UNIVERSITY OF PORT HARCOURT

THE AGONY AND THE ECSTASY OF PAEDIATRIC NEPHROLOGY

An Inaugural Lecture

by

PROFESSOR (MRS) FELICIA EKE

INAUGURAL LECTURE SERIES

NO 54

14 DECEMBER, 2006

DEDICATION

This work is dedicated to my lovely family

ACKNOWLEDGEMENT

Acknowledgment: First, I thank the Almighty God who has guided me, shone the torch for me and made all things possible even when they appeared impossible. I thank my dear husband for his support and encouragement; our lovely children, Dr.Ure Eke, Engineer Kechy Eke and Ikedi Eke who remained loving and caring even when the going was tough. . I acknowledge my wonderful parents who brought me up in the love and fear of God. They have maintained exemplary Christian lives and, being role models of a happy married life, have been a great moral support. I sincerely thank my brother Dr.Uzoma Kenny Acholonu for his generosity and support. I thank my brother-in-law, Barrister Festus Eke for his support & encouragement.

My very special gratitude goes to Professor E.O.Anosike who gave me so much help and support and Professor Bosa Okoli who helped me acquire the very first microphotograph of my renal biopsies. I also thank Professor M.B.Abdurrahman, who helped me acquire some tools for Paediatric Nephrology. My thanks also to the International Paediatric Nephrology Association for a wonderful support in the development of Paediatric Nephrology in Nigeria. I acknowledge East Birmingham Hospital, UK, Guy's Hospital, London, Red Cross Children's Hospital, Cape Town and Children's Hospital, Hannover,Germany for processing my renal biopsy specimens. I thank Dr. Mrs. Ifeoma Anochie who by her interest, hard work and research in Nephrology has sustained my efforts. My special thanks again to Dr. Mrs. I. Anochie and to Dr. Augustina Okpere for proof reading the manuscript. I thank Rev. Fr. Amissah for his prayers and encouragement. May God bless you all with his overflowing fountain of love.

The Vice-Chancellor
The Deputy Vice-Chancellors
The Registrar and other Principal Officers
Provost, College of Health Sciences
Dean, Faculty of Clinical Sciences, my beloved husband
Deans of Faculties
Distinguished Professors and Heads of Departments
Other Senior Academic and Administrative Staff
My colleagues from the Teaching Hospital
Our valued Students of Great Uniport
Invited Guests and Friends
Members of the Press
Distinguished Ladies and Gentlemen

Introduction:
A student once wrote to his dad, 'Dear Dad, No mon, no sun, no fun. Send me a cheque so I'll know you're alright. Your son'. The Dad replied, 'How sad, too bad, your dad'. Today we will embark on a subject that is close to my heart. We may have no sun but I hope we will have some fun in the course of our journey. The word "paediatrics" is derived from two Greek words paidi (παιδί) which means "boy" and iatros (ιατρός) which means "doctor". A nephron is any of the numerous filtering units of the vertebrate that remove waste matter from the blood. Thus Paediatric Nephrology is the study of children's kidney & its diseases. **Figure 1** outlines the normal kidney. Most people are endowed with two.

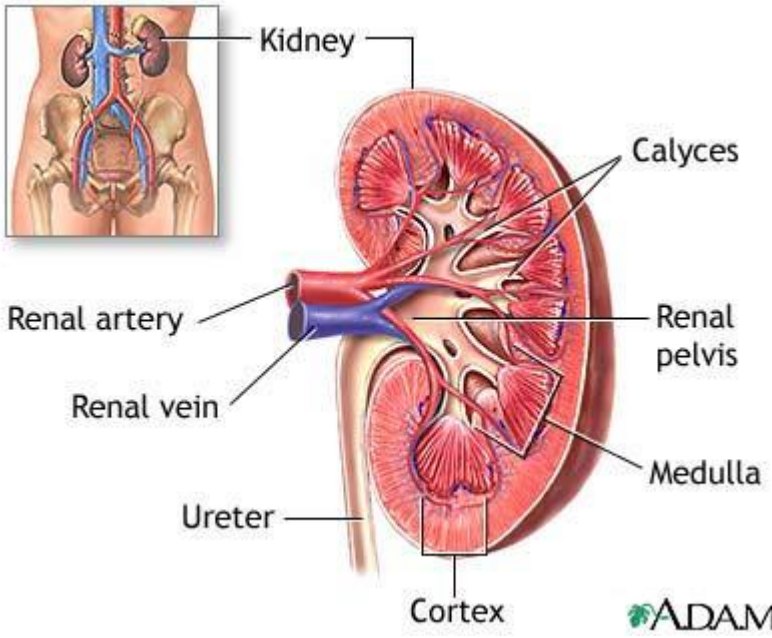


Fig 1

The word 'nephropathy' means 'damaged kidneys' Unlike my better half, Professor N. Eke, who in his Inaugural lecture in June'06 suggested that Urologists be titled 'Senior Advocate for Men's Health'[1], the Paediatric Nephrologist handles the youth and little ones and we have our moments of agony and our moments of ecstasy.

Historical background:
The bittersweet demise of Herod the Great.
One of the earliest references on kidney diseases was made on Herod the Great, who ruled Judea before the birth of Christ. Flavius Josephus describes Herod's illness, in the '*Antiquities of the Jews*'-'Distemper seized upon his whole body, and greatly disordered all his wits with various symptoms, for

there was a gentle fever upon him, an intolerable itching over all the surface of his body, and continual pains in his colon, and dropsical tumours about his feet, and inflammation of his abdomen, … Besides which he.. could not breathe but when he sat upright, had a convulsion of his members'.[2, 3] Most of these symptoms are attributable to chronic kidney disease and uraemia resulting from diabetic kidney disease.

Bright's disease: Subsequently, renal diseases were termed 'Bright's disease' after Richard Bright (1789-1858) wrote , 'With regard to the affections of the heart, I have occasionally been able to trace the gradual increase of the hypertrophy coming on many months after the albuminous condition of the urine has been established.' [4]

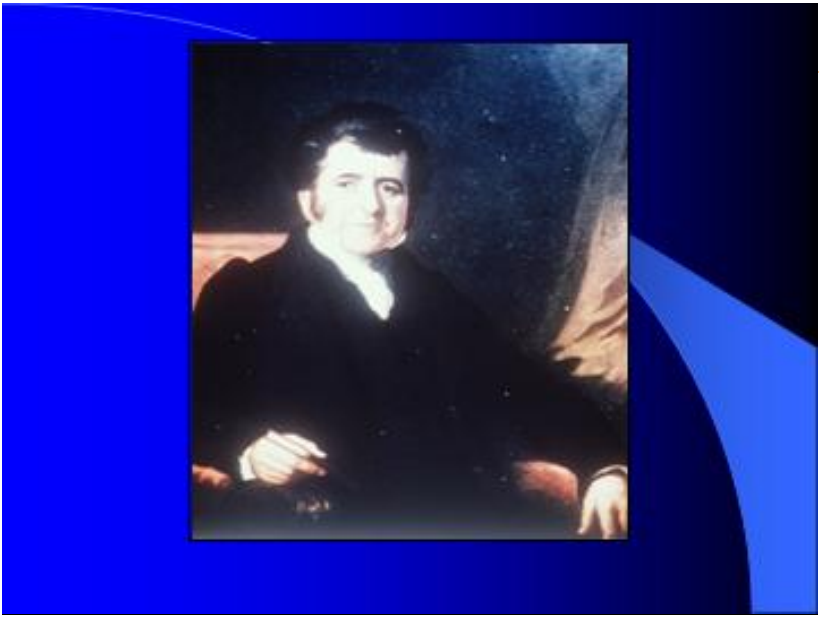


Figure 2: Richard Bright 1833

Interest in the discipline of Paediatric Nephrology arose after the second world war, following classical descriptions of 'an association of purpura (bleeding into the skin), severe abdominal pains, melaena (blood in the stools) and arthritis' by Henoch in 1905 [5]. This association is still called 'Henoch Schonlein' syndrome which 'licks the skin and bites' the kidneys in children

Pioneers of Paediatric Nephrology in Nigeria

The Pioneers of Paediatric Nephrology (PN) in Nigeria were Professors A. Adeniyi, who was made the first Emeritus Professor of the University of Ilorin in July this year, Ralph Hendrickse, Herbert Gilles and GM Edington all of whom worked in University College Hospital, Ibadan. They described Quartan malaria nephropathy from *Plasmodium malariae*. [6] Another author, Kibukamusoke also described quartan malaria nephropathy in Uganda, but with a different histological picture [7]. In all their publications, the malaria parasite was never isolated in any of the tissues[8]. Although, there is no doubt that the rate of deaths from chronic kidney disease (CKD) fell after the eradication of malaria in British Guiana [9], and there are distinct entities associated with malaria infection such as blackwater fever (acute renal failure from malaria), [10, 11, 12] recent authors are questioning the existence of 'malaria nephropathy'[13]

Embrace of Paediatric Nephrology

I first got interested in Paediatric Nephrology while inserting cardiac pacemakers and doing cardiac catheterization at the University of Nigeria Teaching Hospital, Enugu, following my initial training at Sefton General Hospital, Liverpool and Royal Manchester Children's Hospital, UK. Professor Theodore Okeahialam had drawn my attention to the fact that there was no Paediatric Nephrologist in the then East Central

State of Nigeria. I returned first to Yorkhill Children's Hospital, Glasgow and later to East Birmingham Paediatric Nephrology Unit where I took care of children on Haemo and peritoneal dialysis as well as did a three year research into childhood bone disease from chronic renal failure. The fruit of the research was an MD Thesis entitled 'Early detection of childhood renal osteodystrophy and prevention of clinical disease by low dose one alpha hydroxycholecalciferol'[14]. Prior to the Thesis, one alpha hydroxycholecalciferol was used only to treat clinical evidence of bone disease as it was found to be associated with deterioration of kidney function in therapeutic doses. We demonstrated that low doses of the drug could be used to prevent overt bone disease and without a fall in renal function[15,16,17]. Today, the drug is used world wide in small doses to prevent overt bone disease in all children with chronic renal failure. This most fruitful year was crowned by another year as a Fellow in Nephrology at the Hospital for Sick Children, Toronto, Canada 1983-1984. My return to Nigeria since 1984 has been challenging but fruitful and fascinating. Port Harcourt was a virgin soil in Paediatric Nephrology. The discipline entails hard work and commitment. You cannot put a child on dialysis and leave him to even your junior colleague. You must be physically present whether it is 2 am or 5 am. I keep reminding all my colleagues and the students that this is the only way to ensure that these desperately sick children survive. Yes, indeed we took lots of risks sometimes in our own cars, at other times in rickety old UPTH ambulances in the middle of the night, but it was all for a worthwhile cause! I recall my husband once reminded me 'In all you do you must remember that your own life is as important as the one you go out to save'.

Renal Disorders

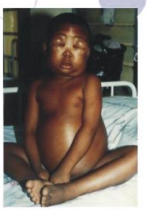
We outlined the spectrum of renal disorders in Nigeria in the *Journal of Paediatric Nephrology* in 1999 [18.19]. The commonest disorders were preventable causes such as acute renal failure, urinary tract infection, nephrotic syndrome, and acute glomerulonephritis. We noted that renal disorders accounted for 1.1% of all admissions of children and that chronic kidney failure(CKF) occurred in 7.4 children per childhood million population[18]. Among Nigerian adults, chronic kidney failure accounts for 10% of all admissions, so it is rare to walk into the ward without seeing a sufferer. It must be remembered that most of the causes of CKF in adults start in childhood.

Nephrotic Syndrome:

This is a swelling of the body from kidney disease. It is the commonest kidney disorder in the tropics. Our studies here in Port Harcourt have shown that over 60% are idiopathic (cause unknown) [20]. Other causes of this disorder include infections such as malaria [21], hepatitis B and C , human immunodeficiency virus (HIV/AIDS), post streptococcal infections, schistosomiasis, typhoid, shigellosis and filariasis. The breeding ground for these is provided by low socio-economic status, overcrowded housing and poor sanitation.

Earlier studies in Nigeria showed that most children with this disorder did not respond to a commonly used drug – Prednisolone (Steroids). However, our studies showed that over 60% of them do respond to prednisolone when properly administered. Following our publications in 1990, studies from various parts of Nigeria have made similar observations. Figure 3 is a 3year old with Nephrotic syndrome. She is massively swollen, almost beyond recognition. The left is before treatment, the right after treatment. She is now 13years old.

BEFORE AND AFTER



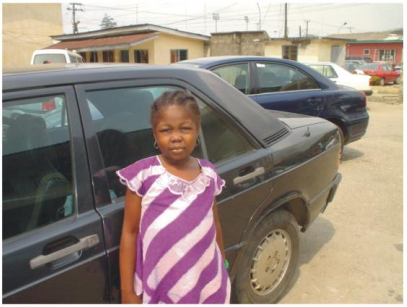


Figure 3

Figure 4 shows the numbers and age ranges of the first group of children that we studied with the nephrotic syndrome.

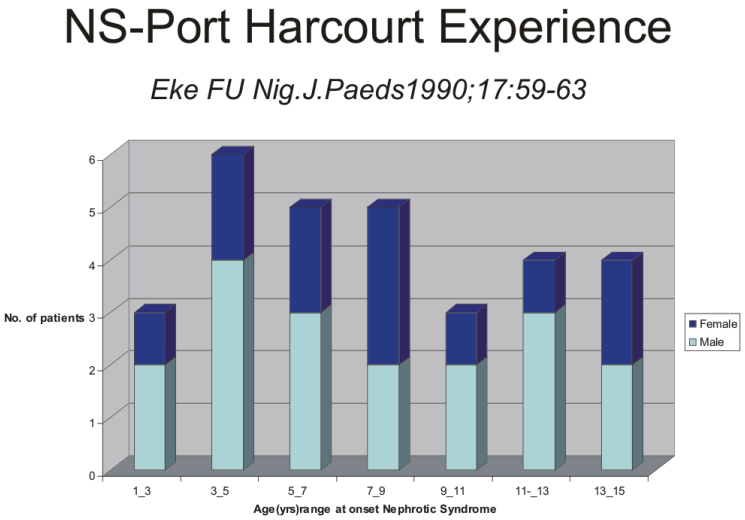


Figure 4: Age and sex of patients with Nephrotic Syndrome

Acute Renal Failure (ARF)

In 2005, we highlighted 'the persistence of ARF, another preventable scourge' [22]. In developed countries, the commonest cause of ARF is following cardiac surgery. In our country, most causes are preventable, being primarily from poor socio-economic conditions. Figure 5 is a common picture of our young children aged 5-15years. Many are in boarding schools but the poor sanitation and overcrowding lead to infection with scabies and streptococcal organisms. A hypersensitivity (allergic) reaction occurs in some individuals resulting in acute Glomerulonephritis, (AGN) which may lead to acute or chronic kidney failure

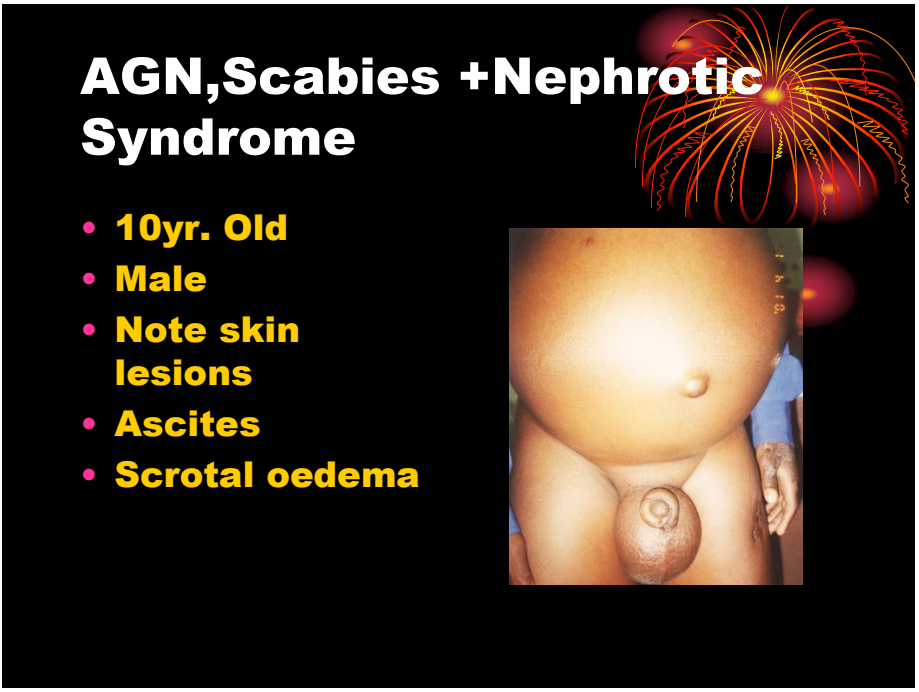


Figure 5: Acute Glomerulonephritis with ascites (fluid in the abdomen)

Table 1 outlines the commonest causes of ARF. Gastroenteritis (diarrhoea and vomiting) is the leading cause [23]. Out of the 16 causes studied in these 177 children, only 3 i.e. leukaemia (cancer of the bone marrow), posterior urethral valves (a congenital abnormality in the urinary system) and renal agenesis (absence of the kidneys at birth), could be said to be non-preventable.

Table 1

Causes of ARF in UPTH 1986-2000

CAUSE	NO	%	CAUSE	NO	%
GASTRO	54	30.5	TETANUS	3	1.69
SEPTICAE	25	14.1	INTES OBS	3	1.69
BIRTH ASP	25	14.1	LEUKAEMIA	3	1.69
ACUTE GN	24	13.6	PUV	2	1.13
MALARIA	14	7.9	PNEUMONIA	2	1.13
HUS	5	2.82	PERITONITIS	1	0.56
TYPH GN	5	2.82	RENAL AGEN	1	0.56
HEPATITIS	4	2.26	UNKNOWN	5	2.82
			TOTAL	177	100%

Gastro=gastroenteritis; septicae=septicaemia; birth asp=birth asphyxia; acute GN= acute Glomerulonephritis; HUS=Haemolytic Uraemic Syndrome; Typh GN = Typhoid Glomerulonephritis; Intes Obs= Intestinal Obstruction; PUV= posterior urethral valves; renal Agen=renal agenesis

We studied the yearly distribution of ARF and found that there has been no significant fall over a 12 year period, Fig 6a. The surge in 1988 was from an 'epidemic' following the ingestion of 'holy water' with resultant ARF and deaths both in adults and

children. A histogram of 1986-1990 is almost identical to that of 1986-2004, Fig 6b. Let us hope that ‘pure water’ will not replace ‘holy water.’

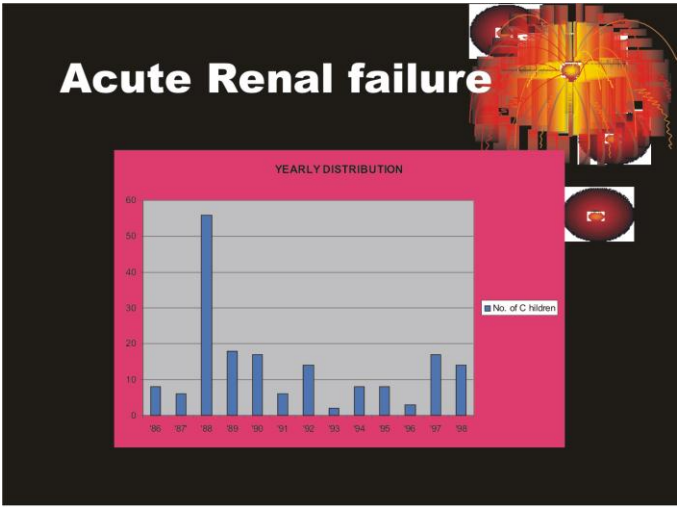


Figure 6a above; **Figure 6b** below

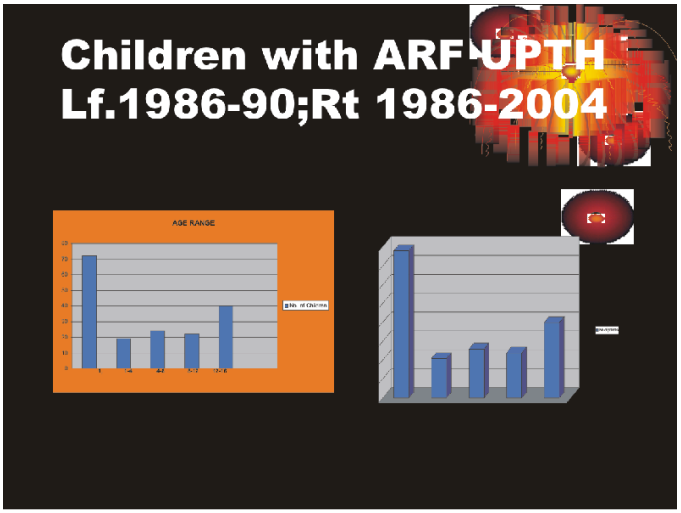


Table 11

Pre-Renal	ATN	Cort.Necrosis	Interstitial	AGN	HUS	Obstructive U
Dehyd Haem	Dehyd Nephr NSAID	Hypox Abrupti Pla	Drugs Rash Fever	Sore thr Skin Inf	Bloody diarrh	Abd Mass
Urine↓	↓, N, ↑	↓	N, ↑	↓,N, ↑	↓,N	N, ↓
Urinalysis N	Granular casts	Haematuria, Protein	Pyuria, Wbc casts	RBC casts, protein	RBC casts, protein	N
Uosm	<350		<350	>4-5	Varia	Varia
FEna <1%	>2%		>2%	<1%	Varia	Varia
UNa<10meq	>30-40		>30-40	<10	Varia	Varia
Urea↑		Plat↓ Micro	Eosinophils	C3,C4↓,ANF	Plat↓,micro	
US: N	E:N, ↑	N, ↓,CM	K: ↑ E↑	K: ↑C ↓	N;C↓	Dilat

Differentiation of Causes of **ARF**. **Cort**=Cortical; **AGN**=acute glomerulonephritis; **HUS**= haemolytic Uraemic syndrome; U=uropathy; N= normal; ↑=increased; ↓=diminished; Wbc= white blood cells; RBC = red blood cells; Uosm= urine osmolality; Varia= variable; FEna= fractional excretion of sodium; UNa= urine sodium; Plat= platelet; micro=microalbuminuria; E= enlarged; CM= lack of cortico medullary differentiation; Dilat = dilatation

When children are exposed to these preventable diseases, either through ignorance, negligence or lack of commitment, they are automatically exposed to more severe consequences. These consequences and complications include ARF which sometimes results in death unless treated with dialysis. It is not always easy to know the cause of acute renal failure. Here, we follow the words of the Holy Gospel, 'Ask, and it will be given to you; search, and you will find; knock, and the door will be opened to you. Everyone who asks receives; everyone who searches finds; everyone who knocks will have the door opened' (Matthew

Chapter 7, verses 7-9). Mr. Vice Chancellor, Sir, if after some agonizing moments, we are lucky to 'catch' a drop of urine, after a little jubilation, we test it, and find some of the chemistry in Table 11, we confidently target some possible causes of the renal failure. Diagnosing renal failure demands meticulous attention to details, but when we search, we find!

Chronic Renal Failure

There is likely underreporting of an increasing number of children with chronic renal failure (CRF) in Nigeria [24]. Most patients present late. Some never reach the hospitals and it is a significant problem that has not been given the priority it deserves. We recently studied 45 children with CRF and the causes are tabulated below[25]

Table III: Causes of Chronic Renal Failure

Primary renal disease	No.(%)	Males	Females
Glomerulopathies	23 (53.3)	9	14
Obstructive uropathy	13 (28.9)	13	0
Vascular,PN,Malign,Malaria Nephropathy	9 (17.8)	5	4
Total	45(100%)	27	18

PN=Pyelonephritis; Malign= malignancy

The commonest cause is Glomerulonephritis.

HIV/AIDS Associated Nephropathy (HIVAN)

Recently there has been an increasing number of children with CRF from HIV/AIDS. Most of these children have had a vertical transmission of this virus from their mothers during pregnancy and vaginal delivery. Characteristically, they are well grown, well nourished and reach the ages of 2-10years before they develop symptoms. Once symptoms develop, they nose-dive into end stage renal failure and death [26]. Figure 7 illustrates this.

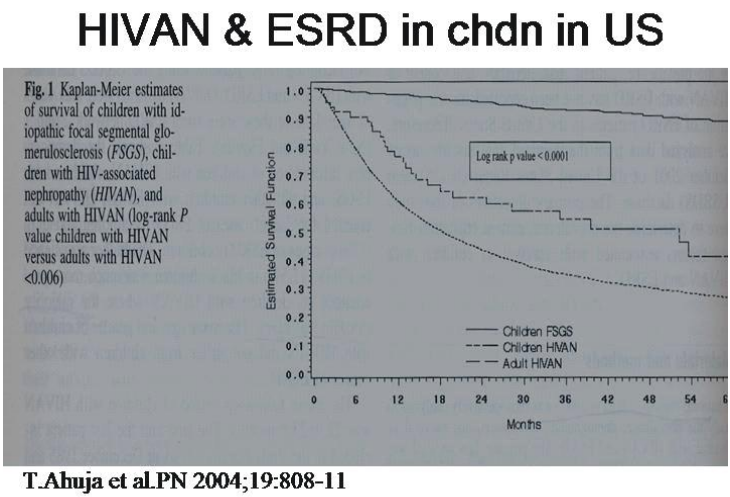


Figure 7

We have treated 10 children aged 2 to 15years with HIVAN in the last 4 years, when we became aware of the association of

chronic renal failure with HIV/AIDS. Two of the children developed renal failure secondary to HIV/AIDS following blood transfusion donated by their fathers. The others were infected in the womb by their HIV positive but clinically well mothers. Renal ultrasound showed the characteristic picture of HIVAN with hyperechoic features, Figure 8

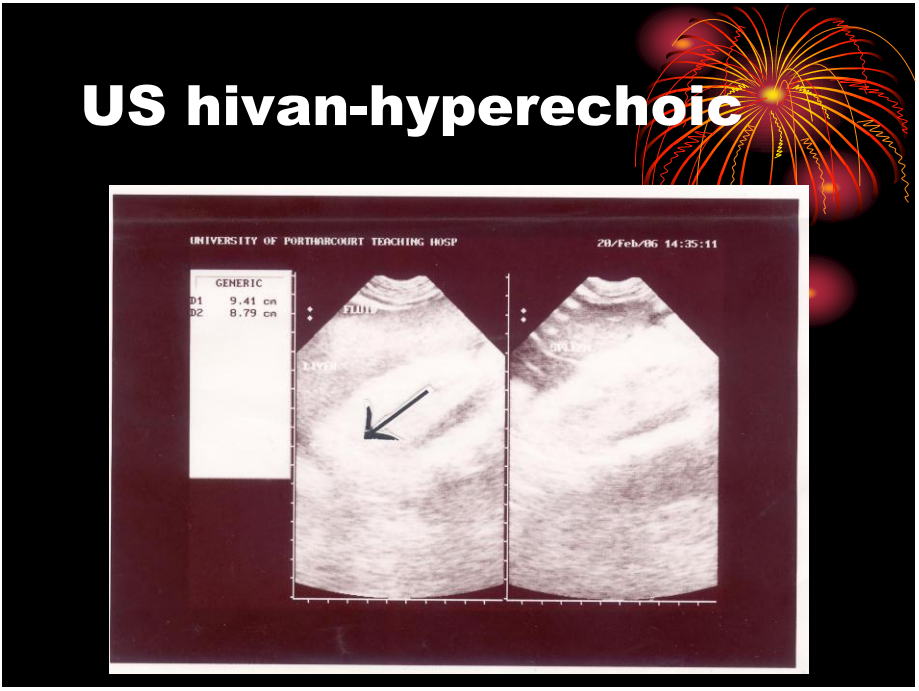


Figure 8: Ultrasound of our patient with HIVAN showing hyperechoic features

Renal tissue shows several hallmarks of HIV/AIDS end stage renal disease and the following, Figs 9-11 were the photomicrographs of a ten year old from our hospital. Fig 12 compares a normal and abnormal photomicrograph.

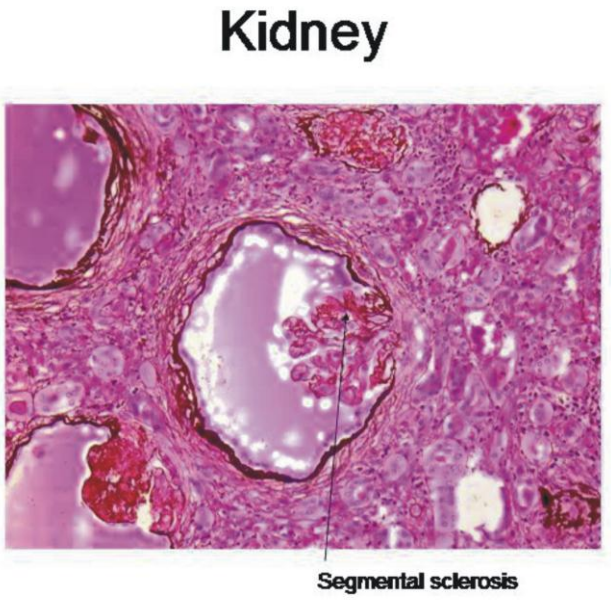


Figure 9

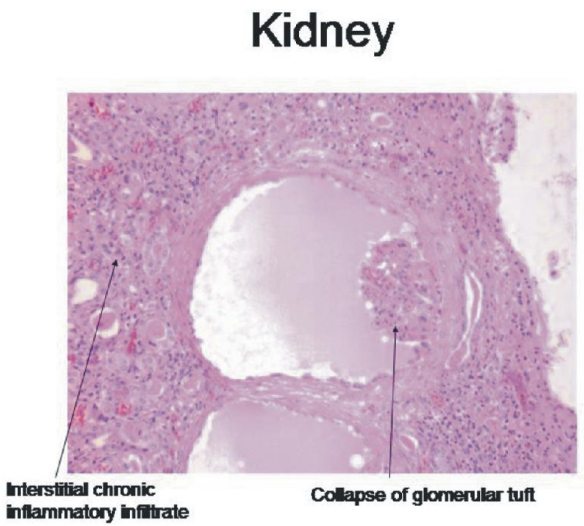


Figure 10

HIVAN

- Hyaline casts in tubules - cause of bright appearance in U/S
- **Precipitate of plasma proteins**

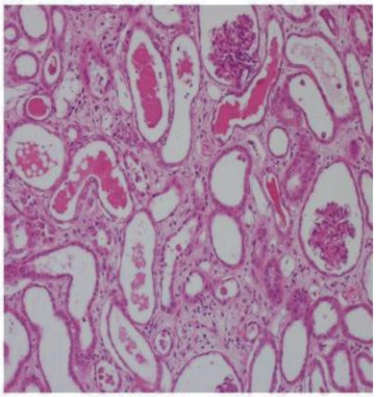
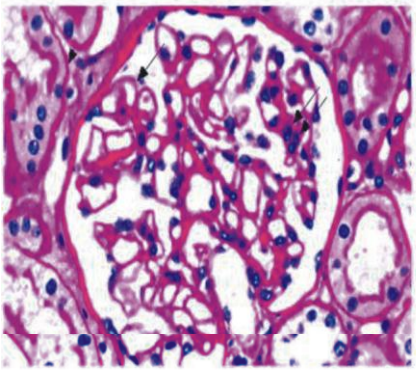


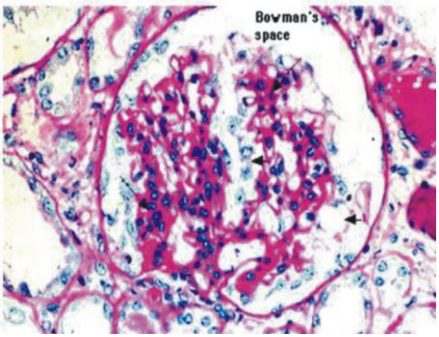
Figure 11

Normal glomerulus



Normal glomerulus Light micrograph of a normal glomerulus. There are only 1 or 2 cells per capillary tuft, the capillary lumens are open, the thickness of the glomerular capillary wall (long arrow) is similar to that of the tubular basement membranes (short arrow), and the mesangial cells and mesangial matrix are located in the central or stalk regions of the tuft (arrows). Courtesy of Helmut G Rennke.

Collapsing FGS



Collapsing FGS Light micrograph showing collapsing glomerulosclerosis with few open loops in the sclerotic areas (long arrows); these findings are characteristic of HIV nephropathy but can also be seen in idiopathic disease. The degree of collapse can be appreciated by the openness of Bowman's space. Vacuolization and crowding of the glomerular epithelial cells (short arrows) is also frequently seen and reflects the primary epithelial cell injury in this disorder. Courtesy of Helmut Rennke, MD.

Figure 12

Effect Of Hydrocarbon Exposure:

Recent studies in adults with CRF in Southern Nigeria have shown that high hydrocarbon exposure was significantly associated with CRF from Glomerulonephritis[27]. The prevalence of CRF and ESRF is rising in blacks, adults and children alike. Our studies have shown that the rate of the diagnosis of a new case in Nigeria of CRF of 7.5 children per year per million childhood population is the same as in Sweden but higher than the rate in the United Kingdom or in the United States of America.[18]

The Impact of Socio-Cultural Practices

There is no doubt that the following contribute to the escalating rise of the incidence of CRF[27, 28]

1. Herbal and traditional medicines
2. Toxins from insect and other bites
3. Environmental pollution
4. Drug overuse
5. Dry hot climate
6. Inadequate water supply

Numbers 5 and 6 contribute to the high incidence of kidney stones –nephrolithiasis. It is of note that the use of herbal and traditional medicines with unknown chemicals cuts across all social classes. For the lower social classes, it is the first port of call. Mr. Vice-Chancellor, Sir, the wealthy and 'knowledgeable' resort promptly to it when medical treatment is slow or deemed ineffective. How many of us have used 'Seven keys to power', silver bird-eucalyptus oil, tura bleaching soap, drank 'holy water' not caring to find out if the water is clean and fit for human consumption?

One may also ask, Are there genetic markers, receptors or structures that give rise to severe renal disease in blacks?. Do a multitude of infections make our kidneys susceptible to rapid progressive renal disease? The answers may be in the following-

Observation among Goajiro Indians; Venezuela, South Amarica
A recent study showed that Goajiro Indians had a significantly higher prevalence of end stage renal failure compared to other inhabitants living in the same environment[29]. The incidence of post streptococcal glomerulonephritis was nearly double that of other inhabitants. Autopsy findings showed that the race had low nephron endowment compared to other inhabitants.

Complications of CKD
Chronic kidney disease (CKD) leads to chronic renal failure (CRF), Once CRF sets in various components of the failing kidney start to manifest. Children are the most affected as they have growing bones. They develop renal bone disease termed renal osteodystrophy, ROD. This author was priviledged to have been one of the earliest researchers into childhood ROD . A prospective study of children with mild to moderate renal impairment with no obvious signs of ROD was conducted at East Birmingham Hospital, UK for 4years(1979-1983). Bone biopsy was done with the Jamshidi needle under local anaesthetic . A MOP Digiplan Electronic scanner was used to make a detailed quantitation of bone (bone histomorphometry). Patients and normal controls were studied. Most patients had histological evidence of renal bone disease with no clinical manifestations. Following this MD Thesis[14], and a few other publications[15,16,17] ,children with impaired renal function are now prophylacticaly put on a small dose of one alpha hydroxycholecalciferol ,a vitamin D analogue, to prevent renal bone disease. Other complications of CRF such as hypertension, acidosis, anaemia , hyperphosphataemia, are sometimes amenable to dietary or drug control. The bi- or tri- weekly administration of the very expensive erythropoietin has revolutionised the management of anaemia in CRF- up till 1986, the normochromic normocytic anaemia of CRF was only treatable with blood transfusion. This had inherent risks. The most severe complication of CRF,

pulmonary oedema is life threatening and requires immediate dialysis. Optimal management of children with CRF ensures they don't develop pulmonary oedema.

Urinary tract infection: (UTI)

This is indeed a very common condition and may manifest in children with bed wetting (enuresis). Mr. Vice Chancellor, Sir, the Nephrologist is so preoccupied with patients making urine, (making wee-wee) that the following, could not be more true

MAKING WEE WEE - as sung by Prof Maurice Kibel at the 3rd AFPNA Congress in Cape Town 2006, with modifications.
(Acknowledgements to Walter Donaldson: Makin' Whoopee!)

When to this world, a babe is born,
The babe soon learns, this adage worn:
That if we eat, we must excrete,
And make a wee-wee.
The infant boy, sprays with conceit,
The infant girl, is more discrete,
But both will mess, cause much distress,
When making wee-wee.
No matter the race or colour,
Each infant this rule obeys,
Whether a male or female,
They just do it in different ways.
At two or three, the little scamp,
Will run around, no longer damp,
He'll have the grace, to know the place,
For making wee-wee.
But late at night, that tiny tot,
Will pass the lot, into his cot,
His happy dreams, are of soft streams,
And making wee-wee.

If by a strange misfortune,
The colour is red or blue
Rush him to Professor Eke
She will know what to do;
In a small pot, a drop she'll nab,
And send it off, to UPTH Lab
For the location, of the aberration,
In making wee-wee.
At seven or eight, to ma's delight,
He's learned the skill, to last the night,
But certain charmers, in their pyjamas,
Still make a wee-wee.

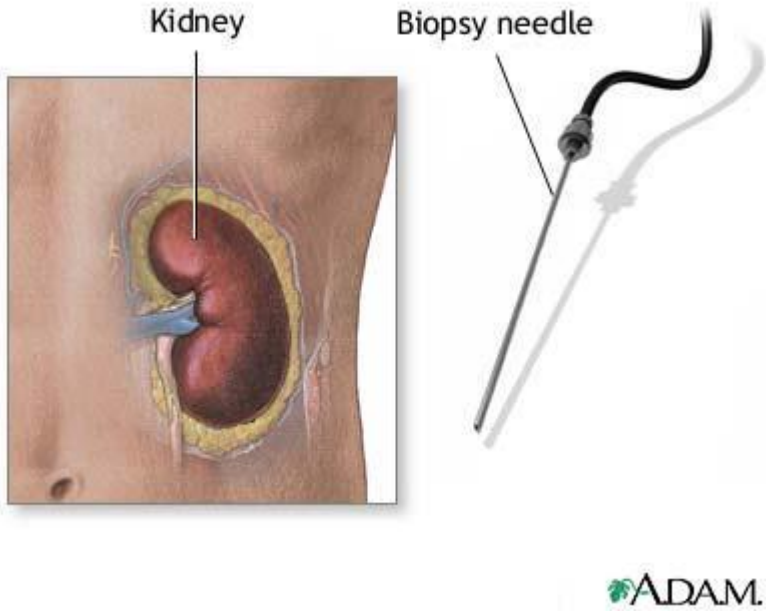
Sometimes the little darling,
Constantly wets the bed,
Violence will get you nowhere,
Bribe-the-little-brat instead;
But if in doubt, just ask for me
I have a cure, for a small fee,
I wrote a thesis, on enuresis,
(That's making wee-wee).
A lusty lad, at twenty three,
Will do his bit, behind a tree,
His great obsession, is his possession,
For making wee-wee.
At thirty five, Mr. and Ms,
In Powder Rooms, marked Hers and His,
Need no tuition, in maturation,
Or making wee-wee.
At fifty, you're in a cross state,
The power's no longer strong,
They tell you that it's your prostate
You can't hold it in too long.
At seventy two, the tinkling stream,

Of former years, is but a dream,
It's treatment drastic, with tubes of plastic,
For making wee-wee.
At eighty, I, Jan Wikkels too,
May quite forget, to use the loo,
Or skill we'll lack, to put it back,
When making wee-wee.
And so we bow, our heads in awe,
At Nature's skill, with ne'er a flaw,
To fabricate us, with apparatus,
For making wee-wee.
Maurice Kibel
16-03-2006

Most children with significant UTI in Nigeria have congenital abnormalities of their kidneys , particularly posterior urethral valves. Till date despite intensive therapy following the diagnosis and treatment of this condition even in the womb, all children with posterior urethral valves, have subsequently ended up with end stage renal failure, requiring dialysis and transplantation. In the Western world, most significant UTI are caused by Reflux nephropathy which thankfully is rare in blacks.

Specialised Investigations for renal diseases:
Renal Biopsies: In order to study diseases of the kidney, we use a special needle called the biopsy needle, to take a small sample of kidney tissue. A local anesthetic is given to numb the skin at the biopsy site. A tiny incision is then made in the skin.

Figure 13: Renal biopsy



A biopsy needle is inserted into the skin. Based on a previously determined kidney position or under direct ultrasound visualization, the needle is advanced to the surface of the kidney. The patient is then asked to take and hold a deep breath, the needle introduced into the kidney, and fired. This removes a small sample of kidney tissue. If the Paediatrician is not using direct ultrasound guidance, he may ask the patient to take deep breaths to verify needle "embedment" before firing.

The biopsy needle is then withdrawn and pressure is applied to the biopsy site to stop the bleeding. Several passes may be required before an adequate amount of tissue is collected. After the procedure, a bandage is applied to the biopsy site.

The patient is requested to remain in bed for 6-8 hours after the procedure. Pain medicines are prescribed. Oral or IV fluids are administered and urine is monitored for excessive hemorrhage. (A little bleeding usually occurs). Blood counts and vital signs are monitored. The patient is observed in the hospital for a day.

Below are three pictures of renal biopsy specimens Fig 14a and 14b. To fully assess a biopsy material, we prepare a simple light microscopic slide LM (a), but also an electron microscopic slide EM (b) and an Immunofluorescence slide, IM (c). By the way, IM has nothing to do with the IM of 'Imma Madu!'. As the last two are not available for renal biopsies in this country, we have been helped out by my colleagues abroad in four centers- Birmingham Children's Hospital, UK, Guy's Hospital, UK, Red Cross Children's Hospital, Cape Town, and Children's Hospital, Hanover Medical School, Germany

Light and electron microscopy

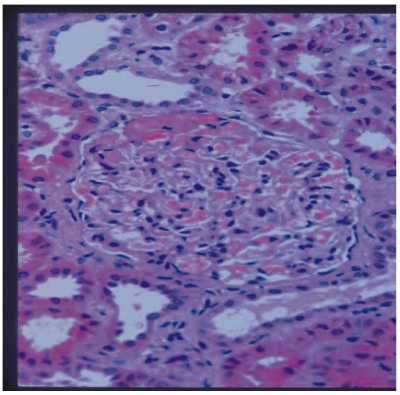


Figure 14a

Figure 14b

Immunofluorescence

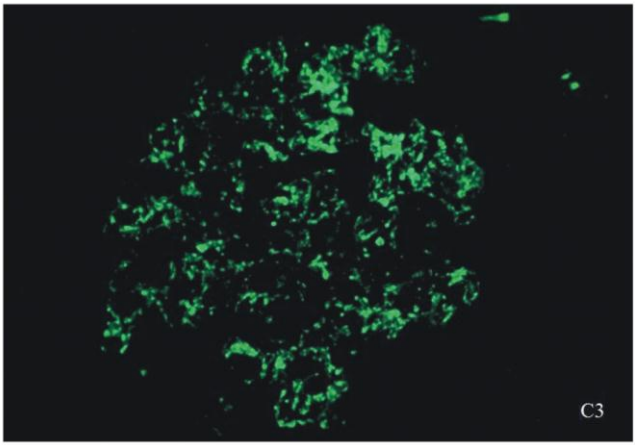


Figure 14c

GOOD OLD DAYS-1960-1975

In those good old days, there were beautiful microscopic slides of renal diseases as facilities abounded-There were IM, EM and of course LM. IM &EM for renal biopsies have been 'non-existent' in Nigeria since the 1980s.

Indications for renal biopsy

Renal biopsies are used to diagnose kidney disease when

- There is unexplained, persistent blood or protein in the urine such as in Nephrotic Syndrome
- There is reduced kidney function, as determined by kidney function tests.
- There are abnormalities seen on an ultrasound or a CT scan.

- There is need to monitor disease and evaluate the effectiveness of treatment.
- There is need to evaluate a transplanted kidney for evidence of rejection.

The commonest indication is the Nephrotic Syndrome which is also the commonest renal disorder in the tropics

Other specialised investigations:
Other specialised investigations used to study diseases of the kidney include iliac crest bone biopsy for the detection of bone disease caused by chronic kidney failure - renal osteodystrophy (ROD) [14,15,16] – Figs 15 and 16

Osteomalacia

Figure 15: Bone biopsy showing wide osteoid seams (arrow) in a patient with osteomalacia (renal osteodystrophy) from CKF (Acholonu FU,= Eke FU, MD Thesis 1995)

Hyperparathyroidism

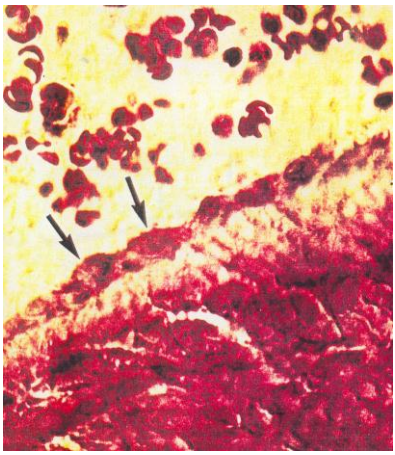


Figure 16: Bone biopsy showing prominent fat, plump active osteoblasts (arrows) lining the osteoid surface of a patient with predominant hyperparathyroidism(renal osteodystrophy) from CKD (Acholonu FU =Eke FU, MD Thesis 1985)

If ROD is not treated promptly, bow legs, knock knees, rickety rosary and other bone abnormalities appear, disfiguring the child, Fig 17. Most children with the earliest signs of CKD are now treated prophylactically with 1&hydroxycholecalciferol, a Vitamin D analogue, to avoid gruesome disfigurements as is shown in the next picture

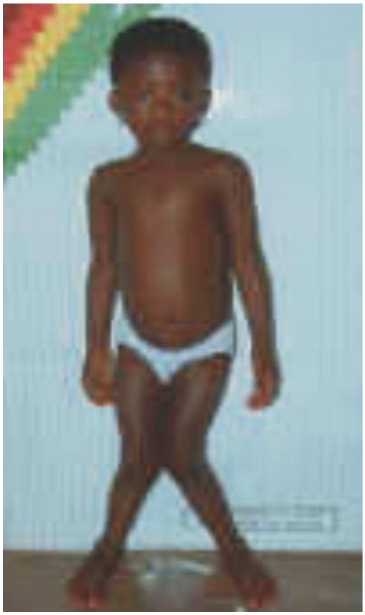


Figure 17: Knock knees from renal bone disease.

Other investigations, include the blood measurements of plasma and renal vein renin levels [30] . Often these tests involve a highly specialised procedure- angiogram for the diagnosis of renal hypertension secondary to renal artery stenosis and Takayasu arteritis [31,32] . Below, (Figs 18 and 19) are pictures taken from a 10 month old baby. She had presented with failure to thrive and found to have very high blood pressure.

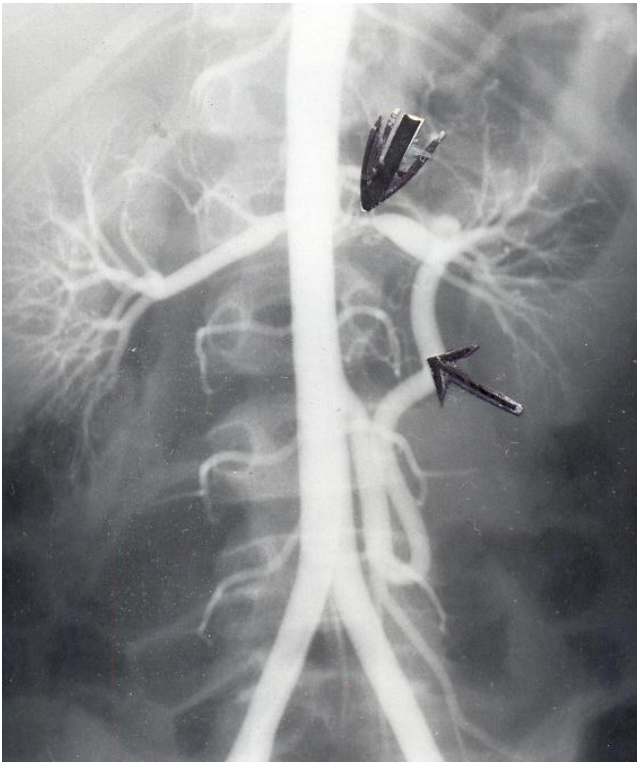


Figure 18: Abdominal aortic and renal angiogram showing left renal artery stenosis (big arrow) and the emergence of collateral artery of Drummond (small arrow) on the same side

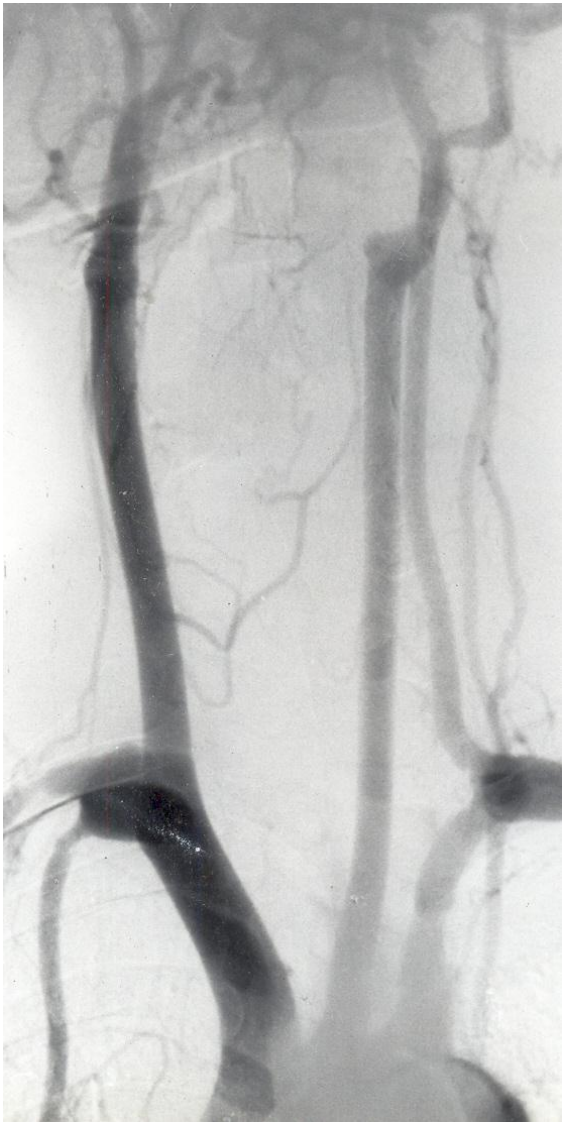


Figure 19: Carotid angiogram showing normal blood vessels in the head and neck of the same patient

Treatment:

We have treated 35 children with ARF[33] with acute peritoneal dialysis and will share some of our experiences with you.

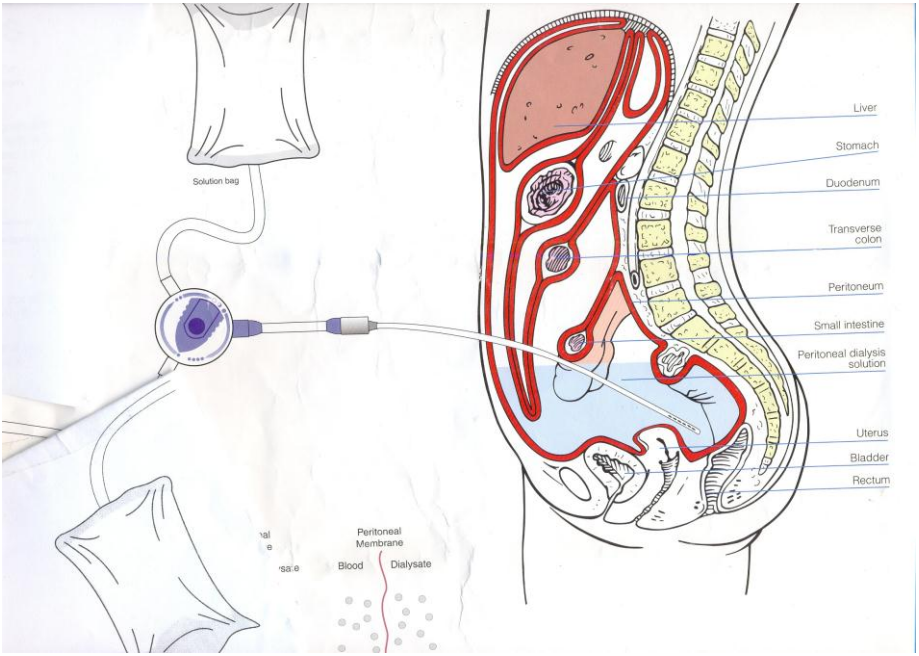


Figure 20: Acute Peritoneal Dialysis:

Acute Peritoneal Dialysis

Peritoneal dialysis is a method used to clean the blood and get rid of nitrogenous substances without blood leaving the vessels. This is not quite like the washing of blood as is done in Onitsha, Anambra State. Above is a vertical section of the Abdominal cavity. The peritoneum, a smooth soft skin which covers the inner surface of the abdominal cavity, serves as a filter to clean the

blood. A soft peritoneal catheter is inserted into the peritoneal cavity and a special dialysis fluid (dianeal) is introduced into the cavity. There is a fill time, a dwell time and a drain time. The fill time usually takes 5-10 minutes to fill the peritoneal cavity by gravity. The dwell time allows filtration to take place, waste products being filtered into the peritoneal cavity. Dwell time may vary from 30 minutes to 4-6hours.During drain , fluid containing waste products and extra fluid is drained by gravity into a drainage bag. The child's blood is gently cleansed over about 5-7 days. If the renal failure is acute, the catheter is often removed after this period and the child makes a complete recovery.

One of the earliest beneficiaries of this life saving procedure was a 7 year old who developed acute renal failure from a very severe form of malaria called, Blackwater Fever. Blackwater fever is the combination of severe haemolysis, haemoglobinuria, and renal failure. The disease became rare since 1950 when quinine was replaced by chloroquine. The disease reappeared in the 1990s after the reuse of quinine because of the development of chloroquine resistant organisms. The exact pathophysiology is unknown but it appears that a double sensitization of the red blood cells to the *P. falciparum malaria* parasite and to the amino-alcohols is necessary to provoke the haemolysis. Earlier initiation of intensive care and dialysis ensures a better outcome. Several cases have been described after therapy with halofantrine and mefloquine. It is of note that halofantrine was withdrawn from UK markets over 10years ago.

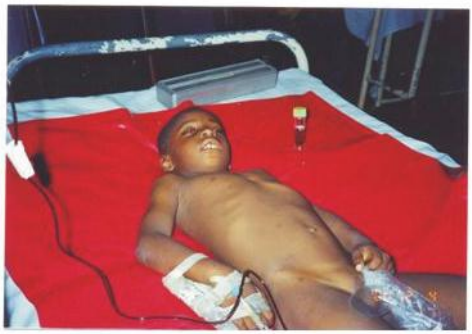


Figure 21: Blackwater fever . Bloody urine as inset. Haemolysis and severe anaemia have necessitated blood transfusion.

We have treated a 7 day old, Fig 22, with very severe symptoms of renal failure following sepsis with acute peritoneal dialysis. Left is during and right is 3 months after dialysis, happily cuddled by her mum.

BEFORE AND AFTER

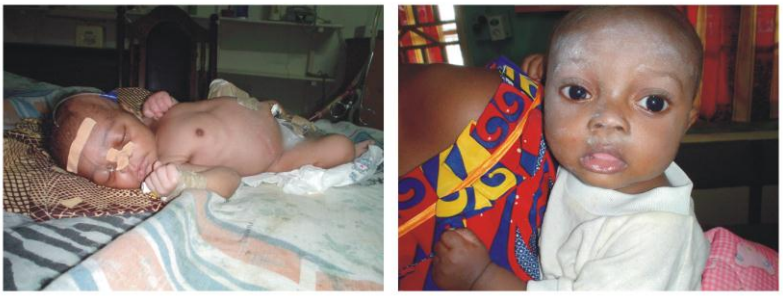


Figure 22 Peritoneal Dialysis

Another is a 3 year old, with the scar of the exit site of the dialysis catheter, 6 months after Fig 23.

BEFORE AND AFTER

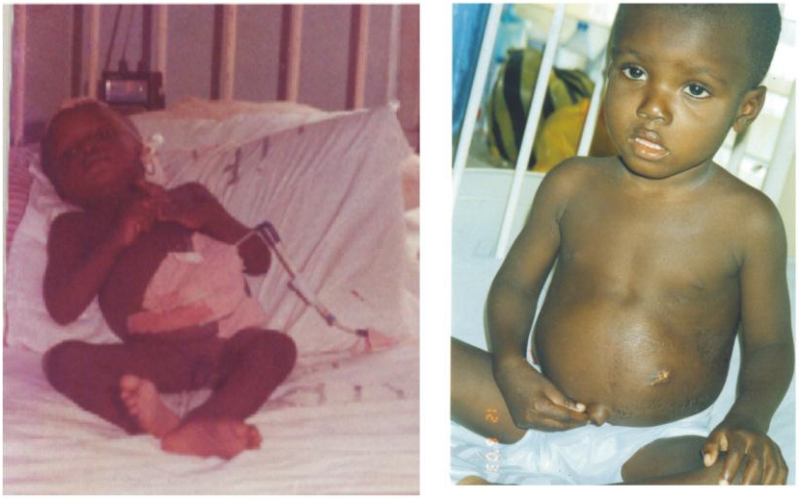


Figure 23 Peritoneal Dialysis

In the last two sets of pictures, peritoneal dialysis was undertaken with the manual method, which is preferable for very small children because of the small volume of fluid used. Recently, we use the Home Choice Dialysis machine which minimizes the risks of infection (peritonitis). Below is a 10 year old on the simple and portable Home Choice Peritoneal Dialysis machine which automatically fills, allows for dwell time and drains, the peritoneum . This significantly minimizes the risks of peritonitis which is the commonest cause of failure of peritoneal dialysis. This child was so moribund, that we were skeptical about his

survival. He made a complete recovery and is now safely in Togo, where he originally came from, with his parents.

Figure 24 Home Choice Peritoneal Dialysis

The other form of dialysis is haemodialysis which is often not suitable for children because of their small blood vessels and problems with vascular access.

TREATMENT OF END STAGE KIDNEY FAILURE (ESKF)-RENAL REPLACEMENT THERAPY (RRT)

The first renal transplant was in 1954. A patient is said to have ESKF when his creatinine clearance, Cr.Cl (=glomerular filtration rate) is <10mls/min/1.73m^2 or in children when the serum creatinine is >500µmol/l (Normal Cr.Cl 100-120mls/min/1.73m^2, serum creatinine <80µmol/l). Plans are made

for renal replacement therapy when the Cr.Cl is 20mls/min/1.73m^2. The term RRT includes haemodialysis (HD), peritoneal dialysis (PD), and renal transplantation. The programs designed for these are called End stage kidney disease programs.
The number of people developing or living with kidney disease has increased exponentially worldwide with end stage (terminal) kidney disease (ESKD) now assuming epidemic proportion in developed and developing countries [34].

In our country, Nigeria, hospital data revealed that Chronic Kidney Failure (CKF) accounts for about 10% of medical admissions. An extrapolation of this puts the prevalence figure between 300-400 patients per million population.

Majority of the individuals afflicted with CKF are young and in their economically productive years, usually between 25 and 40 years. A large majority of them (as high as 75-80%) first consult a Kidney specialist (Nephrologist) after they have reached the terminal stage. Many of these patients developed abnormalities of their kidneys following infections we have mentioned in childhood.

Treatment of CKF is expensive and beyond the reach of government workers, irrespective of status. We can then imagine the condition of the general public, dependants and the unemployed who suffer from chronic kidney failure.

Government expenditure on health is less than 30% of internationally recommended figures and unfortunately renal care is not included in our fledgling national health insurance scheme. Even in developed countries, for example, in the USA current annual cost of treating CKF is USD $ 17 billion and it is estimated to increase to $29 billion by the year 2010 [35].

Also, in Europe dialysis alone consumes 2% of health care budget (for just 1% of population). It is estimated that the cost expended on management of CKF globally is about USD$1.0 trillion[35].

In Nigeria there is no subsidy at all on the care of chronic kidney failure (CKF) hence all expenditures on renal health in most cases come from out -of-pocket expenses in spite of the endemic nature of poverty. As a consequence, less than 2% of all children with ESRF receive any kind of kidney support treatment (renal replacement therapy).

The vast majority of patients starting haemodialysis die or stop treatment because of cost constraints within the first 3 months and less than 2% are started on peritoneal dialysis. Although kidney transplantation is the most cost effective option that offers best quality of life, only about 1% of all patients with ESKD in Nigeria end up having a transplant. To date there is no RRT Program for children in Nigeria.

Table 1V Variation in End Stage Renal Disease and programs

Country	Chd Pop /m	Expected ESRD Pmp/yr	Chd ESRD progm	Total Pop/ /m	Adults with ESRD/ Pmp/yr	Adult ESRD Progm/ /pmp	Adult Progm started	GNI/ Capita/ Annum
India	400		0	1billion	100	0.9	1987	$454
Kenya	8	15.4	0	20	90	0.2	1984	$336
Nigeria	48	7.5	0	120	200	0.1	1981	$277
Sudan	12		0	30	100	0.2	1986	$280
USA	72	6.0	150	281	313	14.9	1950	33,684

Chd=children, m=million, Pmp=per million population, progm=program, GNI=gross national income

It is of interest to note that although India and the African countries listed do not have specific centers devoted solely to children for the treatment of ESRD, they all transplant adults and children FREE. Sudan that started their ESRD program only in 1986 have transplanted over 30 children free of charge – obviously funded by their government. The gross national income per capita in Sudan is similar to that in Nigeria. In Pakistan an individual was so moved by the fate of his people suffering from ESRD that he founded a center, SIUV which has over five years been transplanting free of charge and not denied anyone RRT. It is still funded by charity, has an impressive website and is a marvel to all who have been there. Mr. Vice Chancellor, Sir, we all know there are Nigerians with much more than 30 million Naira. There are people out there whom God would bless more abundantly if they shared. In Nigeria, endowed by God with natural and human resources, and acclaimed to be one of the richest countries in Africa we have a different story. There is paucity of Dialysis Units, which are mainly restricted to urban centers. Most of the dependable dialysis units that can be relied on for dialysis especially in emergencies like acute pulmonary oedema are privately owned. Most sufferers from ESRF lack funds to afford regular haemo or peritoneal dialysis. Those who can afford it often get dialysis and transplant abroad. There is no government funding or subsidy. There is no Health Insurance and RRT was excluded from its National Health Insurance Scheme. The few government institutions with dialysis units have old machines which often break down. There is absence of technical support and spare parts, accompanied by frequent power outages.

A session of HD in Nigeria costs 20-30,000 Naira. Optimal dialysis prescription is 3 sessions a week i.e. 60-90,000 Naira a week. Peritoneal dialysis is equally very expensive. A 1.5L fluid bag (all imported) is 4-5,000 Naira; the catheter with three way tap is 10,000Naira. Often 2 or more catheters are required. The

use of 2 bags a day for a child X 7 days will cost 70-100,000Naira a week if 2 or more catheters are used.

The first renal transplantation in Nigeria took place in St. Nicholas private Hospital, Lagos, in 2000. Since then 2 other transplant centers have been operational – Kano and Ile-Ife. Between them there have been 58 total transplants; 43 in St. Nicholas, 12 in Aminu Kano and 3 in Ile-Ife. Two twelve year old children were transplanted in St. Nicholas (Adult Program). A renal transplant costs N3.2million(deposit) in St. Nicholas; N1,000,000 in Aminu Kano . The same in India costs US$5,000 (N700,000); in Pakistan US$6-10,000 (N840,000). Immunosuppressive drugs which must be used after transplantation add prohibitive costs of $2,000/yr(Cyclosporine A) and $200/yr (Azathioprine).The average Nigerian earns $277(₦ 38,780) per annum. For all affected by ESRF, a strong Family and financial backing is essential. For children in addition, teachers, social workers, church members and pastors play vital roles.

Mr. Vice Chancellor, Sir, Samuel Jackson once said 'Nothing will ever be accomplished if all possible objections must first be overcome'. The first child that received RRT after being diagnosed to have ESRF in Port Harcourt had dialysis and two renal transplants in USA. Ten years later, it was obvious she suffered immensely socially and psychologically from being away from her family and friends. In March this year we started RRT on the first child in Port Harcourt in collaboration with Aminu Kano Teaching Hospital. The child has been on haemodialysis for six months awaiting a renal transplant.

It is clear from the above that we need to focus on the prevention of Chronic Kidney Failure , with renal awareness, and other programs.

Renal awareness

Awareness and interest in childhood renal disorders, their prevalence, socio-cultural impact, prevention and treatment in Nigeria are low. We therefore welcomed the First World Kidney Day on 9th March 2006. The International Society of Nephrology(ISN) and the International Federation of Kidney Foundations (IFKF) jointly proposed that a World Kidney Day be held on the second Thursday of March yearly and I would ask all of you to take part in whichever way you deem fit to draw global attention to the increasing pandemic of chronic kidney diseases.

On the inauguration of the World Kidney Day last March, the Nigerian Association of Nephrology (NAN) held a Symposium, "COMBATING THE MENACE OF CHRONIC KIDNEY FAILURE IN NIGERIA" The main objective was to proclaim the message about kidney disease to governments, government health officials, general physicians, allied health professionals, individuals and families.

The principal reason for creating this special day tagged "World Kidney Day" is to focus on the prevention of CKF. This will be an annual programme; the objective is similar to that of the initiators of the world health day and this is to sensitize all the tiers of government, government health officials, general physicians, allied health professionals, individuals and families about the emerging epidemic of Chronic Kidney Disease so that we can all rise up to the challenge of arresting it. The Nigerian Association of Nephrology has been in the forefront in championing preventive nephrology in our country and propose the following:

Prevention of chronic kidney failure: This could be subdivided into three major categories:

1 Primary Prevention

2 Secondary Prevention
3 Tertiary Prevention

PRIMARY PREVENTION:

· Aims at preventing kidney disease from occurring at all
· This calls for the knowledge of
  - risk factors that predispose to renal disease
  - risk factors that initiate renal damage.
  - modification, removal, or avoidance of factors.
  - development of a positive health seeking attitude and behaviour

Risk factors for kidney disease that should be avoided, removed or aggressively treated include

Urinary tract infection
Bacterial infection
Parasitic infection
Hypertension
Diabetes
Chronic inflammation of the kidney
Smoking
Obesity (fatness)
Analgesic consumption
Bleaching creams/soaps
Undefined herbal preparations

SECONDARY PREVENTION: Aims at identifying factors that aid or hasten progression of kidney disease and/or accelerate loss of kidney function, and preventing or removing such factors. While a few of these factors are not modifiable, majority of them could be modified, controlled or completely avoided.

These include

- Hypertension
- Diabetes Mellitus
- Protein in urine
- Dyslipidaemia (Increased fat in blood)
- Obesity (fatness),
- Smoking
- Excessive alcohol consumption (>2 drinks/day)[36]
- Analgesic (pain killers) consumption
- Undefined herbal remedies
- Environmental pollution (heavy metals – Lead, Mercury, Hydrocarbons)
- Bleaching creams / Soaps (Mercury exposure)
- Communicable diseases – malaria, filariasis, schistosomiasis, Hepatitis B & C, HIV/AIDS)
- Chronic Urinary Tract Infection

TERTIARY PREVENTION: Is usually hospital based, capital intensive and is carried out by specialists. Its main goal is the prevention of complications that arise and affect quality of life of patients on haemodialysis, peritoneal dialysis and transplantation. It involves the development of community based nephrology practice or 'community nephrology' and community based programs designed to screen for risk factors for the development of CKD.[37]

Role of General Practitioners or Family Physicians:

§ Majority of patients with CKF are managed by non specialists until they reach terminal stage. There is the need to educate general practitioners, family physicians and first line primary health workers on how patients at risk should be detected and treated and/or appropriately referred.

§ Any individual with hypertension, proteinuria and/or deranged serum chemistry must be referred to a Nephrologist (Kidney Disease Expert)
§ Any individual with Diabetes Mellitus, proteinuria, hypertension and/or deranged serum chemistry → Nephrologist and co-managed with a Diabetologist.
§ Any individual with a family history of chronic kidney failure with or without proteinuria and/or deranged serum chemistry → Nephrologist
§ Any individual with recurrent urinary tract infection with or without proteinuria and/or deranged serum chemistry must → Nephrologist
§ Any individual with familial type of renal disease with or without proteinuria and/or deranged serum chemistry → Nephrologist
§ Provision of appropriate treatment options for identified people at risk of progressive renal function loss:
- Early use of ACE (Angiotensin converting enzyme inhibitors) or ARB (Angiotensin Receptor blockers) to reduce proteinuria in diabetics and hypertensive patients.
§ Recognising appropriate targets for blood pressure control in patients with renal disease.
§ Emphasizing the need for prompt referral of patients that need more expert attention or detailed investigations.

Roles of Government:
§ Inclusion of renal health screening in the primary health care program
§ Provision of facilities for, and training on simple urine testing for protein and sugar at the primary health centres.
§ Provision of reliable and simple to use blood pressure measuring kits for the rural and community health centres
§ Intensification of community health education to promote improved personal and environmental hygiene.

§ For the patients that require tertiary care there is need for government subsidy on all forms of renal replacement therapy (Dialysis or Renal Transplantation).

Roles of the individual:

§ Calls for knowledge of kidney health and disease
- risk factors that predispose to renal disease.
- modification, removal, or avoidance of factors.
- development of a positive health seeking attitude and behavior

§ Prompt visit to hospitals or health centres for suspicious complaints and ailments.

All the outlined preventive measures along with comprehensive renal care for Nigerians were included in the draft National Renal Care Policy produced by NAN which has been submitted to the Federal Ministry of Health. It is hoped that the Federal Government will constitute a committee that will produce a final document which will guide provision of renal care services in all hospitals and outline the responsibilities of all tiers of Government.

We plead that renal care should be adequately supported and not neglected by Federal Government Health Reform Agenda which is strongly in line with the W.H.O (World Health Organization) Millennium Development Goals. Australia's recent response to an epidemic of renal and cardiovascular diseases is worth emulating.

Effect of preventive studies with Australian Aborigines

An epidemic of renal and cardiovascular diseases was noted among the Australian Aborigines with a 3-5 fold increase in death rates compared to the rest of the population. In 1995, a renal and cardiovascular program was introduced into the community.

Angiotensin inhibitor drugs were given to all with overt albuminuria, and microalbuminuria if a patient is diabetic. There was strict control of high blood pressure, blood glucose and lipids (cholesterol), together with health education. Five years later, 2005, a 50% reduction in renal failure and all cause natural deaths was noted.[38]

Challenges

Among the challenges that face us are the development of screening programs for the prevention of CRF, encouraging local manufacturers to produce consumables which are otherwise so expensive when imported. We need a radical re-orientation to research, and collaboration across our continent.

The International Paediatric Nephrology Association (IPNA) And The African Paediatric Nephrology Association (AFPNA)

The International Paediatric Nephrology Association (IPNA) was established in 1957 and has contributed immensely towards the development of Paediatric Nephrology in Africa. The African Paediatric Nephrology Association, AFPNA was the last Association to join the International body in 2000 with its maiden Congress in Cairo. Following the Congress I was elected to represent West and Central Africa in the International body. The second Congress was held in Port Harcourt in 2002 and the third in Cape Town in March 2006. At that last Congress, it was decided that my humble self should represent the continent at IPNA as an Assistant Secretary and be the President of AFPNA.

Specific contributions of IPNA in Africa include the training of 2 Nigerians in Paediatric Nephrology for six months each in Cape Town (Drs F. Ikimalo and G. Achugwo), the training of 10 other African Paediatricians and the sponsoring of 3AFPNA Congresses in Cairo, Port Harcourt and Cape Town. IPNA has a continuing Fellowship Program in Nephrology training 3-6 Doctors every year in Africa and 32 world wide annually. This

Collaboration has resulted in research with various institutions and strong African representation in Paediatric Nephrology[39,40,41]

Prioritization

We need to have our priorities correct. Health is wealth and we need to devote our resources to the eradication of nephropathic infections. Black African countries are the only countries in the whole world that have become poorer in the last 25 years. This poverty is relative as the wealth of the nation is in the hands of a few. The rich should be encouraged to donate and share. The Government should develop a political, social, and international will and input for success.

Hope for the future

Some hope for the future lies in the rising number of trained professionals . This signals a growth in Paediatric Nephrology. In 1963, there were 3 Paediatric Nephrologists in Nigeria. In 2004, 7 and today, there are 13. Our childhood population is around 80 million ie.1 Paediatric Nephrologist for>6million children.
In South Africa, the ratio is 1 to 1.5 million children.

Way forward

In 2003 the Commission for Global Advancement of Nephrology(COMGAN) wrote: "The Value of investment in renal prevention programs is astonishing"[42]
We should focus on prevention of ESRF by systematic screening and treatment programs, health Education and increased Government funding for basic health and for the wider availability of Dialysis/Transplantation.
Improving the quality of health for all Nigerians will be incomplete if renal disease that affects quite a significant proportion is not catered for. As stated in the new National Health Policy, we are at a critical stage where we need to improve the total health of Nigerians not only to break the vicious circle of ill-

health, poverty and low level of development but to convert it to the virtuous circle of improved health status, increased well being and sustainable development.

Mr. Vice-Chancellor, Sir, I plead to rest my case. May the Good Lord bless you all with his fountain of love.

Figure 25

References

1. Eke N. "From Barefoot Fag to Urology. The odyssey of a Surgical ant." ***Inaugural lecture series No 51,*** 22 June, 2006

2. WY Loebl. "The bitter sweet demise of Herod the Great." ***The Antiquities of the Jews. Cited in Litchfield WR.Journal of the Royal Society of Medicine1998;91:283-284***

3. www.livius.org/he-hg/**herod**ians/**herod**_the_**great**01.html. Jona Lendering. Herod the Great 73BC as cited in Perowne S. ***The life and times of Herod the Great***. London. Hodder and Stoughton 1956. 185-6

4. Richard Bright (1789-1858). Reports of Medical Cases. 1827

5. Henoch EH 1903 Nephritis. Purpura. In: ***Verlesungen Uber Kinderkrankheiten***, 11th Ed, Hirschwald Berlin, pp1-883

6. Gilles, HM, Hendrickse, RG. "Possible aetiological role of Plasmodium malariae in Nigerian children." ***Lancet*** 1960.1:806-7

7. Abdurrahman, MB, Greenwood, BM *et al*. "Immunological aspects of NS in Northern Nigeria." ***Archives of Disease in Childhood*** 1981;56:199-202

8. Kibukamusoke, JW *et al.* "NS in Uganda & its association with quartan malaria." ***Quarterly Journal of Medicine*** 1967;38:393-408

9. Giglioli, C. "Malaria & renal disease with special reference to British Guiana II. The effect of malaria eradication on the incidence of renal disease in Br. Guiana." ***Annals of Tropical Medicine and Hygiene*** 1962; 56:225-241

10. Eke FU, Obioha, "N. Plasmodium falciparum parasitaemia at the University of Port Harcourt Teaching Hospital." ***Current Therapy and Prevention of Malaria*** 1990; 1: 208 - 212.

11. Eke FU, Frank-Briggs A, Ottor J. "Childhood Mortality in Port Harcourt, Nigeria." ***Anil Aggrawal's Internet Journal of Forensic Medicine and Toxicology*** 2001 Vol 2, No 2 (July- Dec 2001) http://anil299.tripod.com/vol_002_no_002/papers/papers003.html

12. Eke F, Anochie, I. "Effects of pyrimethamine versus proguanil in malarial chemoprophylaxis in children with sickle cell disease: a randomized, placebo-controlled, open-label study." ***Current Therapeutic Research*** 2003: 64: 616-625

13. Ehrich & Eke. "Malaria induced renal damage : Facts and myths." ***Pediatric Nephrology*** 2006;20: 1879-1885

14. Acholonu FU(=Eke FU). MD Thesis 1985. **"Early detection of childhood renal osteodystrophy and prevention of clinical disease by low dose one alpha hydroxycholecalciferol."** *National University of Ireland, Cork*

15. Eke FU., Winterborn M. "Effect of one alpha hydroxycholecalciferol on glomerular filtration rate in moderate renal failure." ***Archives of disease in childhood***

16. . Eke FU, Winterborn, MH, "Robertson PW. Detection of early renal osteodystrophy." ***Child Nephrology Urology*** 1988; 9: 33 - 37.

17. Eke, FU, Winterborn, MH. "Bone histomorphometry: Detailed analysis of 17 cases." ***Orient Journal of Medicine*** 1991; 11: 71 - 75.

18. Eke F, Eke N. "Renal disorders in children. A Nigerian study." ***Pediatric Nephrology*** 1994.8: 383-386

19. Eke F U. "Urinary Tract Infection in Nigerian Children." ***Nephron*** 1995; 70: 132

20. Eke F "Nephrotic Syndrome in Port Harcourt. Clinical presentation and response to steroids." ***Nigerian Journal of Paediatrics*** 1990;17:59-63

21. Eke FU. "Treatment of Uncomplicated Malaria." In: ***Rational Use of Antimalaria Drugs***. Obi C. ed. Tropics Interpharm Services Limited, Lagos 1993; 75 – 79

22. Anochie I.C., Eke FU. "Acute renal failure in Nigerian children: Port Harcourt experience." ***Pediatric Nephrology*** 2005.20: 1610-161

23. Eke FU, Simpson PJ. "Rotavirus gastro-enteritis at the University of Port Harcourt Teaching Hospital." ***Nigerian Journal of Paediatrics*** 1991; 18: 51 - 55.

24. Eke F. "Chronic renal failure in childhood." ***Nigerian Medical Practitioner*** 1992: 35-37

25. Anochie IF, Eke, FU. "Chronic renal failure in children: a report from PH, Nigeria" (1985-2000). ***Pediatric Nephrology*** 2003 18:692-695

26. Ahuja T *et al*. "HIV associated Nephropathy and end stage renal failure in children in the United States of America." ***Pediatric Nephrology*** 2004. 19: 808-11

27. Ishola DA *et al*. "Hydrocarbon and chronic Glomerulonephritis." ***Saudi Journal of Kidney Disease and Transplantation*** 2006;17:82

28. Bamgboye EL. "Hemodialysis: management problems in developing countries, with Nigeria as a surrogate." ***Kidney International Supplement***.2003;83:S93-5

29. Herrera J, Rodriguez-Iturbe B. "End stage renal disease & acute GN in Goajiro Indians." ***Kidney International*** 2003;63:S22-26

30. Eke FU, Winterborn MH. "Plasma renin activity in children after surgical relief of hydronephrosis." ***International Journal of Paediatric Nephrology*** 1983; 4: 177 – 180

31. Eke FU, Balfe J W, Hardy BE. "Three patients with arteritis." ***Archives of Disease in Childhood*** 1984; 59: 877 - 883.

32. Eke FU, Balfe JW. "Captopril in Takayasu's disease." ***Archives of Internal Medicine*** 1984; 144: 2283

33. Anochie I.C., Eke F.U. "Paediatric acute peritoneal dialysis in southern Nigeria." ***Postgraduate Medical Journal*** 2006.1:136-139

34. Moeller S, Gioberger S, Brown G. "End stage renal disease patients in 2001: global overview of patients, treatment modalities and development trends." ***Nephrology Dialysis Transplantation*** 2002 ;17: 2071-2076

35. Lysaght MJ. "Renal replacement therapy. Maintenance dialysis population dynamics: Current trends and long-term implications." ***Journal of American Society of Nephrology*** 2002. 13: S37-S40

36. Reynolds K *et al*. "Alcohol consumption and risk of stroke." ***Journal of the American Medical Association*** 289:579-588

37. Ramirez SP, Hsu SI, McClellan W. "Taking a public health approach to the prevention of end-stage renal disease. The NKF Singapore Program." ***Kidney International*** 2003; 63:S17-S21

38. Hoy W, WangZ, Baker RA, Kelly AM. "Reduction in natural death and renal failure from a systematic screening and treatment program in an Australian Aboriginal community." ***Kidney International*** 2003. 63: S66-S73

39. Hoosen M Coovadia, Felicia Eke, Martin Luta. "Paediatric Nephrology around the world Africa." ***Pediatric Nephrology*** Barrat MT, Avner ED, Harmon

WE, eds. Paediatric Nephrology. Baltimore, Maryland Lippincott Williams & Wilkins; 1999; 1362 – 1367

40. Moustafa B, Eke F., Bhimma R. "Africa." In :***Pediatric Nephrology*** Ellis Avner, William Harmon, Patrick Niaudet eds. Lippincott, Williams &Wilkins. Philadelphia, New York, London, Tokyo. 5th ed.2003

41. Anochie I., Eke F, Okpere A. "Childhood Nephrotic Syndrome: Change in pattern and response to steroids." ***Journal of the National Medical Association*** 2006;98: 230-239

42. COMGAN: "Renal disease prevention programs." ***Kidney International*** 2003;63:145-150

Glossary

1. ACE: Angiotensin converting enzyme inhibitor
2. ARB: Angiotensin receptor blockade
3. AGN: Acute glomerulonephritis
4. ARF : Acute renal failure
5. CKD : Chronic kidney disease
6. CKF : Chronic kidney failure
7. ESKD : End stage kidney disease
8. ESKF : End stage kidney failure
9. AFPNA : African Paediatric Nephrology Association
10. IPNA : International Paediatric Nephrology Association
11. NAN : Nigerian Association of Nephrology
12. PN : Paediatric Nephrology
13. ROD : Renal osteodystrophy
14. RRT: Renal Replacement Therapy