
- Petechial limited to cortical gray matter due to RBC diapedesis through tear in the endothelium
- Greater disruption of vessels mass effect
- Due to reperfusion of ischaemic tissue

*MRI Findings varies with time.*

- Petechial haemorrhages areas of hyperindensity on T,W
  - Acute haematomas usually low-signal intensity on T, W images.

**Constraint Enhancement in Ischaemic Stroke**

Brain enhancement can be associated with stroke

- Earliest signs are seen on MRI
- And varies with time
- Increased enhancement in the cortical vessels and meninges over the area of ischaemia
Due to delay wash-over of contrast as a result of slow flow or
Auto-regulatory vasodilation

**Venous Occlusion Infarction**

Venous occlusion --- increased pressure with non-focal neurologic symptoms seizures, headache, cerebral infarction
- Dehydration, infection polycythemia, SCD hypercoagulate state, contraceptive
- Location and extent is variable
- Cortical veins: unilateral
- Major veins or dura sinus bilateral and usually sub-cortical

**MRI Findings**
- Increased T₁ signal within venous structures
- Lack of flow related void on T₂
- Lack of enhancement of the venous structure after gadolinium
- Use of flow sensitive sequence e.g. time-of-flight and phase contrast MR venograms.

**PIT FALLS IN MRI**
- Hyperintense thrombus on T₁,W₁ is mistaken for flow or with TOF images.
- Compare T₁ and T₂ images for clots using phase contrast MR venography.
- Flowing blood can appear hyper-intense on T₁ weighted images mimicking hyper-intense signal due to thrombus.
- Conventional MRI has a lower sensitivity in detection of acute parenchyma haemorrhage than CT

**Perfusion Imaging in Stroke**
- One important goal of haemodynamic stroke imaging is to demonstrate tissue at risk of infarction that can be saved through intervention. This is usually referred to as the penumbra.
- Methods of cerebral perfusion include: radioisotope with SPECT & PET

For perfusion MRI
- A volume of contrast material is injected rapidly into the arm vein by automatic injector.
- The bolus of contrast is tracked by the scanner through a slice of brain.
- This is scanned repeated over 45-60 seconds.
- MR perfusion complements DW imaging
- DW imaging usually demonstrates the region of core infarction while the region of perfusion abnormally represents both core and the penumbra.
- Difference between these two is therefore the area of Penumbra.

Penumbra can also be shown with mean rCBF value.
- Also rCBV may also provide additional information about tissue viability. It has been shown that tissues with moderately rCBF and rCBV values may carry a better prognosis than that for tissues in which both rCBF and rCBV values are low.
- MRI perfusion sequence can also be used to show the degree of stenosis in the carotid arteries.
- There is adequate compensation of unilateral stenosis when less than 90%.
The risk of stroke is higher in patients with stenosis exceeding 70%

**DW1 IMAGING IN ACUTE STROKE**

- Diffusion produces image contrast that is dependent on the molecular motion of water.
- It is particularly sensitive to ischaemic stroke. DW images are highly sensitive to restricted diffusion of water restriction, which is seen in acute stroke and cost of a much higher contrast to noise ratio. Reported sensitivities ranges from 88%-100% and specificity of 86%-100%. (Conventional MRI 58% and 100% respectively)
- Images are created by applying a pair of magnetic gradient pulses which sensitize the sequence to motion.

- Amount of D Weighting on the DW image depends on:
  - magnitude of the applied gradients, its duration and time between the two lobes
  - duration of the applied gradient
  - interval between the 2 lobes
- the image is compared with a similar image scan without diffusion sensitizing gradient i.e. the zero image, this will give an ADC map.
- Acute cerebral ischaemia are typically hyper-intense on DW images and hypointense on ADC maps.
  - ADC values varies with the age of ischaemic stroke
  - In the first few hours ADC rapidly to 30% below (N) value.
  - $60 \times 10^{-7} \text{mm}^2/\text{sec}$ in ischaemia.

After 24 hours ADC values begins to increase again and return to (N).
- After 2 weeks ADC values are typically increased within the territory of the infarction.
- It can therefore differentiate old from new stroke in the same area.

- ADC values in acute but in old infarcts, chronic being isointense on DWI and hyperintense on ADC map.
- Other diseases show high ADC of TIAs, migraine, dementia, metabolic disorders which have no restricted diffusion.

[a] Trace Weighted DW1
[b] showing diminished perfusion identical image P/D merged image

DWI 3 Hours After Cardiac arrest
Diffusion Images in Cerebral Anoxia
- Bright lentiform nucleus 3hrs after cardiac arrest
- T2W image ~3 days after insult bright BG
- Abnormally bright basal ganglia and cortex.
- High strength Diffusion weighted image-cortex & parietal region.

**Artefacts on DW Images**
- T2 - shine through which mimicks acute stroke
- due to carry-over hyper-intense signals of the spin density and T2 weight
- due to whiter matter diffusion anisotropy
- when DW images sensitize to diffusion in one direction is used.
- Therefore weighting should be applied in all 3 direction i.e. trace-weighted images.
- Susceptibility artifacts due to patient motion. Therefore seen at tissue/bone and soft tissue/air" interfaces
  - they are flame-shaped and cause regional distortion if large.
  - cerebral abscess may also show diffusion restriction.
- Axonal injury can also show hyper-intensity on DW scans

MRS Magnetic Resonance Spectroscopy

H atoms in other molecules such as Na, F,&Li in given areas of the brain are measured spectrograph

- This will document low N acetyl-aspartate (NAA) peak and Lactate peak in infarction picture

CT versus MRI

- MRI is more sensitive than CT in acute stroke; especially with DW MRI which has highest sensitivity.
- It is better able to detect small strokes and those located in the posterior fossa.
- DWI and PWI play an important role in detecting earliest alterations in the pathophysiologic cascade leading to ischaemic injury.
- CT remains the 1st imaging test performed in many institutions even when MRI is later performed cf. higher sensitivity in Haemorrhage & greater availability

THANK YOU FOR LISTENING

REFERENCES

- Neuroradial 39:7885-787. 1997 MRI fogging in cerebella ischaemia
- Scuostto et al
- Radiol. 210:519-527 1999
- Surensen A.G. et al
- Hyperacute stroke measurement of relative CBU, CBF and mean transit time.

DWI in early sub-acute stage
T2W reported Normal BjDW Image with Bright cortex

Images obtained in the late sub-acute period .T2W Image increased Signal Intensity in WM
High strength DWI shows abnormally bright WM in Central Semi-Ovale- No cortical
abnormality
Images of laminar necrosis 22 days after cardiac arrest. A) TW1  B) DWI
Basal Ganglia and Cortex DWI 20 hrs after insult
Corresponding low-strength DWI showing no abnormality
Corresponding high-strength DWI now showing abnormally bright BG, T and medial Cortex
Corresponding high-strength DWI shows abnormally bright cortex. Pt survived.

AN OVERVIEW OF CURRENT SITUATION IN RADIOTHERAPY IN W. AFRICAN SUB-REGION
BY
Prof. E.A. Durosinmi-Etti

RADIOTHERAPY AS A SPECIALTY
- Investigation and clinical assessment of tumor stage.
- Offer as a major treatment modality for cancer treatment.
- Curative treatment HD & NHL, H&N, Gynae, Bladder.
- Palliative-Symptom control- bleeding, cord compression, relieve obstruction, SVC, Pain relief, Growth Restraint.
- Chemotherapy
- Hormone Therapy.
- Research, Teaching and Training
- Public Education Campaign

SERVICES PROVIDED
- Teletherapy Linear Accelerator, Cobalt-60, Photons, Electrons, Neutrons, other high LET radiation.
- Brachytherapy Surface Moulds, Intracavitary, Interstitial, Intraluminal.

SIMULATION
- Use of 3 dimensional imaging techniques
- Availability of Multileaf collimation devices for irregular fields. (Conformal radiotherapy)
- Computer Aided Designs.
- Computerized Treatment Planning System
- 3-D Designs
- Radiobiological based corrections tumor dose fractionation regimes.
- Combined Teletherapy and Brachytherapy procedures.

MOULD ROOM FACILITIES.
- For Beam Directed Radiotherapy.
  Common types of tumors managed by XRT in Nigeria
- Cancer Cervix 26.3%
- Cancer Breast 24.2%
- Cancer of the Prostate 16%
- Cancer of Head & Neck 11%
- Paediatric tumours 10%
RADIOThERAPY RESOURCES

- USA
  - Popln. 240m
  - GNP $10,000
  - R/therapists 2199
  - M.Phys. 1067
  - R/graphers 3648
  - Linacs. 1018
  - Co-60 units 744

- AFRICA
  - 560M
  - $500 (100 6720)
  - 127
  - 38
  - 65
  - 12
  - 52

EQUIPMENT AVAILABLE

4. PERSONNEL AVAILABLE

FUTURE PROSPECTS IN RADIOThERAPY

- Improved & Earlier presentation and diagnosis
  - Improved techniques based on research in Cancer Biology
- Improved Genetic diagnosis and definition of tumour characteristics
- Improved Chemotherapy with discovery of new drugs
- Improved use of radio sensitizers
- Improved treatment planning techniques- conformal XRT x 3D planning
- Predictive assessing of individual tumours and radio sensitivity
- Manipulation of stems cells to protect normal tissues
- Supra fractionation regimes (multiple treatments/day)
- Combined Radio and Chemotherapy
- Use of High LET Radiation

POSERs

- Where does Nigeria/West Africa fit in?
- Any chance of meeting up?
- 100,000 New Cancer Cases diagnosed per year. (WHO)
- 60% require Radiotherapy. (60,000 cases)
- 500 new cases each treated at the 5 existing centres. Total of 2500. (4.2% only)
- Apprx 95.8% are left untreated.
- 80% cases present with late stage 3 and 4 disease.
- WHAT NEXT ???
APPENDIX VI:

THE ROLE OF C/T ANGIOGRAPHY/INTERVENTIONAL PROCEDURES IN CEREBROVASCULAR ACCIDENT

DR A. O. ADEYINKA FWACS, FNMCR
CONSULTANT RADIOLOGIST UCH IBADAN.

CTA-OBJECTIVES IN IMAGING

- Confirm clinical diagnosis
- Identify pty intracerebral haemorrhage
- Detect structural lesions MMCKNG stroke, tumour, AVM, SDH
- Detect early complication of stroke
- Pre-DX test-intervent vascular

CVA- CLASSIFICATION
(1) NON-VASCULAR (5%)-TUMOURS

ADVENT OF CURRENT TRENDS IN ANGIOGRAPHY
Color Doppler Ultrasound (CDUS)
Intravascular-Ultrasound (IVUS)

ANGIOSCOPY
- Carotid angiography
  Magnetic resonance angiography (MRA)

FREE INTRAPERITONEAL FLUID (IPF) ON ULTRASONOGRAPHY: CLINICO-SURGICAL AND PATHOLOGICAL (LABORATORY) CORRELATION

By Dr. Erinle of FMC Bida, Niger State.

OUTLINE OF PRESENTATION

- Objectives of study
- Materials and methods
- Results
- Conclusion

OBJECTIVES OF STUDY

- To highlight sonographically demonstrable causes of free intraperitoneal fluid.
- To ascertain any observable clinico-surgical and /or laboratory correlation with the sonographic diagnosis.

MATERIALS AND METHODS

- Retrospective study
- USS records of patients found to have free IPF on US examination over a 12-Month period from Sept.2001 to August 2002.
- Case files of the patients also studied to obtain information on clinical, laboratory and
operative findings

- Equipment: Siemens sonoline SL1+3.5 MHz linear and 5.0 MHz sector transducers.
- All patients scanned by a Consultant Radiologist, with patients supine.

RESULTS

- Total number of patients with sonographic diagnosis of free IPF = 77, 28 males & 49 Females.
- Age range: 40 days-90 years
- The commonest sonographic causes found were Gynecological, Hepatic and Bowel diseases in decreasing frequencies. Others include Trauma, "Idiopathic" etc. (Table 1)
- The majority of the patients had mild to moderate amount of free IPF on USS (Table 2)
- Majority of the patients who had laboratory tests done had results that supported the sonographic diagnosis especially the 'hepatic' group.
- The Clinical or surgical outcome tend to be better for the Gynaecological and Trauma causes while the reverse seems to be the case with the hepatic causes.

FREQUENCY OF SONOGRAPHICALLY DEMONSTRABLE CAUSES (Table 1)
DEGREE OF FREE IPF IN EACH DISEASE GROUP (Table 2)
LABORATORY FINDINGS CORRELATION (Table 3)
CLINICOSURGICAL OUTCOME (Table 4)

CONCLUSION

- Gynaecological, hepatic and bowel pathology are the commonest sonographically demonstrable causes of free intraperitoneal fluid, producing mainly mild to moderate qualities of such fluid.
- Hepatic causes tend to have more supportive laboratory findings but less successful clinical outcome while gynaecologic and trauma cases tend to have more successful clinico-surgical outcomes.

DETERMINATION OF NORMAL RANGE OF ULTRASONIC SIZES OF PROSTATE IN OUR LOCAL ENVIRONMENT

AUTHORS

1) MARCHIE T.T
DIAGNOSTIC UROLOGY UNIT
DEPARTMENT OF RADIOLOGY
UNIVERSITY OF BENIN TEACHING HOSPITAL
BENIN

2) ONUORA V.C
SURGICAL UROLOGY UNIT
DEPARTMENT OF SURGERY
UNIVERSITY OF BENIN TEACHING HOSPITAL
BENIN

Abstract

- The aim of this study is to determine the range of sizes of prostate gland in the asymptomatic adult males in our local environment using supra-pubic
ultrasonography, in order to determine acceptable range of normal prostate gland dimension.

- Hence three dimensions of sizes of prostate gland, which consist of maximum length, height and width were taken from each subject and the volume calculated.
- The criteria for subjects' selection were those with no complaint, concerning urinary system or sign of urinary tract disease. The following were statistically deducted as normal ranges of prostate gland dimensions in the locality:

**INTRODUCTION**

- The prostate gland is glandular elements that are embedded in a fibro-muscular stroma, and they surround the first part of the male urethra.
- The shape is like an inverted pyramid, of which the base is applied to the neck of the bladder and the apex is below abutting the fascia covering the upper surface of urogenital diaphragm.

**METHOD**

- A random selection of adult male above the age of 18 years
- Who had no history of: frequency, hesitancy, incontinence, haematuria, poor stream.
- No physical sign of an enlarged prostate.
- Were evaluated with gray scale two dimensional ultrasound using medison sonace and siemen machine in two centers.
- Trans-supra-pubic scan using moderately filled bladder as acoustic window.
- Subject in supine comfortable position. p
- Properly visualized prostate gland had the following characteristic, regular with well define outline and slightly hypo echoic uniform parenchyma.
- The evaluations consist of measuring maximum height, length and width of the prostate gland.
- And the scan machine automatically computes the volume of prostate gland.
- The scan probes used are 3.5mHz curvilinear real time array and a sector probe.
- analyzed done with statistical package of social science (SPSS).

**RESULTS**

<table>
<thead>
<tr>
<th>Table 2: Occupations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 3: Age range of respondents</td>
</tr>
<tr>
<td>Table 4: Mean/ Standard Deviation /Median of respondents' age</td>
</tr>
<tr>
<td>Table 5: Longitudinal Diameter (length)</td>
</tr>
<tr>
<td>Table 6: Transverse Diameter (width)</td>
</tr>
<tr>
<td>Table 7: Anterior-posterior Diameter (height)</td>
</tr>
<tr>
<td>Table 8: Volume</td>
</tr>
<tr>
<td>Table 9: Mean/ STD Deviation/ Median of prostate gland dimensions</td>
</tr>
</tbody>
</table>

Prostate gland showing length (longitudinal diameter) =37.32mm

Zoom image of prostate gland on maximum transverse scan

- Statistical analysis of the data showed that among the 74 subjects evaluated, 49 of the men were married and 25 were single, giving percentage ratio of 66.2% and 33.8% (table 1).
Among the occupation alluded to the subjects, the common ones were farmers (21.6%), students (18.9%), teachers (13.5%), artisans (12.2%), and medical workers (12.2%); table2).

81% of the subjects evaluated were within the age of 21 years to 60 years, and highest percentage frequency of 21.6% were seen in age group of 21-30 years and 41-50 years respectively (table3).

The mean age of the subjects were 43.338 years with standard deviation of 15.88 years and median age range of 42.5 years (table4).

Hence the average age range of subjects evaluated were 43.3 to 50.18 years, which is equal to 27.42 to 59.18 years.

The statistical analysis of the measurements showed the following; length ranging from 22.00 mm to 53 mm with highest frequency at 26 mm (table 5).

The mean value for the length is 33.97 mm with standard deviation of 6.52 mm and median value of 34.00 mm (table 9).

The width had range of 26 mm to 54 mm with highest frequency at 41.00 mm (table 6).

The mean value for the width was 41.78 mm with standard deviation of 6.86 mm and median value of 41.00 mm (table 9).

The height had range of 24.00 mm to 51.00 mm with highest frequency at 26 mm and near comparable frequencies at 30, 31, and 32 mm (table7).

The mean value for height was 30.85 mm with standard deviation of 4.47 mm and median value of 31.00 mm (table 9).

The calculated volume of the glands ranges from 13.70 cm3 to 40.6 cm3 (table 8). The mean value was 22.94 cm3, standard deviation of 6.653 cm3 and median of 22.0 cm3 (table 9).

A cross-tabulation analysis of the marital status, ages of respondents to the dimensional measurements and the volume did not show any organize pattern of response.

Discussion

- This study is meant to determine the normal dimension and volume of prostate gland in the normal adult male in our environment.
- The authors are aware of the advances in this area of study, but decided to conduct this study with two-dimensional or B ultrasound scan machine.
- Basically due to unavailability of the other required diagnostic machine in the locality.
- B scan machines with supra-pubic probes are readily assessable to target group (medical practitioners) in the locality.
- No baseline reference values for local assessment of dimension of prostate gland among the adult male.
- Past decade, has shown other non-invasive imaging procedure in evaluation of prostate gland and staging of prostate neoplasia.
- Multi-detector CT-scan with 3 dimensional image reconstruction, MRI with multi-planar plane of scan view and MRI spectroscopy.
- In addition is Trans-rectal sonography (TRUS) with 3 dimensional reconstructions, tissue typing and guided tissue biopsy.
- Use of sonography in prostate gland assessment is the most cost effective mean of evaluation, especially in here where cost is a known limitation in patients' management.
- Thus, the effort to use gray scale supra-pubic B scans sonography in spite of known advances in this area.
It is readily available and proven to be adequate for dimensional measurement.
Can be use to complement the limitation in use of prostate specific antigen (psa) in assessing prostate neoplasia.
The assessment took in to consideration the three-dimensional shape of the prostate gland.
Measures length on the longitudinal scan plane and using it focus point, to get the maximum transverse scan plane of the prostate gland, in other to measure the maximum height and maximum diameter.
The results of the data analysis using SPSS, has shown no remarkable contradiction, when compare to other studies done elsewhere.
There were no contribution of the subject marital status, occupation, and age of patient to the variation in the sizes and volume of the prostate gland among the seventy-four male evaluated.
These were the average dimensions and the volume of the prostate gland, in the normal subjects studied;
The prostate gland has variable dimensions, in the adult cadaver; the average dimensions are about 3cm height, 4cm width and 2.5 cm length. The weight is about 20gram.
Pre-operative dimension of prostate as follows were elicited in caucasian study, length 29-59mm, mean value of 41mm, width 48-80mm, mean value of 52mm, and height of 33-60mm, mean value of 35mm
Nathan et-al in a comparative assessment of prostate volume and dimensions by trans-rectal (TRUS) and trans-urethra (TUUS) sonography suggested
mean value for TRUS as follows length 40.1 8.7mm, height 27.7 7.6mm and transverse diameter of 47.4 6.8mm and volume of 29.4 16.2cm3.
The mean values for TUUS were length 42.3 10.2mm, height 32.7 7.1mm, and transverse diameter of 42.1 7.1mm and volume of 32.6 19.3cm3.
Our local study has suggested a slight lower dimension of normal when compare to values mentioned in these pre-operative dimensions done with different modalities of sonography, from different environment and race.
Hence our study may have produce a good baseline dimensions and volume of prostate gland in our locality, in-spite of our use of supra-pubic sonography.
We are suggesting these reference value as a comparative parameters in assessment of patients with suspicious of prostate gland enlargement.
PRESENTED AT THE 42 ASSOCIATION OF RADIOLOGISTS OF WEST AFRICA ANNUAL CONFERENCE
BY
DR. REMI AJEKIGBE
B. PHARM [HONS] MBBS, DMRT, FMCR, FWACS CONSULTANT RADIOTHERAPIST & ONCOLOGIST LAGOS UNIVERSITY TEACHING HOSPITAL
IDI-ARABA SURULERE LAGOS.

SUMMARY

- Cancer accounts for approximately 8.5% of the 51 million deaths occurring in the world each year.
- Of the estimated 4.3 million cancer deaths, more than half [2.5 million] occurs in developing countries.
- Cancer of the cervix is the 2nd most important cancer among women worldwide; with about 500,000 cases occurring annually.
- The estimated incidence in Nigeria is 250/100,000.
- 25,000 new cases are expected to occur yearly.
- The aim of the study was to identify the sociodemographic characteristics of commercial sex workers in AYILARA, a low income semi-urban area of Lagos State.
- All commercial sex workers [CSW] located in the area were interviewed with a six month period.
- 105 respondents voluntarily accepted to participate in the study.
- Data was collected using PIMPS and LANDLORDS of the CSW.
- Data was analysed using EPI-INFO version 6.4

OBJECTIVES

- To describe the socio demographic characteristics of the high risk group.
- To determine the level of awareness of preventive programmes on cancer of the cervix among the high-risk group.

MATERIALS AND METHODS

- The study was carried out in Ayilara, which is located in Surulere Local Government Area of Lagos State. It is an area with a cluster of commercial sex workers who either reside there for migrate there for business. Quite a lot of them also migrate to other red spot districts like Allen Avenue, Ikoyi and Apapa all within the Lagos Metropolis.
- Data was collected using Pimps and Landlords of the commercial sex workers “CSW”. The interviewers were trained and given financial inducement to participate in the survey. All “CSW” located in the area were interviewed within a six month period. “CSW” who had migrated at the time of the study were left out. In all, 105 respondents accepted to voluntarily participate in the study.
- Data was analyzed using EPI info version 6.4.

RESULTS

- Table 1 showed that 3 in every five of the “CSW” were single, while one in every five were separated. Majority of them were Christians [94.3%]. The mean age of the respondents was 27.94 years while the modal age group was 30 years. Over two-thirds were from the south south zone of Nigeria and four-fifth had attained menarche in their early teens.
[12-14 years old]. Over 70% had an average of 1 to 3 sexual partners per day while the rest had four or more sexual partners per day.

- A high proportion of the respondents consume alcohol. There is a positive statistical association between the consumption of alcohol and smoking as all the respondents who smoke consume alcohol [Table 2].
- The mean age and modal age group at first sexual initiation was 12.7 years and 12 years respectively. There is a positive statistical association between age at first sexual initiation and the consumption of alcohol as all the respondents who do not consume alcohol had early sexual initiation [Table 3].

Table 1: Social demographic characteristics

- Mean Age of respondents = 27.94 years
- Median Age group = 28 years
- Modal age group = 30 years
- Minimum age = 18 years
- Maximum age group = 45 years

Post coital bleeding was reported among 17.1% of the respondents while 6.7% had irregular vaginal bleeding [Table 4].

Table 2: Relationship between Alcohol and Smoking among Respondents

Table 3: Relationship between alcohol intake and age at first sexual initiation

Table 4: Gynecological history and awareness of screening process of respondents on Cancer of the cervix.

Table 5: Source of Awareness of Cancer of the Cervix

DISCUSSION

- The results of this study have revealed that majority of the respondents were from the South South & South-East zones, which may account for the fact that majority of the respondents were Christian as Christianity is a very common religion in both zones in comparison with other religion.
- Almost half of the respondents smoke which further increases their risk of cancer of the cervix as smoking is reported to be an independent risk-factor for cancer of the cervix.
- The mean age of sex-initiation was 12.7 years which also implies a high risk of cancer of the cervix.
- There was also a high percentage of other risk factors as evidenced by 83.0% acceding to a history of past sexually transmitted diseases and 70% reporting an average of 1-3 sexual partners per day.
- In this study only 37.3% of the respondents had heard of cancer of the cervix which is, however, higher than the 15.0% and 4.2% reported in studies in Ibadan and Lagos respectively. It is important to note however, that the target population in the two studies were women attending primary health facilities may not necessarily have same level of risks as commercial sex workers.
- Higher level of awareness were, however, reported in developed countries which may be explained by a probable higher educational level in their study population.
- Only 16.8% of the respondents had heard of pap smear as a method of screening which implies that they are less likely to have undergone the test as evidenced by the fact that only 2.9% had actually had a pap smear test carried out which is similar to finding in another study.
- The main source of awareness about cancer of the cervix was the radio/television which
means that this is an important means of improving awareness about diseases.

CONCLUSION
- In conclusion, only a small proportion of commercial sex workers in Lagos are aware of cervical cancer despite their high risk factor and an even smaller proportion are aware of the available cancer prevention strategies.
- There is need for awareness campaign targeted at commercial sex-workers on their risk of cancer of the cervix and available prevention strategies.

RECOMMENDATION
- It is recommended that is a need for awareness campaign targeted as CSW on their risk of cancer of the cervix.
- They should have information about screening methods which will help reduce the high morbidity and mortality from cervical in a high risk group such as this one.

CEREBRAL TOXOPLASMOSIS IN PATIENTS WITH AIDS:
COMPUTERISED TOMOGRAPHIC DIAGNOSIS OF TWO CASES.

AUTHORS
1. DR KC EZE; MBBS, FWACS, FMCR.
DEPARTMENT OF RADIOLOGY
UNIVERSITY OF BENIN TEACHING
HOSPITAL, (UBTH), BENIN CITY, NIGERIA.

2. DR GOG AWOSANYA, MBBS. FMCR
DEPT OF RADIODIAGNOSIS
LAGOS UNIVERSITY TEACHING HOSPITAL (LUTH), LAGOS

3. DR EMEKA EZE ; MBBS, FWACP.
DEPT OF INTERNAL MEDICINE
DERMATOLOGY UNIT, UNIVERSITY OF BENIN/UBTH, BENIN CITY, NIGERIA.

INTRODUCTION
- Toxoplasmosis is the disease caused by infection with the protozoan organism called toxoplasma gondii.
- Toxoplasmosis is the most common opportunistic infection of central nervous system in patients with Acquired Immunodeficiency Syndrome (AIDS) (1).
- The prevalence rate of cerebral toxoplasmosis in patients with AIDS in United States is 15% which is the same as the prevalence rate of latent toxoplasmosis in the general population showing that the disease becoming prominent in patients with AIDS is due to reactivation of the latent infection in presence of depressed immunity (2).
- Happe et al (3) reported that up to 50% of all patients infected with Human Immunodeficiency Virus (HIV) in Europe develops cerebral toxoplasmosis and even with the therapeutic option available prognosis is still poor.
The prevalence rate of toxoplasma antibodies among pregnant women in Nigeria who are not necessarily infected with HIV was reported by Onadeko et al (4) to be 75%. 

And in another study, Olusuyi, Gross and Ajayi (5) reported that incidence of toxoplasmosis during pregnancy (of those not necessarily infected with Human Immunodeficiency Virus (HIV)) in Nigeria was 43.7%.

The prevalence rate of cerebral toxoplasmosis in patients with AIDS in Nigeria is not known, but since the disease is due to reactivation of dormant toxoplasmosis in the presence of depressed immunity therefore high prevalence rate in normal population means increase prevalence in patients with AIDS.

Positive response when placed on anti-toxoplasma therapy like pyrimethamine or sulfadiazine within one to two weeks is also taken as diagnostic of cerebral toxoplasmosis in majority of cases. Misdiagnosis with stroke is common (6).

Computerized tomography (CT) scan is effective at demonstrating the cerebral toxoplasmosis in AIDS patients which is seen as hypo- or isodense lesion on pre-contrast scan and single or multiple ring enhancement on post-contrast scan with varied degrees of surrounding oedema.

Therefore accurate diagnosis of cerebral toxoplasmosis using CT scan is necessary to avoid preventable deaths in patients with AIDS who develops cerebral toxoplasmosis in this era of wide availability of highly active antiretroviral drugs.

CASE 1

Mr UB, a 57 year old worker with the Ajaokuta Iron and Steel Company in Nigeria, presented to the out patient clinic of University of Benin Teaching Hospital (UBTH) on 4th May 1999 with history of fever of 8 months duration, weight loss of 8 months duration and gradually decreasing level of consciousness of one month duration before presentation.

Other presenting complaint was skin rashes for one month, seizures for four days and loss of consciousness 3 days before presentation.

His problem started about 8 months before presentation when he began to experience recurrent fever.

The fever was of both high and low grade.

He was treated with various anti-malaria drugs at several clinics and hospitals but with persistent recurrence after some remission.

There were associated constitutional symptoms of malaise, anorexia, headache, joint pains, chills, rigor and sometimes vomiting.

At the same time, progressive weight loss was noticed which continued till his presentation to the hospital.

No cough or history of contact with patient with chronic coughing was admitted.

No history of night sweats.

However, about a month before presentation patient noticed non-pruritic skin rashes and his level of consciousness continued to decrease

No history of previous hospital admission.

Patient smokes cigarette occasionally and drinks alcohol (beer) moderately.

No history of chronic illness in the family.

He is married with three children but does not reside with the wife in his working place.
On physical examination patient was restless slipping to coma and waking up intermittently and also convulsed intermittently.

He was moderately pale, not jaundiced not cyanosed, no peripheral lymphadenopathy.

There were generalised maculo-papular rashes at different phases of eruption and healing.

Pulse rate was 83 beats per minute, regular and good volume. Blood pressure was 120/70 mmHg.

Other systemic examinations yielded no significant findings. Patient was subsequently admitted.

On admission, he continued to have seizures.

This was focal and sometimes generalized of the tonic chronic type lasting 30 seconds to 1 minute.

His level of consciousness continued to decrease from Glasgow coma Scale of 13 on admission, to 6 on the fourth day.

A left hemiplegia was noticed on the fourth day of admission.

Serum haemoglobin was 9g/dl; Retroviral screening was done on the day of admission, which proved positive.

This led to a provisional diagnosis of cerebral complication of Acquired Immunodeficiency Syndrome (AIDS).

Cerebral toxoplasmosis was the first suspect. Computed Tomography (CT) scan was ordered.

Pre-contrast scan showed a hypodense lesion in the right basal ganglia adjacent to the right lateral ventricle with mass effect on the adjacent right ventricle and dilatation of the contralateral left ventricle (figure 3.1 A).

Following intravenous contrast injection there was single ring enhancement in the right basal ganglia with surrounding oedema (figure 3.1 B) and multiple ring enhancement (figure 3.1 C) with surrounding oedema.

Figure 3.1: Axial CT scans of brain. Pre-contrast scan (A) showing hypodense lesion in the right cerebral hemisphere (white arrow head) with mass effect and narrowing of the adjacent right lateral ventricles (V). Contrast scans (B) show single ring enhancement (single black arrow), and multiple ring enhancements (curved white arrow) at different slice level (C) and with surrounding oedema and narrowing of the adjacent ventricles (V) due to cerebral toxoplasmosis abscess in a patient with AIDS.

Trans- abdominal ultrasonography using real time B- mode two-dimensional Sonace 1500 scanner with 3.5 MHz curvilinear probe was done and showed normal findings.

The CD4 count was not done because the test was not yet available in the hospital or any nearby center at that time. Magnetic resonance imaging (MRI) is not available in our centre and thus was not done.

Cerebral tissue biopsy with or without CT guide was not done because of lack of appropriately trained personnel and inadequate facilities.

Patient was treated with full doses of Dexamethasone, cotrimoxazole, clindamycin and pyrimethamine and made steady rapid progressive recovery within one week.

Clearing of skin rashes, resolution of seizures and rapid improvement from the hemiparessis and hemiplegia was noticed. Patient was discharged to the out patient clinic three weeks after admission and to physiotherapy clinic.

Patient is attending clinic on a regular basis since then and is well and free of symptoms.
CASE 2

Mrs IS, a 58 years old Secretary in a private company in Benin City, presented to the Accident and Emergency department of University of Benin Teaching hospital on 24th of May 2002 with six month history of fever, weight loss, skin rashes and two weeks history of seizures and weakness of the left side of the body. Her problem started about 6 months before presentation when she noticed that she was having recurrent fever.

- The fever was low grade, associated with chills and rigor and occasionally it was high grade.
- There was associated progressive weight loss, profuse watery diarrhoea, which was on and off for about three months.

She also developed generalized maculo-papular non-pruritic rash for which she had been treating on self-medication.

There was no history of chronic cough or night sweats or contact with a person with chronic cough. She is married with three children.

- Husband is alive and healthy.
- She does not drink or smokes and there is no history of hypertension, diabetes mellitus, sickle cell disease or asthma in the family.
- On examination she was febrile to touch, moderately pale, had oral candidiasis and severe left hemiparesis.
- She also had papilloedema and dilated pupil and generalised maculo-papular rashes at different phases of healing and eruptions.

- Pulse was 80 beats per minute, regular and good volume.
- Blood pressure was normal at 110/70 mmHg.
- Human immuno deficiency virus (HIV) test was done and was positive.
- Serum Haemoglobin was 9g/dl; erythrocyte sedimentation rate (ESR) was 50 mm/hour.

- The CD4 count was not done because the test was not yet available in the hospital or any nearby centre at that time.
- Patient was admitted as a case of Retroviral infection with possible space occupy lesion.

- A provisional diagnosis of Cerebral Toxoplasmosis was made to rule out central nervous system lymphoma.
- In the ward she continued to have seizures of the tonic chronic generalized type lasting for one to 2 minutes.

- Her level of consciousness decreased from Glasgow coma Scale of 13 on admission to 6 after one week.
- Cranial CT scan was done which showed hypodense areas at the right cerebral hemisphere close to the falx cerebri at the region of basal ganglia, with compression of the adjacent right lateral ventricle and dilatation of the contralateral left lateral ventricle on pre-contrast scan (figures 3.2 A and B).

- With contrast enhancement there was a hypodense region in the right basal ganglia with marginal ring enhancement of the lesion (figures 3.2 C and D). Chest x-ray was normal.
- Trans- abdominal ultrasonography of the abdomen using real time B- mode two dimensional Sonace 1500 scanner with 3.5 MHz curvilinear probe showed normal findings. Magnetic resonance imaging (MRI) was not available in our hospital or any nearby center at that time and thus was not done. Cerebral tissue biopsy with or
without CT guide was not done because of lack of appropriately trained personnel and inadequate facilities.

- A diagnosis of cerebral Toxoplasmosis was made to rule out central nervous system lymphoma.
- Patient was commenced on parenteral full doses of Dexamethasone, Pyrimethamine, Clindamycin and broad-spectrum antifungal agent.
- Patient recovered rapidly within 1 week.
- Seizure stopped.
- She gradually recovered from hemiparesis and with the aid of physiotherapy she was back on her feet within three weeks and was discharged to the out patient clinic for further care.
- Patient visited the clinic for six months after discharge and was in good health.

**DISCUSSION**

- In Nigeria and other developing countries, the true prevalence rate of cerebral toxoplasmosis is not known due to high level of under-reporting caused by lack of optimal use of the few available radiological modalities like computerized tomography scan, cost, lack of facilities for cerebral tissue biopsy and socio-cultural practice that make people to refuse autopsy on their diseased relatives (1-6).
- There is a decreasing trend of opportunistic diseases like cerebral toxoplasmosis in patients with AIDS who adhere strictly to antiretroviral therapy and prophylaxis (7).
- Kumarasany et al (8) reported mean survival age of 20 months in those who develop cerebral toxoplasmosis remain untreated unlike the treated patients who can live in excess of 15 years.
- The presentation of cerebral toxoplasmosis is variable including focal neurological deficit usually sub acute seizures and signs that may be attributable to cerebral tumours like headache, movement disorder and altered level of consciousness including coma, and signs of stroke (6,8).
- The disease is due to reactivation of latent infection of *Toxoplasma gondii* (1,2,3). On computed tomography pre-contrast scans it has various appearances.
- It can be normal.
- It can appear as single or multiple areas of isodense or hypodense focal lesion with evidence of surrounding oedema, which may variably compress the adjacent ventricles, (figures 3.2 A and B).
- They can also be seen as multiple isodense or hypodense lesions with thin-walled ring enhancement.
- Solitary lesions are seen in up to 39% of cases.
- Multiple or solitary dense nodular lesion may also occur.
- Non-enhancing focal oedema may be seen.
- High detection rate are better seen after double dose of contrast enhancement.
- The lesions are seen especially located in basal ganglia, also scattered throughout in brain parenchyma at gray-white matter junction.
- Cerebral atrophy with dilatation of gyri and prominent sulci can be seen and is of poor
prognosis (3, 9, 10).

- Multiple or single ring-enhancing lesions at gray-white matter junction in a patient with AIDS are characteristic of cerebral toxoplasmosis but not specific (figure 3.2 B and C).
- Biopsy of cerebral tissue and histology are required for conclusive diagnosis (9, 10) but cerebral tissue biopsy is unavailable in our centre due to lack of facility and appropriately trained manpower.
- Improvement of patient with AIDS who develops cerebral toxoplasmosis when placed on therapy with pyrimethamine or sulfadiazine within one to two weeks is also taken as diagnostic of cerebral toxoplasmosis (1, 2, 3, 7-10) as in these two cases presented.
- At the time of presentation of this cases CD4 cell count was not yet available in our centre.
- Magnetic resonance imaging (MRI) where available will show sub insular or peritrigonal hyper intense area and is better at showing subtle signs of cerebral, cerebellar and brain stem atrophy.
- MRI may show changes in most AIDS patient and some of these changes are thought to be due to direct action of HIV virus (7).
  - Magnetic resonance spectroscopy, single photon emission computerised tomography (SPECT) and positron emission tomography (PET) have been used in cerebral infection in patients with AIDS, the result yielded high sensitivity but low specificity making them yet unacceptable for clinical practice, and none of them is available in our center.
- Persistent ring enhancing lesion on CT scan after treatment has been advocated as a sign of recurrence and rescan is advised by some authors after two weeks of treatment (6-10).
- Our patient recovered completely without residual symptom and needed no repeat scan at that time.
- The differential diagnosis of cerebral toxoplasmosis is mainly from lymphoma and it may be difficult to differentiate the two but multiple ring enhancing lesion and response to antitoxoplasmisis drugs like pyrimethamine and sulfadiazine after two weeks of treatment is taken as diagnostic of toxoplasmosis (1, 2, 3, 7, 10).
- Cerebral tuberculosis has multiple nodular or ring lesions scattered within the brain and enhances in cerebral toxoplasmosis but the lesion in cerebral tuberculosis are smaller in size and are more likely to calcify and not all cases will have signs of pulmonary tuberculosis in chest radiographs.
- In every case where facilities are available cerebral tissue biopsy with or without CT guide and histology of specimen should still be done to diagnose or exclude multiple opportunistic infection like cerebral tuberculosis, cryptococcus and cryptosporidium.
  - Histology is also required in order to accurately differentiate between cerebral toxoplasmosis and lymphoma or even where both co-exist since patients with AIDS are more likely to develop cerebral lymphoma and patients with lymphoma (including those living with AIDS) are more likely to develop central nervous system opportunistic infection due to depressed immunity, as complication, including cerebral toxoplasmosis (1, 3, 5, 7, 8).

CONCLUSION

- Two patients living with AIDS who developed cerebral toxoplasmosis demonstrated by CT scan is presented.
  - Resolution of symptoms followed appropriate drug treatment.
  - Effective use of available radiological facilities in developing countries will help in accurate diagnosis of treatable complications of AIDS and other diseases.
This presentation is also to highlight the problems of making accurate diagnosis in the developing countries.

REFERENCES


INTERSTITIAL BRACHYTHERAPY: Current needs, Constraints and Prospects in the West African sub-region

By Dr. Adewuyi

INTRODUCTION

- This presentation on Interstitial Brachytherapy: “Current needs, Constraints and Prospects in the West African sub-region” focuses on the overarching factors that will impact on Radiotherapy practice and research in the next decade.
- While this analysis has a Nigerian orientation, it equally recognizes that radiotherapy and related sciences have become global in both their clinical and industrial contexts.
- The Impact of Demographic Changes on Radiotherapy shows that in the next 20 years, the elderly are likely to become major consumers of health care and radiotherapy services.
However, faced with fiscal exigency, governments at all levels have looked to achieve savings by reducing capital spending on certain aspect of technology.

- Cutbacks in training positions are now coming to be seen as shortsighted as human resource shortages are compounded by the decaying technological infrastructure that makes recruitment and retention difficult.

- Society and health-care policy makers must recognize the need to plan for an increased capacity for radiotherapy in the future. There is an urgent need to repair the results of years of under funding of capital investment and infrastructures in West African radiotherapy hospitals and clinics.

- Facilitate cost-effective technological innovation. Health-care funding, including capital cost amortization, needs to be stable and predictable, and independent of political uncertainties.

- Similarly, there must be a focus, within a regional context, on future directions in health care and its delivery, as well as on clinical demands, patients’ needs and trends, changes in disease prevalence and demographics.

The purpose was to:

- Examine the status quo;
- Identify any deficit in enabling technologies;
- Provide a context for developments;
- Show how technology could enhance the quality and timeliness of patient care;
- Facilitate planning by public and private policy makers.

- A characteristic of populations in developed societies in 2000 is the relatively high proportion of elderly people. It is useful to reflect on current demands for service in relation to population demographics, and then to project these into the future based on forecasted global, regional and national population trends.

- According to United Nations’ data concerning the 1999 global population, Japan, Western Europe and the United Kingdom presently have 20-24% of their populations over the age of 60. In North America, China, Russia, and Australia, the percentage of people over age 60 ranges from 10-19%, while in the under-developed countries it is estimated to be from 0-9%.

- Trends in World Population Demographics United Nations’ data indicate that by the year 2050 Canada, Eastern and Western Europe, Russia, and China will have greater than 30% of their population over 60 years of age. The U.S. and Australia will have 25-29% of their population in this category, while South America, India, and the Middle East will have 20-24%. Most of Africa will have between 0-19% of their population over 60 years of age.

- The fiscal climate in which medicine is practiced in Nigeria inhibits change, innovation, and the application of cost-effective technology. If this situation and the rigid perpetuation of specialty boundaries persist, medicine, and the public, will suffer as innovation is stifled and cost-effective change is inhibited.

- A recent assessment reveals a severe and escalating national/regional shortage of radiotherapists. This shortage amounts to some 15 or less radiotherapists nationwide. In this context, the depleted and decaying technology inventory in the region does not help.

- The goal of radiation therapy is to kill the cancer while sparing normal tissue. This means using large doses of radiation that must be accurately known and precisely delivered to the tumor.

- A silent crisis in cancer treatment persists in developing countries and is intensifying every year. At least 50 to 60 per cent of cancer victims can benefit from radiotherapy but
most developing countries do not have enough radiotherapy machines or sufficient numbers of specialists.

- Meeting the challenge is not simply a matter of providing appropriate equipment. There must be sufficiently trained and knowledgeable staff. Appropriate facilities and radiation protection infrastructure for monitoring and regulatory control are needed.

- According to International Atomic Energy Agency (IAEA), over half of the 10 million people diagnosed with cancer worldwide each year live in developing countries. The World Health Organization foresees a doubling of cancer cases in the developing world over the next 10 years, from just over five million today to 10 million in 2015.

- “The growing cancer crisis in the developing world can be traced to people living longer, changing lifestyles, un-hygienic living conditions and other important factors”. This crisis is predictable and, to some degree preventable, depending on how well we start to manage it now.

- The developing countries have very low ratios of machines per population, often one machine for several million people, versus a ratio of one machine per 250,000 inhabitants, which is typical of most developed countries.

- The establishment of interstitial brachytherapy facility involves staff training, programmes and equipment specification, equipment procurement, designing protocol and procedure manuals, and developing quality control programmes e.t.c. before initiating the treatments.

- Typically, about five years are needed to complete all phases. Evidences abound that the IAEA has addressed the enormous task of upgrading antiquated services that were present in former Soviet Union and former Yugoslavian countries with the objective of providing safe, effective therapy. This can equally be done in our environment.

- If I may quote an expert: “There are insufficient facilities and qualified staff to adequately treat the victims of cancer in the developing world today. The IAEA supports the provision of radiotherapy equipment, training, quality assurance and maintenance in developing countries”. Ana María Cetto, Head of the IAEA Department of Technical Co-operation.

- Radiotherapy treatment requires highly trained personnel in a variety of interrelated disciplines. Indeed, the most important component of any radiotherapy programmes is qualified personnel. Investment in equipment without concomitant investment in training is dangerous. It is important that training is comprehensive and teamwork amongst various specialists and supporting staff is enhanced.

- Clinical conditions that require interstitial brachytherapy are very prevalent in our environment, for example Head & Neck cancers and prostate cancers. Like in other developing countries in Africa and Asia, the presentation is usually a late presentation. •In view of the changes in the concept of patient management from disease management to a holistic approach, it becomes paramount that the quality of life of any patient should be improved whether the disease is curable or otherwise.

- It is this desire to improve the quality of life of the patients that this particular aspect of cancer care i.e. Interstitial Brachytherapy is being considered and presented. I do believe that at the end of this presentation, the house will agree that we need to look towards the availability of this facility and mode of treatment.

- Obviously to establish a functional cancer center with facility for interstitial brachytherapy, the needs are enormous and the constraints apparently appears insurmountable.

- Thanks to the Nigeria nuclear regulatory authority and the various centers for energy research across the country that are up and doing.
CURRENT NEEDS

Interstitial brachytherapy has a role to play definitely in cancer management.

1. As the sole treatment modality: It can be used as the primary treatment modality in early stage cancers of the skin, tongue, lip, and other H & N cancers. The advantages of this are shorter duration of treatment, relative sparing of normal adjacent tissues and increased therapeutic ratio.

2. As a boost: This is probably one of the major reasons for interstitial brachytherapy. Because of adjacent normal structure, and the penetration of mega voltage beams, teletherapy doses have limits to minimize the risk of late complication. For better tumour control, interstitial brachytherapy is the only alternative left.

3. Recurrent tumour: In the situation where there is recurrent tumour and additional teletherapy doses cannot be administered due to adjacent normal tissues and surgery is not feasible, recurrent tumour is best treated with interstitial brachytherapy especially in the H & N, and prostate cancers.

4. Palliative care: In presence of symptoms like pain, as a result of tumour in a clinical condition where patient is not fit for radical treatment/curative care due to some other medical condition or disease is to advanced, interstitial brachytherapy could be use to palliate this group of patients.

5. Adjuvant Post-operative brachytherapy: If the surgical margin is microscopically involved or grossly < 5mm, the incidence of local recurrence is extremely high.

6. Intra-operative brachytherapy: When the pre-operative assessment suggests that the surgical margins are likely to be unsatisfactory, brachytherapy applicators may be placed intra-operatively in the region of the cut-through, e.g. the carotid artery and the base of skull. The applicators must be separated from the skin and mucosal surfaces by an adequate thickness of soft tissue, and the suture line must not be under tension.

MOUTH AND OROPHARYNX

- It can be through an applicator, implant or remote after loading technique and the isotopes used are Iodine-125 seeds, Iridium-192 wire (LDR or HDR source).
- An applicator can be used to treat rigid structures (hard palate, alveolus, floor of mouth) as a single plane where the depth to be treated does not exceed 5-7mm.
- Thus the activity require for a specific dose given over a specific time can be calculated for this area and depth. Knowing the activity of the I-125 seed/1r-192 wire, the number of seeds/length of wire is determined and evenly distributed over the area, and covered with ash metal/Pb to protect adjacent tissues.
- An implant is used to treat mobile structures such as the tongue, soft palate, tonsil, buccal mucosa and floor of mouth and may be a single plane or volume implant.
- The volume to be treated is calculated from the dimensions of the tumour and a margin 5-10mm, depending whether it is a boost or total treatment.
- The activity of I-125 required to give a specific dose in a certain time to this volume is calculated and divided by the activity of each seed to give the number of seeds require. As the seeds will be placed in tubes 1cm apart, the number and length of tubes can be
ascertained and thus the number of seeds per tube calculated.

**Intra-Oral I-125 implants** using curved needle.

**Floor of mouth (superficial):** single plane, 1 cm apart.
- Tongue < 1 cm thick - circles, 1 cm apart
- Buccal mucosa: single plane or volume implant, straight or curved - Volume: posterior-straight
- Soft Palate: Single plane - anterior - straight - Volume: - posterior and curved to include pillars of fauces ± Nasal tubes if soft palate thick

**Submental/Submandibular I-125 Implants**

- Posterior tongue, large tumour of the lateral tongue and floor of the mouth: Volume implant with loops of I-125 trains, 1 cm apart via straight introducers through SM region.
- Tongue/tonsil - As above with a separate plane of 3 tubes just lateral to the tonsil.
- The low energy of I-125 permits the shielding of gums and palate with ash metal dentures and also staff protection.
- Iridium-192 implant is the treatment of choice for the soft palate and tonsils as the thin wire (0.3 mm) is more comfortable than the plastic tube for I-125 seeds and no shielding is possible at the back of the mouth. The disadvantage is the staff exposure at insertion, removal and nursing.
- The number and length of Ir-192 wires are calculated from the position and size of tumour.
- AP and lateral x-rays are taken and the position of points on the wire digitized in together with the activity and the isodoses calculated. Dose: same as I-125.

**EYELIDS**

**Eyelid implant**
- Indication: Extensive BCC or Squamous Ca., Malignant melanoma or Adenocarcinoma.
- Role: Post op or sole treatment
- Advantages -? Higher RBE, lower OER, shorter treatment time.
- Disadvantage eyelid swelling

**EYE**
- Malignant melanoma of the uveal tract choroids ciliary body, iris, can be treated conservatively with surgery, proton therapy, I-125 or RU-106 implant.
- Malignant melanoma: Plaque usually larger than for retinoblastoma.
- Dose 60-80 Gy to the apex in 5 days.

**ORBIT**
- Lacrimal gland carcinoma: Excision + RT. Size of plaque determined from pre-op CT scans. Plaque inserted immediately after tumour removed by lateral orbitotomy, to treat tumour bed.
- Dose: 35 Gy in 3-4 days followed by external beam RT. 35 Gy in 3.5 weeks. Alternatively, protons + neutrons.

**IODINE-125 PLAQUES**
ADVANTAGES:
- Custom built flexible system,
- Protection of Staff and surrounding structures
- Low energy, 27–35KeV.
- Short treatment time.

INDICATIONS FOR WHOLE EYE IRRADIATION
- Large tumours,
- Multiple tumours,
- Vitreous seeding,
- Localized retinal detachment,
- Vision present and a chance of cure.

- Problem with EBRT is 4 weeks of daily treatment, which may require sedation or GA.
- Late complication with EBRT:
  - Cataract,
  - Dry eye,
  - Cosmesis,
  - Dental problems,
  - Second non-ocular malignancy.

- Whole eye applicator “claws” developed in Cape Town by Sealy has a better advantages compared with external beam RT e.g.
  - Avoid dry eye,
  - Better cosmetic result as no impaired growth of facial bones,
  - No growth retardation,
  - Shorter treatment time.
  - Less chance of 2” non-ocular malignancy.

ORBITAL IMPLANT
- Because of the disadvantages of EBRT, Sealy designed an implant to irradiate the orbit using I-125 seeds in tubes with protective “gutters” to reduce the dose to the bony orbit.

ORBITAL IMPLANT POST-ENUCLEATION
  Indication: retinoblastoma with deep choroidal/sclera/nerve involvement.
  Advantages
  - Protection of eyelid and orbit,
  - Improved cosmetic result,
  - Short treatment time.

CONSTRAINTS
- A. Availability of Interstitial Brachytherapy Sources
- B. Availability of trained personnel
- ? Radiation Oncologist
- ? Medical Physicists
Nigeria like other West African Countries is a developing country, and the level of technological advancement is still at an early stage. These required sources are yet to be made within the country but there is hope with the commissioning of some of the Energy centers within the countries.

Even now, interstitial brachytherapy can be done by importation of the sources only that it will be very expensive compared to if sources with their specification can be made within the country. These sources have to be calibrated, identified, encapsulated etc. The assistance of the IAEA must be sought in this respect.

PROSPECTS OF INTERSTITIAL BRACHYTHERAPY

- PRIMARY TUMOURS (HEAD & NECK)
  - T1-2: Surgery or Radiotherapy (incl. Brachytherapy, if appropriate)
  - 3-4, resectable: Surgery and Radiotherapy, or chemotherapy and Radiotherapy (incl. Brachytherapy, if appropriate).
  - Unresectable: chemotherapy and Radiotherapy, then Surgery (incl. Brachytherapy, if appropriate).

- NECK NODES
  - N0-N1: Surgery or Radiotherapy
  - N2-N3: Surgery and Radiotherapy, or Chemotherapy and Radiotherapy (? and Surgery)
  - Fixed neck nodes: Chemotherapy and Radiotherapy, then Surgery (incl. Brachytherapy if appropriate).

BRACHYTHERAPY IN HEAD & NECK CANCERS

AIMS/INDICATIONS
- Sole treatment for early cancers.
- Boost treatment after teletherapy or chemo radiotherapy for moderately advanced cancers.
- Boost treatment for Nasopharyngeal cancers
- Adjuvant post operative brachytherapy
- Intra-operative brachytherapy.

IMPLICATION
- Adding a brachytherapy boost after teletherapy can decrease the local recurrence rate to < 10%, at least for stages T1 – T3, even without Chemotherapy (vs. > 30% in the intergroup trial).

BRACHYTHERAPY (Other Sites)

<table>
<thead>
<tr>
<th>One plane</th>
<th>Volume</th>
<th>Intraluminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Keloids</td>
<td>Breast</td>
<td>Oesophagus</td>
</tr>
<tr>
<td>Sarcoma</td>
<td>Prostate</td>
<td>Bronchus</td>
</tr>
<tr>
<td>Bladder</td>
<td>Rectum</td>
<td>Intravascular</td>
</tr>
<tr>
<td>Intraoperative</td>
<td>Brain</td>
<td></td>
</tr>
</tbody>
</table>
CONCLUSIONS AND RECOMMENDATIONS

- A number of influences have been described which suggest an increasing demand for Interstitial Brachytherapy. These include, but are not limited to, demographic factors, technological evolution and, not least, changes in the very nature of medical practice.
- West African hospitals and clinics enter the 21st century with limited inventories of often-obsolete equipment. This is a handicap, which will, unless corrected, represent a hidden deficit to be passed on to our descendants.
- Interstitial Brachytherapy technology has enormous potential to contribute to the improvement of health care in this new century and will, no doubt, have the power to contribute to solving some of the financial pressures, which also beset health care.

To address these deficiencies, I wish to make the following recommendations:

1. West African countries must become aware of the prospects and opportunities in the use of interstitial brachytherapy. These opportunities increasingly depend upon technologies (e.g. making of therapy isotopes) other than those primarily involved with in teletherapy.

2. Society and health-care policy makers must recognize the need to plan for an increased capacity for radiotherapy in the future. There is an urgent need to repair the results of years of under funding of capital investment and infrastructures, and strategies to retain and repatriate (voluntary) African radiotherapists need to be developed.

3. The health-care system needs to develop budgetary tools and financial systems that permit and facilitate cost-effective technological innovation. Health-care funding, including capital cost amortization, needs to be stable and predictable, and independent of political uncertainties.

A 5 YEAR AUDIT OF MYELOGRAPHIC FINDINGS IN PATIENTS WITH SPINE RELATED DISEASES REFERRED TO A PRIVATE RADIOLOGICAL OUTFIT IN SOUTH-EASTERN NIGERIA.

AUTHORS: DRS: DRS. MGBOR SO* IMO AOC** ONUH AC* AND MEZUE***

* Dept. of Radiology UNTH Enugu
** Dept. of Radiology EBSUTH Enugu
*** Dept. of Neurosurgery UNTH Enugu

** All correspondence to Dr. Imo.

2. MATERIALS & METHOD:

This is a retrospective reviews of all referred patients from different parts of South-Eastern Nigeria especially the tertiary health institutions who had myelography done for one or other spine related condition from 1995-2000. Most of the examinations were done via lumbar puncture in a sitting position using a disposable lumbar puncture needle of about 20-22G in aseptic technique.
RESULTS:

The results were quite revealing as shown in the tables below.

**TABLE 1: AGE & SEX DISTRIBUTION OF PATIENTS:**

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Male (%)</th>
<th>Female (%)</th>
<th>Total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 9</td>
<td>1 (0.9)</td>
<td>2 (1.8)</td>
<td>3 (2.7)</td>
</tr>
<tr>
<td>10 - 19</td>
<td>3 (2.7)</td>
<td>2 (1.8)</td>
<td>5 (4.5)</td>
</tr>
<tr>
<td>20 - 29</td>
<td>5 (4.5)</td>
<td>4 (3.5)</td>
<td>9 (8.0)</td>
</tr>
<tr>
<td>30 - 39</td>
<td>16 (14.3)</td>
<td>7 (6.3)</td>
<td>23 (20.6)</td>
</tr>
<tr>
<td>40 - 49</td>
<td>32 (28.6)</td>
<td>7 (6.3)</td>
<td>39 (34.9)</td>
</tr>
<tr>
<td>50 - 59</td>
<td>10 (8.9)</td>
<td>3 (2.7)</td>
<td>13 (11.6)</td>
</tr>
<tr>
<td>60 - 69</td>
<td>11 (9.8)</td>
<td>3 (2.7)</td>
<td>14 (12.5)</td>
</tr>
<tr>
<td>70 - 79</td>
<td>3 (2.7)</td>
<td>2 (1.8)</td>
<td>5 (4.5)</td>
</tr>
<tr>
<td>80 - 89</td>
<td>1 (0.9)</td>
<td>0 (0)</td>
<td>1 (0.9)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>82 (73.2)</strong></td>
<td><strong>30 (26.8)</strong></td>
<td><strong>112 (100)</strong></td>
</tr>
</tbody>
</table>

M : F = 2.7 : 1

**TABLE 2: SOURCE OF REFERRALS:**

<table>
<thead>
<tr>
<th>S/No.</th>
<th>Hospitals</th>
<th>No. of Patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Teaching Hospitals</td>
<td>76 (67.9)</td>
</tr>
<tr>
<td>2</td>
<td>Private Hospitals</td>
<td>18 (16.0)</td>
</tr>
<tr>
<td>3</td>
<td>General Hospitals</td>
<td>2 (1.8)</td>
</tr>
<tr>
<td>4</td>
<td>Others</td>
<td>16 (14.3)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>112 (100)</strong></td>
</tr>
</tbody>
</table>

**TABLE 3: REGIONAL EXAMS BASED ON CLINICAL DIAGNOSIS:**

<table>
<thead>
<tr>
<th>Region</th>
<th>Frequency (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical</td>
<td>12 (10.7)</td>
</tr>
<tr>
<td>Cervical/Lumbar</td>
<td>2 (1.8)</td>
</tr>
<tr>
<td>Cervical/Thoracic/Lumbar sacral</td>
<td>3 (2.7)</td>
</tr>
<tr>
<td>Thoracic</td>
<td>6 (5.3)</td>
</tr>
<tr>
<td>Thoracolumbar</td>
<td>3 (2.7)</td>
</tr>
<tr>
<td>Thoracolumbo sacral</td>
<td>16 (14.3)</td>
</tr>
<tr>
<td>Lumbar</td>
<td>55 (49.1)</td>
</tr>
<tr>
<td>Lumbosacral</td>
<td>15 (13.4)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>112 (100)</strong></td>
</tr>
</tbody>
</table>

**TABLE 4: FINDINGS ON MYELOGRAM**

<table>
<thead>
<tr>
<th>Lesions</th>
<th>No. of Patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Extradural Lesions (sol) with cord compression</td>
<td></td>
</tr>
<tr>
<td>- Disc herniation</td>
<td></td>
</tr>
<tr>
<td>- Tb Abscess/Spondylodicitis t</td>
<td></td>
</tr>
<tr>
<td>- Spondylolisthesis</td>
<td></td>
</tr>
<tr>
<td>- Spinal Stenosis</td>
<td></td>
</tr>
<tr>
<td>- Metastases</td>
<td></td>
</tr>
</tbody>
</table>
(B) Intradural Extramedullary lesions (SOL) - 9 (8.03)
(C) Intramedullary lesions - 5 (4.46)
(D) Normal findings - 33 (29.46)
(E) Inconclusive - 3 (2.67)

- Many patients presented with more than one lesion
- Most disc herniations occurred in the lumbosacral region
- Spinal Stenosis were seen in the cervical and lumbar regions - This is in agreement with findings in the literature
- Most of the patients seen were between 30-50 years of age the age of great activity and the commonest lesion was disc herniation
- The SOL were more common in the cervical & thoracic regions.
- Extradural lesion with cord compression occurred mainly in the cervical & thoracic region. This is most likely due to the small spaces involved in these regions.

### Conclusion

For effective and efficient health care delivery, our tertiary health institutions nation wide should be adequately equipped to handle these spinal pathologies. This will ensure prompt and proper evaluation of these patients and definitely reduce the mobility and mortality associated with these conditions.

---

**CARDIOTHORACIC RATIO IN FRONTAL CHEST RADIOGRAPHS OF A NORMAL ADULT NIGERIAN POPULATION**

**EN OBIKILI, IJ OKOYE, AC UDE & BC UMERAH**

**Introduction**

- The advent of echocardiography, CT and MRI has made it possible to accurately evaluate heart dimensions.
- These newer modalities may not be readily available or affordable.
- On the contrary, chest radiography is readily available and affordable. It still remains the most commonly used modality for the evaluation of cardiothoracic ratio Kono et al 1992
- A chest radiograph may not provide the specific diagnosis of a cardiac disease but it may indicate its nature or severity.
- Danzer was the first to suggest a cardiothoracic ratio of 50% or less as normal. This value is commonly used by many authors as the upper limit of normal
- Although the CTR is influenced by many factors, it is still valuable and convenient.
- Its convenience lies, among other things, in the fact that it is easily calculated from measurements obtained from a single frontal chest radiograph.
- What is needed to enhance CTR usefulness is to establish age, sex and body physique specific normal standards for different races.
There is paucity of studies on heart dimensions of Africans in comparison with studies on Caucasians.

Few studies have established age, sex and body physique specific values for CTR.

Normal standards available for evaluation of CTR in our environment are often based on studies carried out on Caucasians. Ashcroft and Miall1969 indicated that there are racial differences.

Our study was done to improve the definition of normal limits of cardiothoracic ratio of adults in our environment.

Materials & Methods

- The subjects studied were individuals referred to the Department of Radiation Medicine, UNTH for routine chest radiographs.
- They included new employees who came for pre-employment routine chest radiograph, and individuals who needed routine medical examinations for visas or surgery.
- The age, sex and indications for the chest radiographs were obtained. Hypertensive subjects were excluded.
- The ages of the subjects ranged from 20 to 93 in males and 20 to 80 in females.
- The focus film distance was 2 metres. At this distance projection distortion is minimal and consequently the magnification is about 5%.
- Only good quality standard posteroanterior chest radiographs were studied. The criteria formulated by Kabala and Wilde 1987 were used to exclude radiographs with inadequate inspiration, hyperinflated lung fields, significant rotation deformity of chest wall.

Measurements

- The transverse cardiac diameter (CD) was measured as the sum of the maximum extensions of the heart to the left and right of the midline.
- The transverse thoracic diameter (TD) was measured from the internal surfaces of the ribs above the costal attachments of the diaphragm at the point where the chest diameter was greatest.

Body mass index (BMI) = \( \frac{W}{H^2} \)

Body surface area (BSA) = \( W^{0.425} \times H^{0.725} \times 0.007184 \)

Results

- Table 1 shows the means of the CTR of 157 males and 146 females studied.
- The mean values for the 20-39, 40-59 and 60 year-old males were 45.2, 47.8 and 49.4% respectively. The corresponding values for females were 45.6, 49.4, and 54.4%. Females had larger CTR than men.
- CTR increased with age. In both sexes the increase with age was statistically significant between the 20-39 and the 40-59 age groups, \( p <0.001 \) while between the 40-59 and the 60 year-old age groups, it was significant in females, \( p <0.001 \), but not in males.

Table 2. Correlation of cardiothoracic ratio with age, weight, height, body mass index (BMI) and body surface area (BSA) of males and females

- As shown in table 2, the correlation of cardiothoracic ratio with age was more marked in females than in males.
- The CTR had a significant negative correlation with height in both sexes especially in males. It was not significantly correlated with weight.
Table 3. Proportion of males and females that have cardiothoracic ratio greater than 50%.

- Table 3 highlights the proportion of males and females that had CTR greater than 50%. The proportion increased with age and was higher in females than in males.
- In the 20-39 age groups, 4.6% of males and 14.8% of females had CTR ratio greater than 50%. In the 60 years of age and above the proportion was 46.2% for males and 70% for females.
- With an upper limit of 53%, the proportion of males and females below the age of 60 that would exceed it would be between 0 and 7.1%.
- For the 60 year-old and above, the proportion would be 15.4% for males and 70% for females.
- Even if the upper limit of normal were raised to 55%, 15.4% of males and 40% of females in the 60 year-old and above age group would exceed this value.
- At an upper limit of 60% even though the proportion for males would be zero that for females would still be 20%.

Table 4. Comparative data on cardiothoracic ratio (%) of males and females by various authors.

Figure 2: Cardiothoracic ratio (%) of males and females by race as reported by various authors. Nickole and Wade 1982

- Table 4 and figures 2-4 highlight comparative data on the cardiothoracic ratio of males and females as reported by various authors.
- A comparison with the study done by Nickol and Wade 1982 showed that the cardiothoracic ratio in the present study was similar to the values reported for Africans but statistically higher than those for Caucasians (p<0.001) and Asians (< 0.05 for Asians).

Figure 3. Cardiothoracic ratio (%) of adult males and females as reported by various authors

- Figure 3 shows comparative data on CTR ratio of young adult males and females. The CTR in the present study was similar to the values reported for African-Americans and Jamaicans but statistically higher than those reported for American Whites and the British (p<0.001 for males and 0.05 for females).
- In the older adults, the CTR was also similar to the values reported for Jamaicans and higher than those reported for the British. The differences between the Nigerian and British values were statistically significant in males p < 0.05 but not in females.

DISCUSSION

- CRT of males in the 20-39, 40-59 and 60 year-old age groups were 45.2%, 47.8% and 49.4% respectively. The corresponding values for females were 45.6%, 49.4% and 54.4%.
- The ratio increased with age in both sexes but was more marked in females than males. At all age groups, females had larger cardiothoracic ratio than males. But the sex difference was significant only in the 60 year-old age group.
- These findings corroborate the work of Oberman et al.
- Oberman et al reported that women have higher mean CTR than men.
- Since in their study, men had larger cardiac diameter than women, the higher CTR in women was due to their smaller thoracic diameter.
- They also noted that in the middle and later years, the increase in cardiothoracic ratio
with age was steeper in women that in men. They attributed this to a greater decrease of thoracic diameter with age in females. Cowan proffered the same explanation.

- Edge et al reported that the increase in cardiothoracic ratio with age, found particularly in women, was mainly due to contraction of the thoracic diameter rather than an increase in the cardiac diameter.
- In the 20-39 age groups, 4.6% of males and 14.8% of females had CTR greater than 50%. In the 60 years of age and above the proportion was 46.2% for males and 70% for females.
- If a CTR of 50% were to be used as the upper limit of normal for our environment, only males in the 20-39 age groups would have a proportion that is within normal limits.
- If the upper limit of normal were increased to 53%, the proportion of males and females below the age of 60 that would exceed it would be between 0% and 7.1%. This proportion is within normal limits.
- For the 60 year-old and above age group, 15.4% of males and 70% of females would still exceed it.
- These observations are in keeping with the findings of Milne and Laudar. They showed that the decrease in the chest diameter with advancing age indicated that the CTR overestimates the heart size in the elderly.
- In their study, 71% of women who were over 70 years had a cardiothoracic ratio exceeding 50%. Edge et al noted a similar percentage. In our study, males and females had similar CTR with the Jamaicans and the African-Americans.
- They have larger cardiothoracic ratio than the Caucasians and the Asians. Many authors have made similar observations.
- Ashcroft and Miall comparing the radiographic measurements made in Wales and Jamaica, attributed the larger cardiothoracic ratio in Africans to their smaller thoracic diameter rather than to a larger cardiac diameter.
- Munro-Faure et al. also noted a smaller thoracic diameter in Africans. They attributed the larger cardiothoracic ratio primarily to a larger cardiac diameter and secondarily to a smaller thoracic diameter. In their study, the difference in cardiac diameter was greater than that in the thoracic diameter.
- Nikol and Wade in a study of male applicants found that 2.2% of Caucasians, 4.1% of Asians and 9.1% of Africans had a cardiothoracic ratio greater than 50%.
- They attributed the larger CTR ratio of Africans not only to the smaller thoracic diameter but also to the larger cardiac diameter of Africans.
- The present study does not corroborate this observation. A comparison between the CD, TD and CTR in the present study with the corresponding values for Americans and the British showed that the larger CTR in the present study was principally due to a smaller TD rather than a larger CD.
- Differences in body physique between Africans, Caucasians and Asians are well known. A number of factors may account for these differences
  - Africans tend to have longer limbs and shorter trunks than their Asian or Caucasian counterparts in order to increase the surface area available for heat loss.
  - It is also known that environmental factors such as poor nutrition and infections may cause cardiac enlargement with resultant increase in CD and CTR.
  - The subjects in the present study were well nourished and did not have cardiovascular abnormalities.
  - The concept that infections and malnutrition might be responsible for the larger cardiothoracic ratio of Africans is not valid in the present study.
  - Our study indicates that the physique of Africans due to environmental and racial factors is probably responsible for their larger cardiothoracic ratio.
Rautaharju et al. showed that in women, the ratio is a stronger predictor of cardiovascular disease risk than the cardiac diameter or the electrocardiogram estimate of the left ventricular mass.

They indicated that the ratio may still retain its practical utility as an indicator of cardiac abnormality, notwithstanding the recent improvements in the echocardiographic and radiographic procedures to estimate the left ventricular and cardiac size.

Rautaharju et al. suggested that what is needed is an improved definition of the normal confidence limits, by race, sex, age and body physique, in order to further enhance the usefulness of CTR in clinical risk evaluation.

They also noted that the use of the ratio as a continuous measure will enhance its applicability in epidemiological risk evaluation.

Our study has attempted to improve the definition of normal limits of cardiothoracic ratio in our environment.

**Conclusion**

- A CTR of 53% is recommended as the upper limit of normal for males and females below the age of sixty in our population.
- The CTR is not very reliable for the 60-year-old especially in females, and should be correlated with clinical data.