DARKNESS TO LIGHT: EVOLUTION AND UNMASKING OF SHADOWS AND IMAGES

An Inaugural Lecture delivered at the University of Ibadan

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by

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The Vice-Chancellor, The Deputy Vice-Chancellor (Administration), The Deputy Vice-Chancellor (Academic), The Registrar, Bursar, Librarian, Provost College of Medicine, Deans of Faculties and the Postgraduate School, Director of Institutes/Heads of Departments, Distinguished Guests, Colleagues and dear Students, Members of the Press, Ladies and Gentlemen.

Introduction

I feel highly honoured to stand before you today to deliver the 5th in the series of inaugural lectures for the 2008/2009 academic session from the Faculty of Clinical Sciences of the College of Medicine of our great University. I am really humbled and give all glory to God as indeed the race is not to the swift, nor the battle to the strong, neither yet the bread to the wise or favour to men of skill but time and chance happeneth to them all. By a design of fate, the first inaugural lecture in Radiology is coming at this time and the lot has fallen on me to deliver it in the midst of distinguished forerunners and teachers.

The Department of Radiology commenced in 1953 as a unit in the Department of Medicine under Professor Alexander Brown who brought two visiting radiologists—Dr. (later Prof. Sir) Howard Middlemiss of the University of Bristol and Dr. King, a Radiologist at the Department of Anatomy of the University of Edinburgh. The latter persuaded Dr. Peter Cockshott, who was just completing his training at the Radiology Dept. of University of Edinburgh, and the Royal Infirmary, Edinburgh, to take up the challenge of pioneering Radiology in Ibadan. He arrived in January 1957 to assume duty as the first Lecturer/Consultant Radiologist. In 1963, he became the first Professor of Radiology in Nigeria and the same year, the Department of Radiology was granted full Departmental status. He was succeeded by Professor Stanley Borher in 1967. Professor Borher retired and went back to the United States of America in 1977 and was succeeded by the first indigenous Head of Department—Professor S. B. Lagundoye who is considered the father of Radiology in Nigeria. He, together with the legendary late Dr. Bayo Banjo pioneered the Residency Training in Radiology in Nigeria under the National

Postgraduate Medical College of Nigeria. For about eight years, the University College Hospital, Ibadan (UCH) was the only training centre in Nigeria and I, together with three other colleagues, were among the first set of radiologists to be fully trained in Nigeria with clinical attachment as Registrars in centres in the United States or United Kingdom. I had my clinical attachment at the Royal Infirmary, Bristol, under the Late Sir Professor Howard Middlemiss who was once a member of staff of our Department.

Professor S.B. Lagundoye was succeeded by Professor T.M. Kolawole (also of blessed memory), who was also the Director of Clinical Services & Training and pioneer Fellow of the Faculty of Radiology of the West African College of Surgeons.

The Department works in close collaboration with several other departments, including Medicine, Paediatrics, Obstetrics & Gynaecology, and Surgery and recently with the Department of Morbid Anatomy. It was mainly regarded as a service department in the past. Therefore, not much was known of Radiology in the main campus of the University. It is not surprising that many of those seated here today including some of my colleagues, often refer to Radiologists as Radiographers.

A radiologist is a qualified doctor with post-graduate training in the use of ALL imaging modalities to make clinical diagnoses, which assist his colleagues in the proper management of their patients as he unmasks the realities and substances of the images with the knowledge of his medical training. These imaging modalities include those which use ionizing radiation (plain radiography and computer tomography), sound waves (US) and magnetic radiation and radiofrequency (MRI), Isotopes—Nuclear Medicine. The radiologist cannot work alone as some of these images have to be acquired by properly trained technologists sometimes referred to as Radiographers in the UK, Imaging Technicians in the United States of America and Nigeria. The Imaging Technicians recently redesignated their professionals as Imaging Scientists in Nigeria.

In 1981, Radiology was introduced into the Bachelor of Medicine, Bachelor of Surgery (MBBS) curriculum and clinical students came for short postings of two to four weeks during the paediatric posting while one-hour lectures were given during surgical/medical postings. Radiologists then were few and seen only at grand rounds.

My Journey into Radiology

My interest in Radiology began during the latter part of my training as a medical student, having spent my elective period in the department. I was also stimulated by the role of the few radiologists in the hospital then during the Surgical Grand rounds as they unmasked the human anatomy and pathology from the images and shadows on the radiographs and their reports were corroborated with the findings at surgery or *post mortem*. It was at one of such teachings by the late Professor T.M. Kolawole that I was further convinced of Radiology as a career. I also had another stimulating experience with Professor Borher, which further increased my interest in Radiology. As an intern in a surgical rotation, my Registrar requested that I obtained a booking for barium meal/barium enema examination for a patient with melena (dark) stool and a presumptive diagnosis of Upper Gastro-intestinal Tract (GIT) bleeding. At that time, booking for specialized examination had to be vetted by the HOD. I then went to Professor Borher who gave me a short tutorial on why I could not make two requests on one card, and that I should know the proper examination needed for the patient, a barium meal or a barium enema?

Prof. Borher: If your clinical suspicion was Upper GIT bleeding, what is the likely cause?
Ogunseyinde (then Miss Iyanda): Bleeding duodenal ulcer
Prof Borher: What examination is therefore necessary?
Ogunseyinde: Barium meal examination Sir
Prof. Borher: Go back and ask your Registrar to request for that
Ogunseyinde: Thank you Sir

Since then I knew the importance of Radiology in Medical practice. It was not difficult getting a position in Radiology after the National Service as the discipline was not very popular amongst young doctors because of the fear of the effect of ionizing radiation.

The title of my inaugural lecture is: "From Darkness to Light: the Evolution and Unmasking of Shadows and Images". This is because the practice of Radiology began from the discovery of a young physicist, Wilhelm Conrad Roentgen while working in the darkroom of his laboratory one fateful weekend in the 19th century. Since then, the practice has been influenced by technological developments with the discovery and evolvement of new imaging modalities.

The Discovery of X-Rays and the Birth of Radiology

The 19th century was an era of great scientific discoveries and inventions. In 1895, a young German physicist Wilhelm Conrad Roentgen[1] while carrying out his experiments in his office, discovered a strange phenomenon. He observed a cathode ray tube which he had completely wrapped with black paper in a ***darkened room*** produced fluorescence of barium plastino-cyanide pasted on cardboard paper about 1 meter away when he applied electric current to the tube in the room. He called this "a new kind of rays". Two weeks later, he exposed his wife's hands to these new rays and produced an image which showed the bones of her hands and the two rings she wore on her 4th finger. Because they were unknown rays, they were called 'X-rays', X being the symbol for the unknown in Algebra.

This discovery was received with such excitement and the news spread like wildfire across the Atlantic to New York where the event was reported on 1st January, 1895. He continued to demonstrate the penetrating effects of the X-rays and in 1901, Conrad Roentgen was awarded the first Nobel Prize in Physics for this discovery *from the darkroom of his office*.

Prior to this discovery of the x-ray and its effect, Surgeons had had to carry out operative procedures by opening up the abdominal cavity (exploratory laparotomy), often without a definite knowledge of what to expect during surgery. This discovery however provided an opportunity to unmask for the first time, internal parts of the human anatomy without recourse to surgery. With the discovery of x-rays, people freely offered their hands to x-ray just to see the bones inside the flesh. It was however soon realized that repeated and unguided exposure to these great wonder rays was injurious to the body, as it was discovered that the x-ray was an ionizing radiation with associated biological hazards, particularly on actively dividing cells in the ovaries, testicles, bone marrow and the lining of the Gastro-Intestinal Tract (GIT).

The medical benefits were far-reaching, especially in the field of orthopedics where exact locations and types of bone fracture could now be demonstrated by x-rays. Because x-rays could only discriminate five different tissue densities, the soft tissue structures were usually poorly defined and the need therefore arose for the introduction of inert substances like barium sulphate to see the hollow internal organ—the GIT, and this was the birth of fluoroscopic examination. Iodinated contrast media were also injected into vessels for examining the kidneys, ureters, and the bladder (i.e. intravenous urography), which is a further step in unmasking human shadows and figures.

In fluoroscopy, structural changes caused in the body by diseases are demonstrated and unmasked from the images, e.g. cancers and diverticular diseases. The earliest fluoroscopy was performed by direct vision using a fluoroscopic screen after dark adaptation of the eyes with the red goggle. This was the state of the art when I started my training as a resident in the Department of Radiology.

The practice of general radiology began to be influenced by technological development. Conventional fluoroscopy for barium studies which used to be performed in the dark required the radiologists to wear dark goggles to achieve dark adaptations for some ten to fifteen minutes before commencing screening. This is no longer necessary as image intensifiers coupled to television monitors have taken over and fluoroscopic screening procedures are now possible under bright illumination. A transformation from darkness to light!

Ultrasound Imaging

By 1947, Karl Dussik[2] produced ultrasonically generated images of what were described as ventricles of the brain and by 1950, the first cross-sectional image obtained with the ultrasound was demonstrated by Howry. Ultrasonography is an imaging technique that uses sound waves to demonstrate human anatomy, physiology and pathological changes in disease processes in the body. It has been employed as a diagnostic tool in medical specialties including ophthalmology, obstetrics and gynaecology. It has the advantage that it does not involve ionizing radiation.

Its initial images were recorded in the A mode which gives spikes of echoes representing the reflectivity and the depth of various tissues depending on their acoustic impedance and depth of the organs from the transducer. The images were therefore poor and the interpretations were not infallible. UCH acquired one of such machines in 1975.

The U/S machine now displays the images in 2-D representation of the part being examined. A major progress in this imaging technique of ultrasound was achieved with the introduction of the colour Doppler scanners which are used for vascular studies. Tissue harmonic imaging is the latest concept incorporated into the technological design of the newest generation of ultrasound scanners that produces 3D and 4D images which allows visualization of composite images of structures hitherto seen only in section traversed by the ultrasound beam. It allows visualization of foetal anomaly of the face and limbs and movement of the foetus in utero.

Computer Tomography

By 1972, a British Physicist, Godfrey Hounsfield[3] invented the first Computerized Tomographic (CT) Scanner, an EMI scanner which was installed at the Atkinson's Morley Hospital in London. This heralded imaging in the axial and coronal planes, thereby eliminating the loss of information about tissue and organs, which occur with conventional radiography due to superimposition of anatomic structures.

The CT scanner is a marriage of x-rays and computers, the latter performing mathematical calculations of attenuation of the x-ray as it transverses or rotates through the body. The unit of measurement is Hounsfield unit after Godfrey. The attenuation of each tissue in the body is given in relation to water which has a zero Hounsfield unit. This discovery by Hounsfield was the next major advance in imaging and x-ray technology. He was awarded the Nobel Prize for medicine along with his colleague Alan Cormack.

In the early seventies, CT was mainly for examination of intracranial soft tissue, and the first examination performed on the first EMI scanner lasted seven hours. At the present time, we now have the fourth generation of such equipment with spiral scanning using several numbers of elements and scan time of less than one second! From the early beginning of being a head scanner, CT has since witnessed a tremendous evolution over the past 35 years to multislice scanners capable of whole body acquisition in a very short time.

The invention of CT is considered to be the greatest innovation since the discovery of the x-ray. This cross-sectional imaging technique provided diagnostic radiology with better insight into the pathogenesis of diseases in the body, thereby increasing the chances of recovery. The principles underlying CT examination form the foundation of many sophisticated imaging methods in use today.

With this new imaging technology, my area of interest in research began to focus on neuro-radiology, following in the footsteps of my mentor, late Professor T.M. Kolawole. As a young Lecturer/Consultant, I learnt the rudiments of angiography and had to perform most of the examinations while Professor Kolawole was busy with administrative duties, being the first Director of Clinical Services and Training at UCH. I then quickly developed an interest in neuro-radiology.

The first CT machine in UCH, an EMI scanner, was obtained in 1978. By the time of its arrival in UCH, it was outdated and had to be traded in for a newer version of GE 8800 in 1987. My first encounter with this imaging modality was during my year of clinical attachment as Registrar in Bristol Royal Infirmary.

Magnetic Resonance Imaging (MRI)

The story of MRI is one of a long courtship between physics and medicine. In 1952, Dr. Bloch[4,5] from Stanford University and Dr. Purcell from Harvard University were awarded the Nobel Prize for their work on what was then known as 'Nuclear Magnetic Resonance (NMR)'. However, the turning point came after 20 years of the advent of computers in medical imaging. By this time, the word 'Nuclear' was removed and it is now known as Magnetic Resonance Imaging (MRI).

The medical world experienced a boon in 1973 when Lauterbur and Damadian, working independently, pronounced the potentiality of the science of magnetic resonance, in the human body. Since then, tremendous advances have taken place in the design and technology of magnetic resonance equipment, incorporating computer know-how and sophisticated electronics to provide sectional images of the human body with excellent delineation unparalleled in the medical arena. This imaging technique uses a powerful magnetic field to align the nuclear magnetization of hydrogen atoms in water in the body. Radio frequency fields are used to systematically alter the alignment of this magnetization causing the hydrogen nuclei to produce a rotating field signal detectable by the scanner. This signal can be manipulated by an additional magnetic field to build up enough information to construct an image of the body which is unmasked to give information on anatomy and disease. Now the acquisition of the images is based on proton density differences and on T1 and T2 weighted differences. T1 images show anatomical details while T2 images demonstrate pathologies better.

A major advantage of MRI over other imaging modalities such as CT is its excellent soft tissue contrast which can be widely manipulated. An added advantage is that it does not involve ionizing radiation and can examine the body in three planes (axial, coronal and saggital) without moving the patient within the gantry. It is however more expensive, costing 85 to 160 thousand naira per examination compared to 35 to 80 thousand naira for CT.

Since its introduction to clinical practice in the early 80's, MRI has been a tremendous boon to neuroscience research, helping practitioners to learn more about the functions of the brain by visualizing changes in the chemical composition of the various regions or changes in the flow of fluid that occur over seconds in the brain. Patients with heart pace-makers' metallic implants or metallic chips and clips cannot be examined with an

MRI because of the risk that the magnet may remove the metals from these areas.

The earliest MRI machines were very big and intimidating to patients who often complained of claustrophobia during the examination. This problem has now been taken care of by the design and manufacture of the newer generation open- MRI machines. MRI is at the leading edge of medical imaging and this modality has completely changed the approach to imaging, especially in musculoskeletal and joint diseases and in the imaging of the brain. This is because MRI non-invasively demonstrates intra-articular structures such as the cruciate ligaments and semi-lunar cartilages which were formerly observed with the introduction of contrast media into the joint. It is also of great use in the management of sports related injuries. MRI imaging is time consuming and the images were difficult to interpret at the onset of this imaging technique. Software for Spectroscopy and Angiography are now available for the study of chemical and vascular changes in the brain.

My first exposure to MRI was at the Bristol Royal Infirmary with Professor Rhys Davies in 1980, and later in 1991 through the Senior Commonwealth Scholarship at General Hospital, Newcastle-upon -Tyne. Further exposure to CT and MRI was gained at the Radiology Department of the University of North Carolina, U.S.A under the auspices of Derek Harwood-Nash Award of the Radiological Society of North America in 2002. UCH did not acquire its MRI until 2005.

Interventional Radiology

Interventional radiology has been responsible for much of the medical innovation and development of the minimally invasive procedures that are commonplace today and particularly so in the last 30 years. This was pioneered with the invention of angioplasty and the catheter-delivered stent, first used to treat peripheral arterial disease by Charles Dotter, MD, the father of interventional radiology.

He used a catheter to open the blocked artery of an 82-year-old woman, who refused amputation surgery, to keep her gangrene-ravaged left foot. To the surgeon's disbelief, her pain ceased, she started walking, and three "irreversibly" gangrenous toes spontaneously sloughed and she left the hospital, on her feet. Charles Dotter was nominated for the Nobel Prize in medicine in 1978.

Angioplasty and stenting introduced a unique dimension into modern medicine and led the way for the more widely known applications of coronary artery angioplasty and stenting that revolutionized the practice of cardiology. Today many conditions that once required surgery can be treated non-surgically by interventional radiologists. Through a small knick in the skin, tiny catheters and miniature instruments can be run through a person's network. While no treatment is risk free, interventional procedures are far lower in their risks than open surgery, and have therefore become a major advance in radiology and medicine.

Some of the more recent advances in interventional radiology include:

- Nonsurgical ablation of tumors to kill cancer without harming the surrounding tissue; Embolization therapy to stop hemorrhaging or to block blood supply to a tumor;
- Catheter-directed thrombolysis to clear blood clots, preventing disability from deep vein thrombosis and stroke;
- Carotid artery angioplasty and stenting to prevent stroke;
- Removal of stones in the kidney, gall-bladder, etc.

Contribution to Knowledge

Mr. Vice-Chancellor Sir, the practice of clinical radiology has evolved and revolutionalized medical practice and research, since the discovery of x-rays in the dark room of that young physicist in November of 1895. Radiology has also become the fastest growing discipline with invention of cutting edge equipment which is now employed in daylight to produce images which improve management of patients as the realities and substances of the images and shadows are unmasked by the radiologist.

My contribution to knowledge in this discipline was initially focused on general radiology using plain radiography, fluoroscopy, ultrasonography and CT which were the imaging modalities available to me as a young lecturer.

In 1988[6], I demonstrated that routine pre-operative chest radiograph is unnecessary and adds nothing to clinical information in patients going for non cardio pulmonary surgery and should therefore be limited to patients with clinical symptoms and high risk patients who are over 50yrs of age.

Together with Professor Awotedu[7], I highlighted the radiological changes in chest radiographs of patients with chronic asthma. The radiographs were normal in about two-thirds of the patients while over-inflation of the lung fields were the commonest finding. Only 4.5% of the patients showed evidence of lung infiltrates and this suggested that chest radiographs should be limited to those patients with repeated and severe attacks who may have silent pneumothorax. Working with the Anaesthetists[8], we reported the problem of accessibility to the airways in paediatric anaesthesia using plain chest radiography. Details of this study were given by Professor Soyanwo in her inaugural lecture.

Working with the cardio-thoracic surgeons, we demonstrated that plain chest radiography is more superior to clinical features in demonstrating primary mediastinal masses[9] and it can be relied upon when sophisticated imaging modality like CT is not available. The most common tumour in the mediastium in our study was lymphoma and superior vena cava syndrome was more frequently associated with primary malignant lesions.

In Urology, we showed that the yield of information from routine intravenous urography examination in patients with hypertension is low and does not justify the cost and risk of the examination[10]. CT or U/S or MRI should be employed in investigating such patients. I demonstrated the characteristic radiological features of Osteopetrosis, a rare disease amongst Nigerians with complication of anaemia[11] and the unusual association of pulmonary osteoathropathy with extensive spread of nasopharyngeal tumours[12].

My colleagues and I using Ultrasonography, demonstrated the merits and demerits of computed tomographic scan over sonography[13]. Correlation was found in 77.5% of cases studied and the level of agreement between the two modalities was statistically significant. We concluded that abdominal USS gives a high yield of diagnostic accuracy while CT gives more details and we suggested that ultrasound could be used in patients who cannot afford the cost of a CT examination.

I also demonstrated that the frequency of cholelithiasis (gallstones) in patients with sickle cell disease is about 24% in this environment, using Ultrasonography and working with the hematologists[14]. Gallstone formation was found to be more common in Haemoglobin SC than in Haemoglobin SS.

Later in my career, my research and contribution to knowledge has been focused on imaging in neuro-radiology particularly in the diagnosis of stroke which is a major cause of disability and death, the third after cancer and ischemic heart disease[15]. There are four major types of stroke—cerebral infarction, which accounts for approximately 85% of all strokes[16] while primary cerebral hemorrhages (e.g. sub-arachnoid haemorhage and intra-parenchymal haemorrhage) accounts for the remaining 15%. Ischemic stroke is most often caused by obstruction of cerebral arteries or cerebral veins, the former being more common. This occlusion can occur in major blood supply to the brain—middle and anterior cerebral arteries, posterior circulation, and in the carotid arteries where atherosclerotic plaques are commonly found. A number of medical conditions (risk factors) are associated with atherosclerotic disease and stroke. These include hypertension, smoking, obesity, diabetic mellitus and hypelipidemia which are risk factors. Haemorhagic stroke is more commonly associated with hypertension.

The involvement of new imaging technique of CT and MRI has placed diagnostic neuro-imaging at the forefront of stroke management. Using CT examinations we studied the patterns of stroke in Ibadan[17] and in children with sickle-cell disease[18]. Cerebral infarction was more common than haemorrhagic infarct in both groups.

The diagnosis of stroke before the era of CT was based mainly on clinical findings and the Siriraj Stroke Score (SSS). Our study to assess the frequency of mis-diagnosis using CT as the gold standard demonstrated that there was a high percentage of mis-diagnosis[19,20] of stroke. Only 59% of the patients studied had features constituent with stroke while cerebral atrophy was the most common radiological abnormality of mis-diagnosis. The Siriraj Stroke Score (SSS) was not sufficiently sensitive to differentiate between the two groups hence CT examination is mandatory in the diagnosis of stroke, particularly now that diagnosis can be improved with CT or MRI perfusion and diffusion scans. Sadly, perfusion and diffusion studies cannot be carried out presently in our hospital because of lack of facilities. Cerebral infarction occurred in 57% of the children with sickle cell anemia, and involved both cortices and the deep white matter. In the study, the frontal and parietal lobes were mostly involved and most lesions were on the left side. This is similar to the findings of other workers.

Working with the Ibadan/Indianapolis Dementia Research Group, we compared the ventricular size in patients with dementia, and cognitively impaired, and elderly patients of the same age. It was shown that ventricular dilatation is higher in the dementia patient than in the age related patient. The Silvian, suprasellar and prepontine cisterns are more significantly affected in dementia than the lateral ventricles and there is no significant correlation between the degrees of cerebral atrophy in the studied groups. We concluded that while CT examination alone cannot be used to differentiate the various types of dementia, it can identify patients with high risk of developing Alzheimer's disease.

We have studied the intracranial complications of the paranasal sinus infections[21] (chronic sinusitis) and showed that though the incidence is low, (11.7% of the 94 patients studied), the consequence of delayed intervention is grave and these include epidural and intracranial abscesses. It was shown that maxillary and ethmoidal sinuses were the most common sources of these intracranial complications.

My colleagues and I described the CT findings in patients with head trauma[22]. Patients with focal neurological deficits showed more positive findings which included subdural haematomas and intracerebral bleeds. The research also showed that only 25% of such severe cases have associated skull fractures. Correlating the fracture sites with the site of intracranial haematoma and contusion, we showed that frontal fractures were the most common. When intracranial bleeds occur, they are usually on the ipsilateral side while subdural collections may occur on the contra-lateral side[23].

We have also described the protean manifestations of HIV infections in the brain[24] and abdomen in this environment with the aid of CT and Ultrasonography. Approximately one third of patients with HIV/AIDS have changes in the brain. Some of the presenting symptoms in our study included irrational talk, facial and hemi-paresis, aphasia, tonic clonic seizures, syncopal attacks and headaches. They all had background retroviral infection. The CT examination showed both hypo and hyper-dense lesions with ring enhancement and mass effect. Multiple lesions were present in 65% of the patients. Atrophy of the brain was common in the children. It was suggested that HIV infection should be considered in patients with rapid progression of lymphomas and all patients with rapidly disseminating tumor masses should be screened for HIV infection.

Working with neurosurgeons and ophthalmologists, we have studied the relationship between ventricular size and visual functions in children with hydrocephalus. Ventricular enlargement was most pronounced at trigone and at least at the level of Foramen of Monroe. The third and lateral ventricular sizes and visual function score did not differ between the sexes. It also showed significant inverse correlation between occipitofrontal circumference and visual function[25].

We further studied the effect of associated lumbosacral myelomeningocoele on the visual function scores in these hydrocephalic infants. It was shown that visual function is not further diminished by the associated dysraphism. The major determinant of visual morbidity is thc ventricular enlargement[26]. We have demonstrated various brain tumors using CT and MRI examinations and described the pattern of pituitary tumors and meningiomas in Ibadan.[27,28]

Working with some orthopedic surgeons and the pediatricians[29] we described the computerized tomographic findings in spinal tuberculosis in Nigeria. Osteolytic destruction was the most common type of lesion unlike the fragmented type described by some authors. Posterior elements were involved in 59% of the patients and paravertebral soft tissue was present in 40%.

Mr. Vice-Chancellor Sir, distinguished guests, I have reviewed the history of the x-ray and the birth and growth of radiology which has not stopped in the over 100 years since Roentgen's momentous discovery at the end of 1895. Radiology has achieved importance as one of the most powerful diagnostic approaches in clinical medicine. The contribution of radiology has increased in the past 25years with the advent of cross-sectional imaging and the birth of interventional radiology. This has been made possible as a result of its integration with computers and information technology.

Helical CT and MRI angiography have virtually eliminated the conventional angiography by the Seldinger technique of femoral puncture which is now regarded as invasive procedure. Some conventional procedures obtained by plain radiography have been replaced by CT and visual Colonography on CT is replacing Barium enema. CTA and MRA have improved the diagnosis and management of cerebrovascular accidents and spinal pathologies. Interventional radiology is a new area of development and is gradually replacing some surgical procedures. Brain aneurysm embolization, or detachable coil embolization, is a minimally invasive treatment for aneurysms and other blood vessels malformations called fistulas that occur in the brain and other parts of the body. In the angioplasty procedures, imaging techniques are used to guide the balloon-tipped catheter, a long, thin plastic tube, into an artery or vein and advance it to where the vessel is narrow or blocked. The balloon is then inflated to open the vessels, deflated and removed.

In vascular stenting, which may be performed with angioplasty, a small wire mesh tube called a stent is permanently placed in the newly opened artery or vein to help it remain open. Sadly very little has been done in this area in this country.

The display and transfer of radiological reports has been facilitated by the Picture Archiving and Communication Systems (PACS) or Digital Communication in Medicine (DICOM). I have also enumerated some of my contributions to knowledge in the field of radiology through unmasking the shadows and images obtained to reveal the human figure.

Recommendations

In the tradition of inaugural lectures, I wish to make some recommendations that will be of benefit to the teaching and practice of radiology and to the society at large. The practice of Radiology worldwide has developed tremendously. Sadly, we are left behind. This is partly as a result of lack of appropriate equipment and software as development and progress in radiology are technology-driven. I therefore recommend as follows:

1. The training of radiologists should not only focus on gross anatomy, pathology and clinical radiology but also focus on analysing chemical, genetic and functional information derived from images in this age of Molecular imaging. The radiologist will play an important role in imaging related interdisciplinary research and will spread the word about what imaging technology can contribute to clinical practice and research. The results of such researches can be brought to bear on clinical practice.
2. The University must improve the research infrastructure by purchasing some of the equipment which will be dedicated to researches in animals and on humans as the funding for clinical services cannot bear the cost alone. The cost of a CT machine is about ₦100-₦160 million, while that for an MRI ranges between ₦200-₦230 million.
3. Sub-specialization in Radiology, such as Cardio-pulmonary, Urological, musculo-skeletal, Head and Neck, Gastro-intestinal radiology e.t.c. must be developed with the need for more established posts in Radiology, both in the hospital and the university

setting, and creation of a separate academic department of Radiology should be considered.

4. The Federal Government must increase the funding to the Universities and Tertiary Hospitals through the NUC and Ministry of Health through extra-budgetary allowances for the purchase of radiological equipment.
5. Government must find a way of cutting the very high cost of equipment and curbing the shylock practices of the suppliers.
6. Radiological residency positions should be increased so as to encourage sub- specialization, training, and research.
7. Quality Assurance Certification must be obtained before the design and installation of x-ray facilities as the biological effects of x-rays can be injurious to the human body either by somatic or genetic damage, if not properly applied. Monitoring of x-ray houses, departments and equipment used in radiology by the Nigerian Nuclear Regulatory Authority (NNRA) established by the Federal Government must be continuous.
8. Marketers who have little or no knowledge about the installation and maintenance of radiological equipment should be banned from buying/supplying x-ray equipment to the institutions.

Acknowledgements

Mr. Vice-Chancellor Sir, in ending this celebration, I have several reasons to be thankful to Almighty God for His blessings, kindness and protection over my life for the past six decades. Three weeks ago, I marked my 60th birthday and I give Him all the glory for making this day possible.

I am grateful to my late parents, Mr. Joseph and Mrs. Mariani Iyanda (both from Erin-Ijesha) who struggled through their financial poverty to give me sound education. I appreciate my brother Pastor Ayodeji Emmanuel and his wife, and my sister Mrs. Olujuyigbe and her husband Pastor Yomi Olujuyigbe, other members of my family and my in-laws for their support.

I thank and appreciate my teachers, both within and outside Radiology—Professor S. B. Lagundoye, late Professor T. M. Kolawole, my mentor, who together with Professors Adeloye and Olumide sparked my interest in neuro-radiology, late Dr. Bayo Banjo a legend in Radiology in West Africa, Professors O. A. Akinkugbe, B.O. Osuntokun (of blessed memory), A.O. Ajayi, J.A Adeleye, and Professor Jide Bademosi. I also thank Professor Ajao and Professor Familusi for their support and encouragement at all times.

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Finally, to the most High God, the Alpha and the Omega, the one who has translated us from the kingdom of darkness to the kingdom of light and who makes all things beautiful in His Time be all the glory, honour and majesty.

Thank you all for listening.

Notes

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APPENDIX

Peter Cockshott (HOD 1963-1967)

Professor Stanley Borher (HOD 1967-1971)

Prof. S.B. Lagundoye

Professor T.M. Kolawole

Willhelm Conrad Roentgen

X-ray of hands of Mrs. Roentgen

Ba meal Ca oesophagus

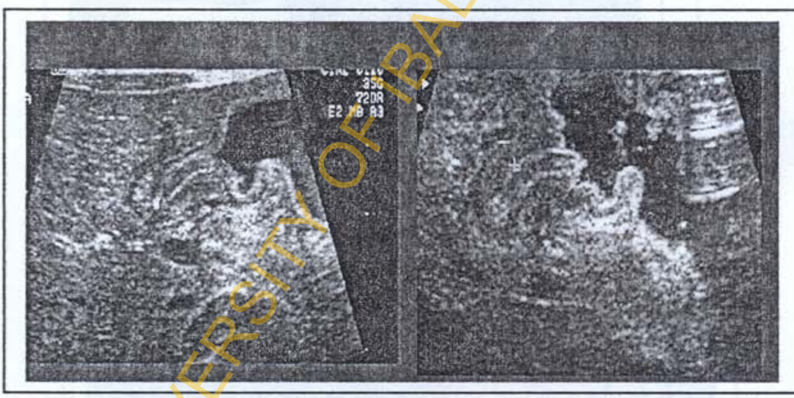
Diverticular disease of the colon

Red goggles

'A' mode of ultrasound

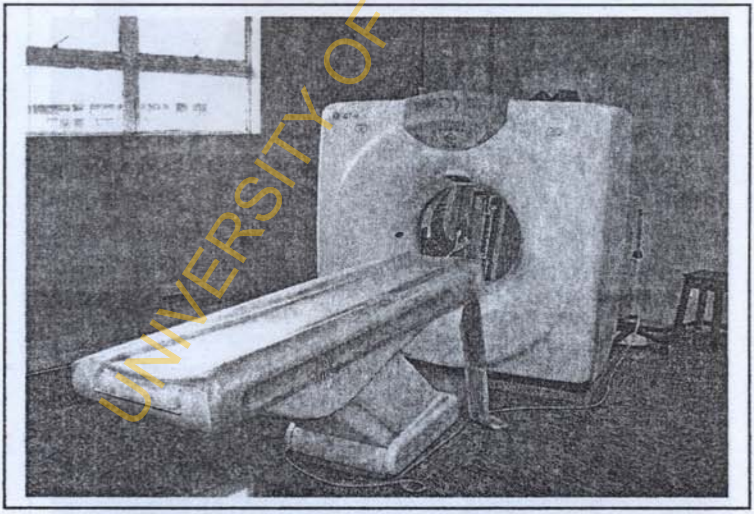
Old Ultrasound machine: A-mode

2D USS of a growing foetus



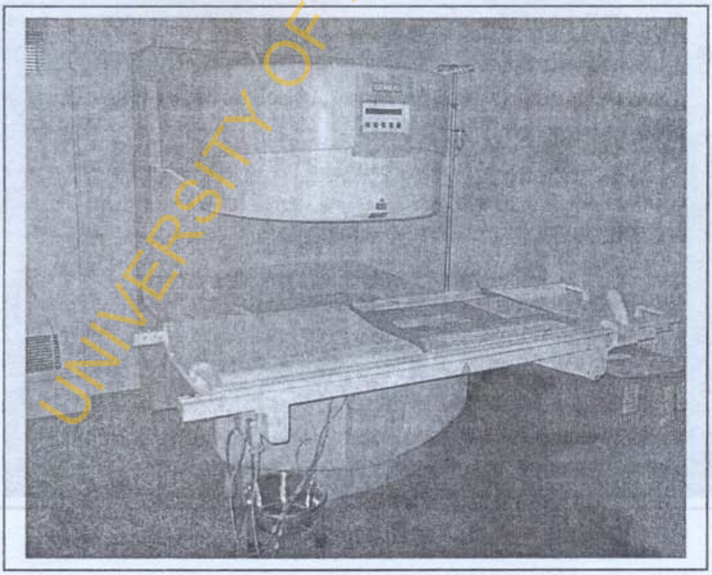
2D USS of Pyloric stenosis

3D Ultrasound Image of Foetus



CT machine

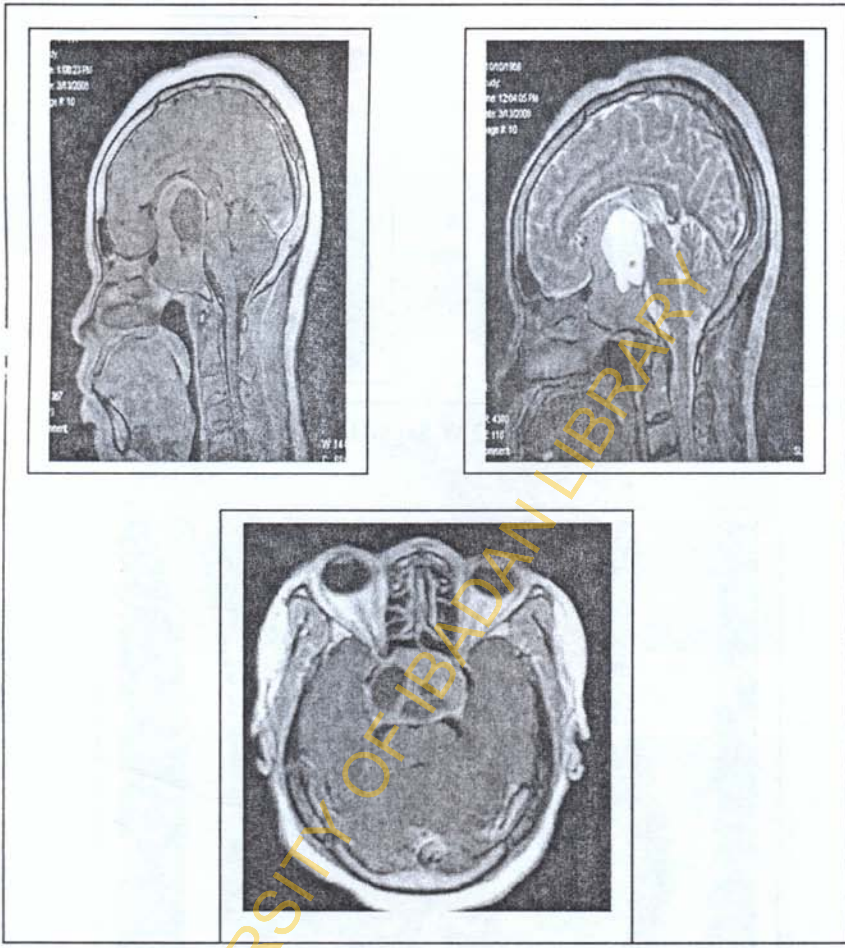
CT machine



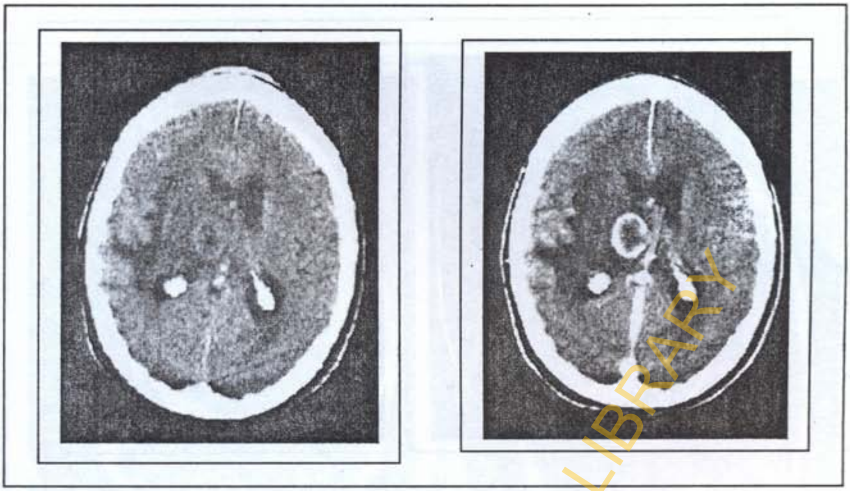
MRI machine – open magnet

T1 and T2 W Sagittal images

MRI of knee joint

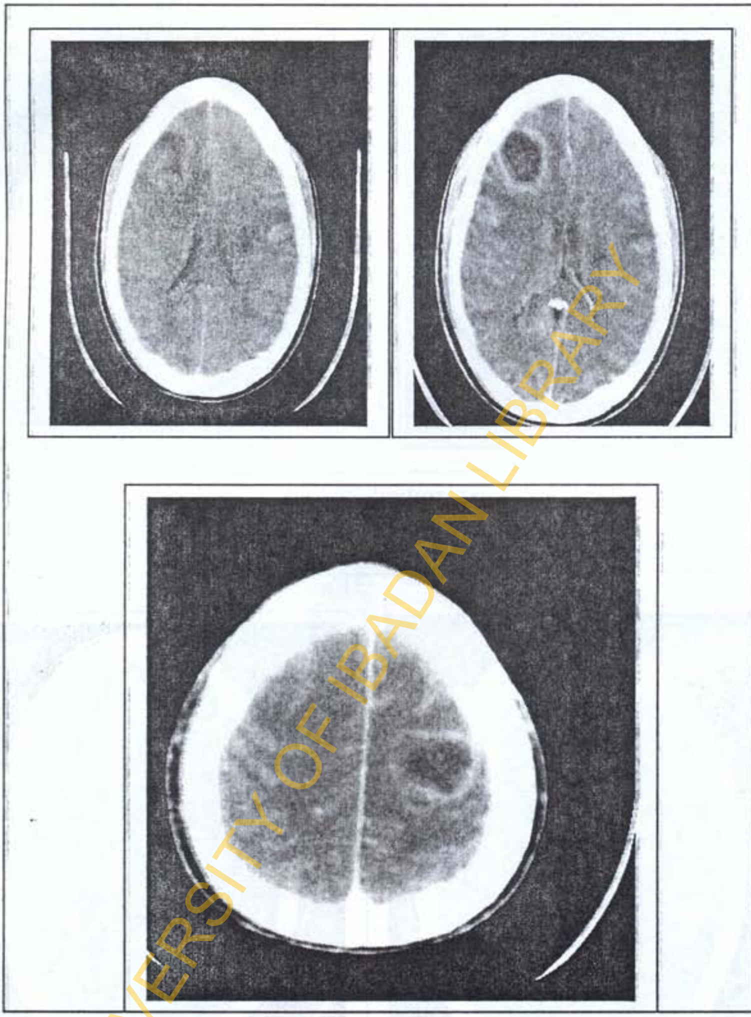


MRI pituitary adenoma



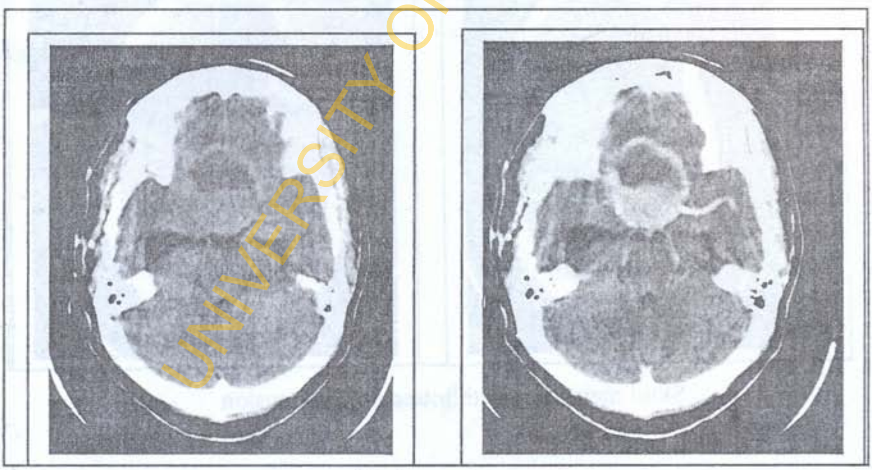
Intracerebral abscess

Epidural abscess



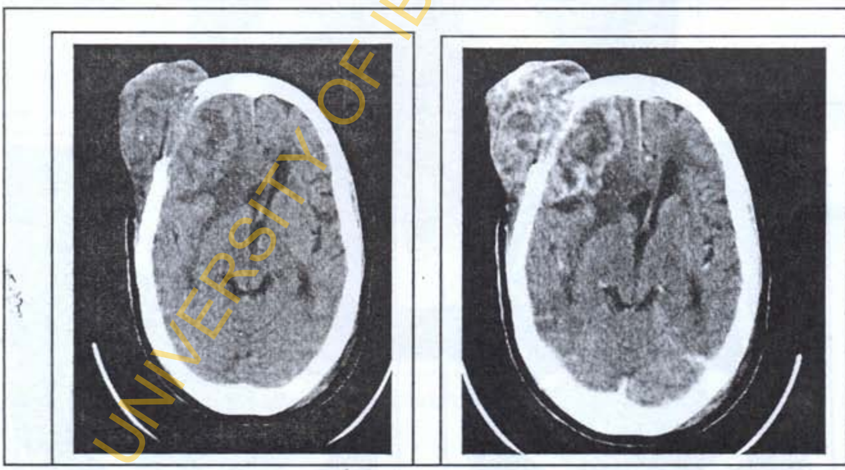
Multiple ring enhancing lesions – in HIV patient

craniopharyngioma

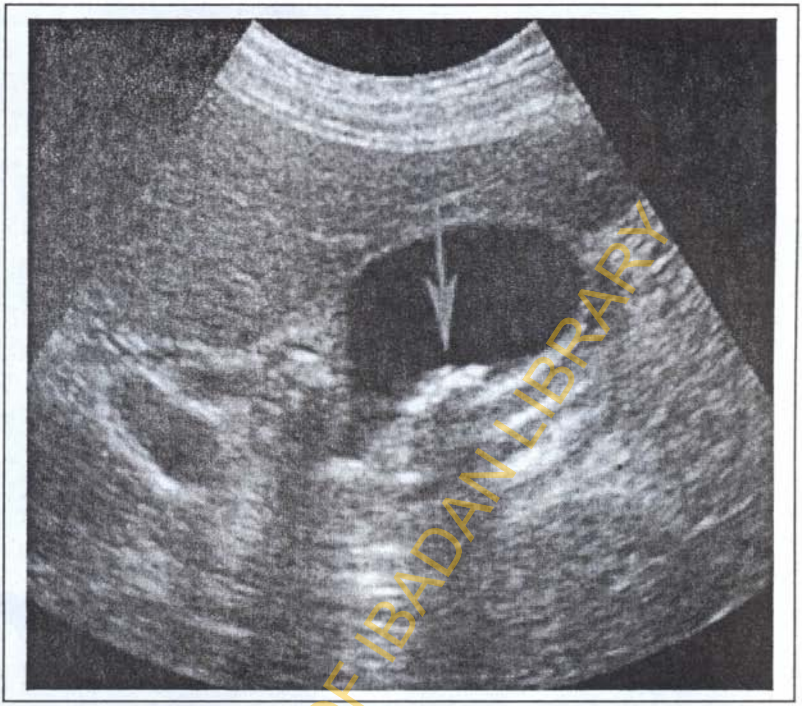


Pituitary adenoma

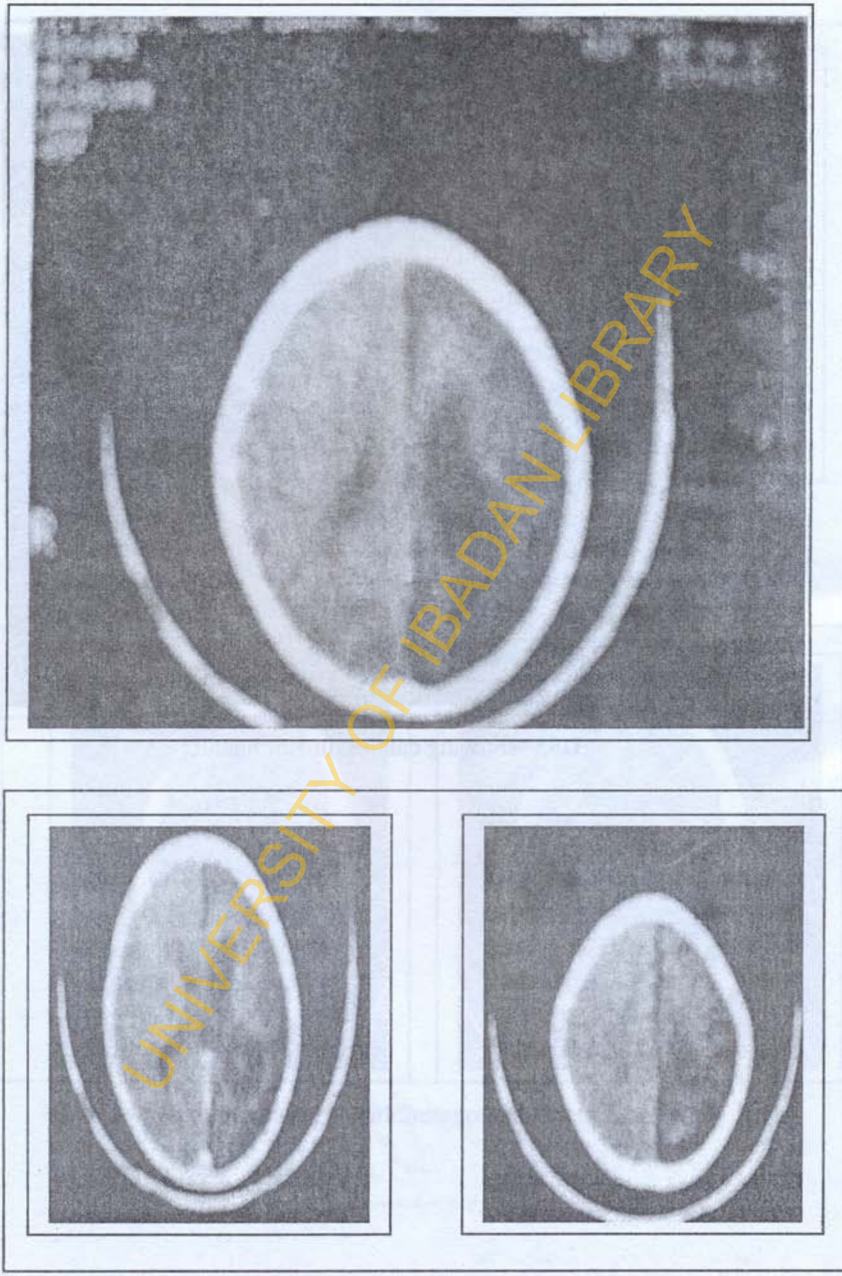
Pituitary adenoma-coronal CT



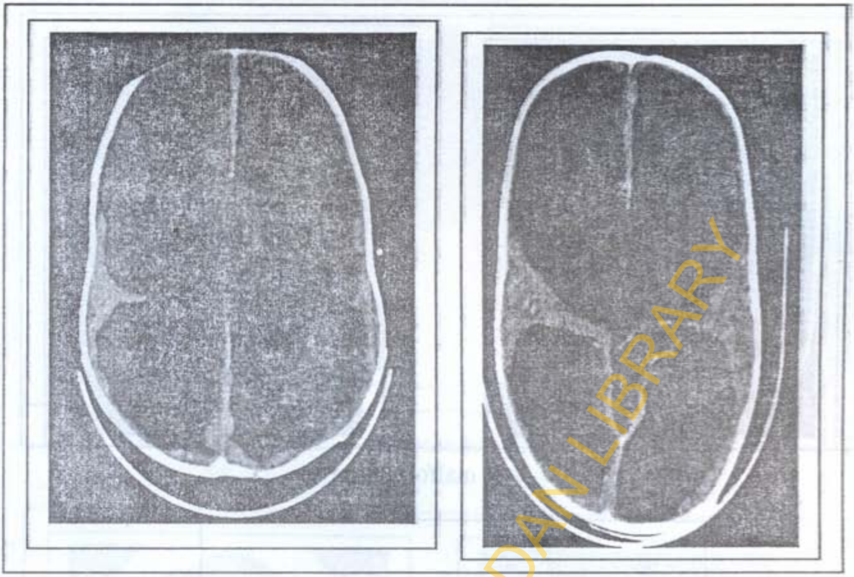
Skull metastasis with intracranial extension



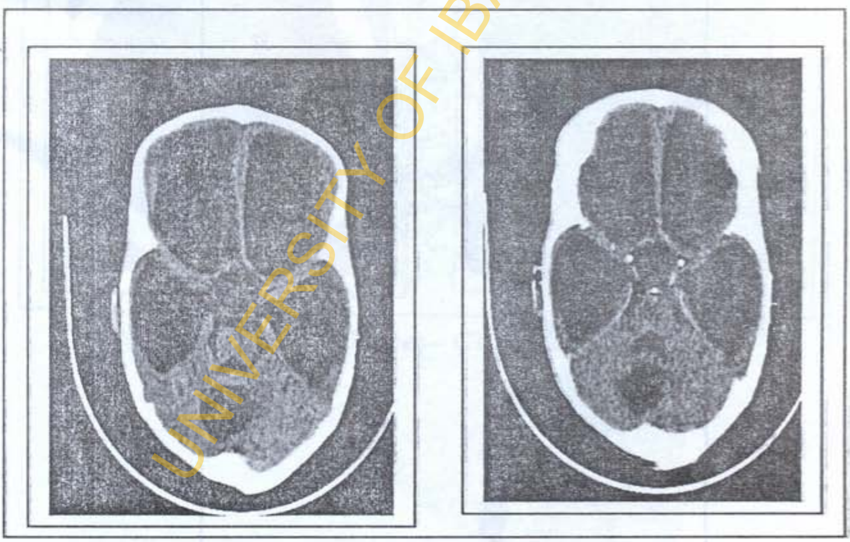
USS- showing calculi in gall bladder



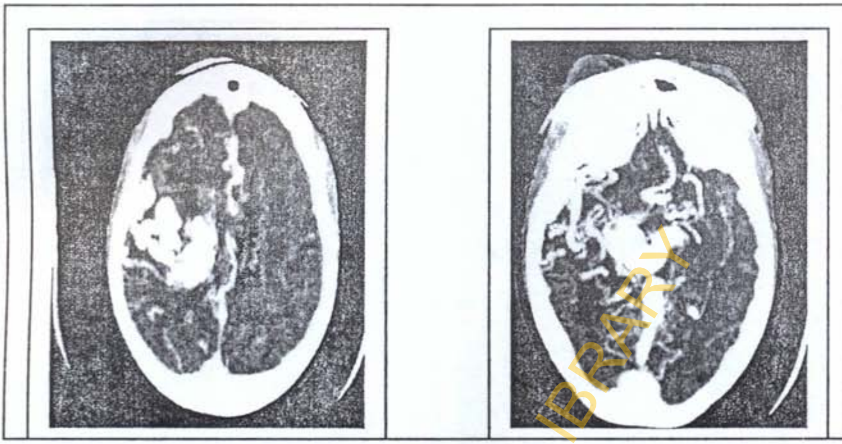
CT brain in SCA showing cerebral infarct and atrophy



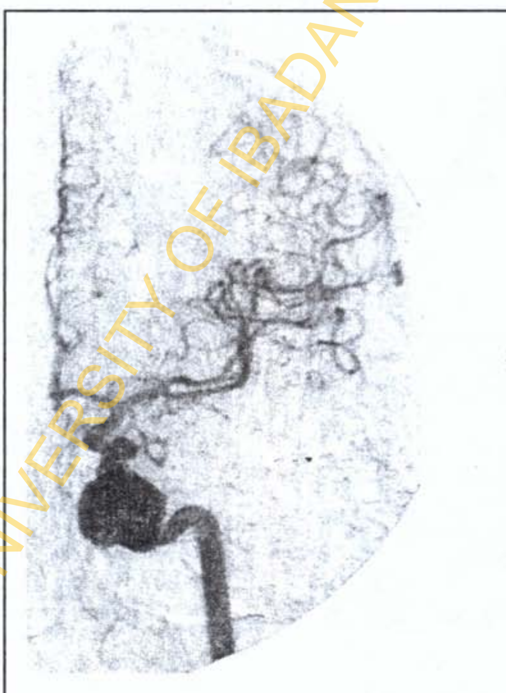
CT brain showing dilated ventricles in Hydrocephalus



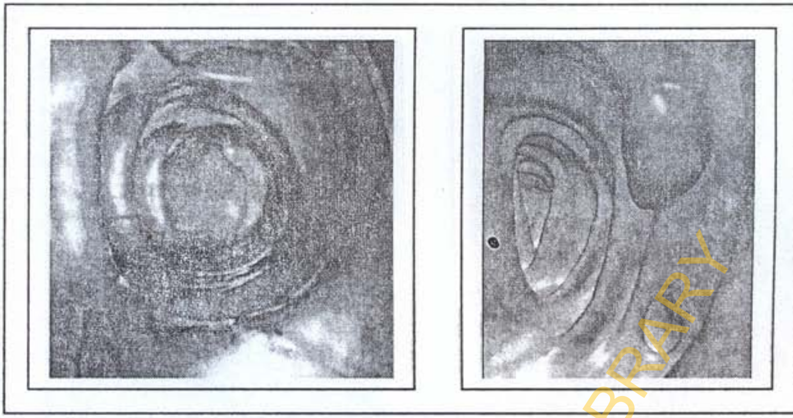
CT brain showing communicating hydrocephalus



CT- AV malformation

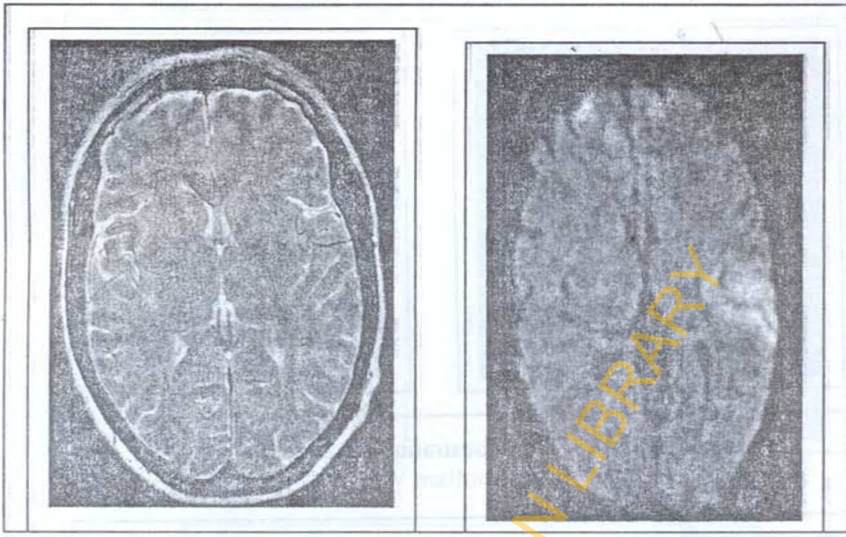


Digital Subtraction Angiogram-Aneurysm



Virtual colonoscopy – demonstrating a colonic polyp

Acute intracerebral haemorrhage – CT & 3D reconstruction

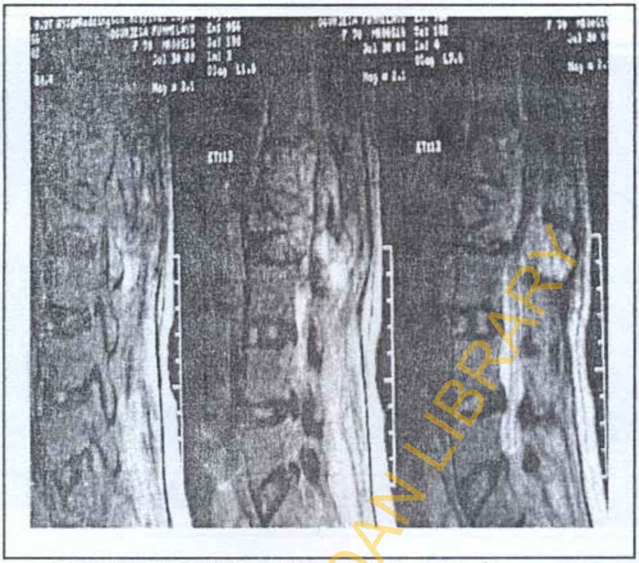


Acute onset of aphasia diffusion image (Note the hyper intensity in the Lt. Parietal lobe on the diffusion image, not obvious on initial MRI)

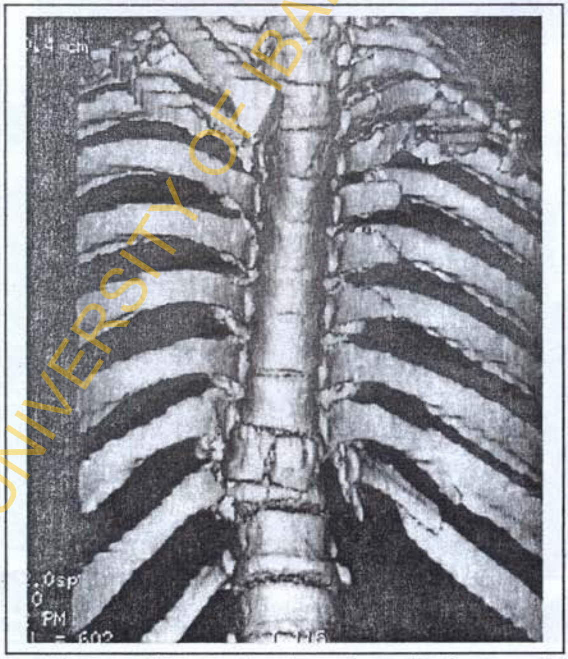
CT & CTA of acute stroke due to MCA occlusion

Tumour Vascularization with 1.5Tesla vs 7Tesla

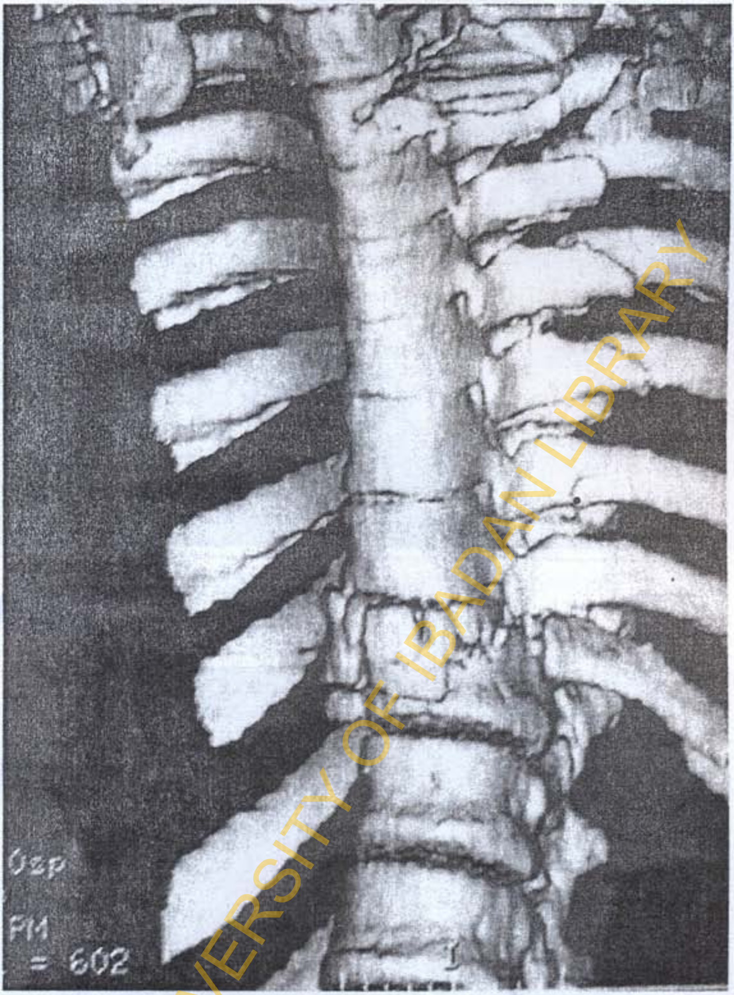
Improved details of the brain image with 7Tesla



MRI Image of the spine, cord compression

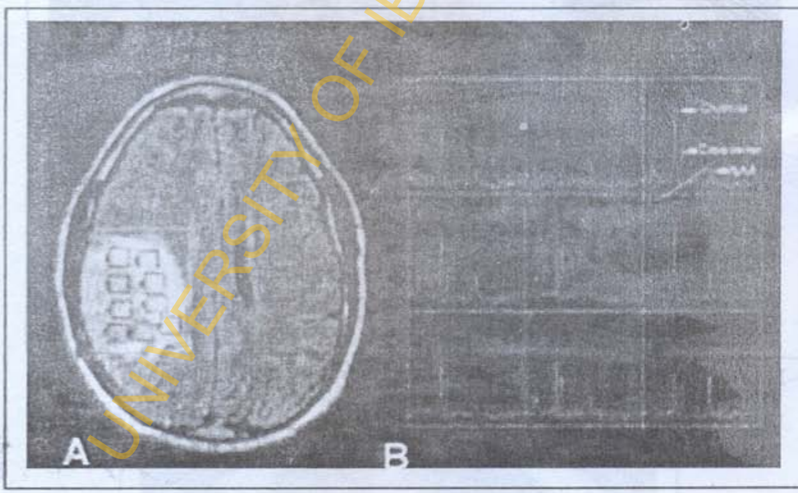


3-D reformatted image of thoracolumbar spine with fracture T11 – AP View



3-D reformatted image of thoracolumbar spine with fracture T11 –
Oblique view

Perfusion and diffusion weighted MR images



MRI spectroscopy