URINARY TRACT INFECTIONS AMONG CHILDREN ADMITTED WITH GASTROENTERITIS IN PAEDIATRIC WARD MUHIMBILI MEDICAL CENTRE, DAR ES SALAAM.

A DISSERTATION FOR THE DEGREE OF MASTER OF MEDICINE IN PAEDIATRICS AND CHILD HEALTH OF THE UNIVERSITY OF DAR ES SALAAM.

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DATE: JANUARY 1982.

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C E R T I F I C A T E

This is to certify that this dissertation is the result of my sole effort. Help was obtained from the microbilogy Laboratory in the preparation and plating of culture medias. All the above was possible under my direction and supervision.

DECLARATION

I herewith declare that the whole of this work has not been submitted for a degree in any other univerisity

CONTENTS:

Page

SUMMARY 1

INTRODUCTION 3

MATERIALS AND METHODS 11

Study Population 11

Collection of Specimen 12

Transportation of urine to Laboratory and storage 12

Culture 13

Identification of organisms 13

Preparation of materials 13

Control strains 14

Drug sensitivity patterns and drug discs 14

Sensitivity test reading 15

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RESULTS: .....

Urinary tract infections among children admitted/seen at Muhimbili Medical Centre 16

Age and sex distribution 17

Symptoms and signs for 41 gastroenteritis children with urinary tract infection 18

Symptoms and signs in 30 control children with urinary tract infection 19

Diagnosis on admission in 41 gastroenteritis children with urinary tract infection 20

Diagnosis in 30 control children with urinary tract infection 21

White Blood Cell (W.B.C) counts per high power field in children positive for urinary tract infection 22

Sugar, proteins, ketones, casts and redblood cells urines of patients with urinary tract infection .. 23

Bacterial urine counts of children with gastroenteritis positive for urinary tract infection 24

Urinary tract pathogenes isolated from patients with gastroenteritis 25

Distribution of urinary tract pathogenes isolates according to age groups 26

Antibiotic sensitivity pattern of the urinary bacterial isolates from children with urinary tract infection presenting with gastroenteritis 27

Antibiotic sensitivity pattern of the urinary bacterial isolates from children presenting with gastroenteritis 28

Antibiotic resistancy pattern of the urinary bacterial isolates from children presenting with gastroenteritis 29

Antibiotic resistancy pattern of urinary bacterial isolates from the control group 30

DISCUSSION: 31

Presenting symptoms 35

Bacteriuria and pyuria 39

Urine collection 45

Bacteriology 48

Antibiotic sensitivity pattern 53

Resistance 58

Radiological investigation 59

Follow up 59

Conclusions and recommendations 61

Acknowledgements 63

References 64

Appendix A 75

SUMMARY:

During the study period of six months; that is from March 1981 to August 1981 a total number of 900 children with and without gastroenteritis were screened for urinary tract infection. Age ranged from one month to seven years, majority of the patients (50%) were in the age group of six months to one year. In group A (children with gastroenteritis) 500 children: 293 (58.6%) males and 207 (41.7%) females were screened. 41 (8.2%) were found positive for urinary tract infection and out of these; 24 (58.5%) were females and 17 (41.5%) were males. In the control group B; 400 children: 241 (60.3%) males and 159 (39.7%) females were screened. 30 (7.5%) children were positive for urinary tract infection.

Out of the 30 positives, 19 (63.3%) were females and 11 (36.7%) were males. There was no statistical difference between the two groups ($X^2 = 0.1471$ $P = 0.5$). In both groups there was significant bacteriuria in females below the age of one year. Presenting symptoms and signs were in both groups non-specific. They varied from gastroenteritis, fever, protein energy malnutrition, anaemia including sickle cell disease, bronch-pneumonia and post measles complications. There was significant correlation between pyuria, bacterial urinedcounts, and urinary tract infection confirmed by cultural methods.

Bacterial urine counts of five or more bacteria per high power field accounted for 90% and 91.3% in both groups A and B respectively in children positive for urinary tract infection.

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The most common bacterial isolates were Klebsiella (49.9%) and Escherichia coli (39.4%). Other bacterial isolates were Proteus species (4.2%); Pseudomonas auroginosa (2.8%); Enterobacter species (2.8%); Enterococci species (1.4%) and Staphylococci (1.4%). Klebsiella and Escherichia coli species were between 90.0% to 100% sensitive to Nitrofurantoin and Nalidixic acid. Cotrimoxazole was Intermediate with a 43.8% to 50.0% sensitivity rate. Both isolates had the lowest sensitivity rate of between 0% to 33.3% to Sulphafurazole, Tetracycline; and Ampicillin. Furadantoin was the most active drug followed by Nalidixic acid; Cotrimoxazole; Amplicillin, Tetracycline, and Sulphafurazole in that descending order.

The overall recurrence rate was 14% (10 children). In 3 patients (4.2%) a different organism was found other than the original grown organism. In the other 7 children (9.8%) Escherichia coli was cultured in both the initial and the recurring infection. No radiological investigation was done.

It is suggested that Paediatricians should always be on the look out for the possibility of urinary tract infection in any child with non specific symptoms and signs. Knowledge of the pattern of bacteriology both domicilliary and hospital acquired be known, and antibiotic sensitivity pattern is essential. An elaborate study to collerate well the rationship of bowel bacteria to those that cause urinary tract infection by doing concurrent stool and urine cultures and serotyping is recommended.

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URINARY TRACT INFECTIONS AMONG CHILDREN ADMITTED IN PAEDIATRIC WARD MUHIMBILI MEDICAL CENTRE WITH GASTROENTERITIS

I N T R O D U C T I O N

Bacterial infections of the urinary tract may be defined as inflammatory process of any part along the urinary tract. These conditions have one feature in common; the presence of significant amounts of bacteria in urine. (1) Although it may be simpler to consider the infection as confined to a section of the urinary tract for example bladder (cystitis) or to involve the kidney (pyelonephritis) for practical purposes it is usually impossible especially in children to establish whether upper, lower, or both areas of the urinary tract are involved. (2) Bacterial Urinary tract infections in neonates and children may be very dangerous not only due to the fact that they can present as life threatening illness but may lead to serious renal complications in adulthood. Hudson and Wilson (3) clearly demonstrated that most examples of chronic pyelonephritis in young adults originate in childhood. It is therefore important to see to it that an attempt is made by doctors to discover these infections early in childhood and treat effectively as many cases as possible so as to avoid sequallae.

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Most symptomatic urinary tract infections seen by physicians and other medical personnel in childhood occur in the pre-school period, and studies of this age group have shown that much of the renal damage which occurs from infection takes place at this age (4,5) It is however, quite unfortunate that mass epidemiological studies are difficult to perform in young children because of the problems associated with urine collection. A high index of suspicion on the part of the paediatricians and other physicians caring for children at this age group is extremely important. At present there exists practicable and quite efficient methods for the detection and treatment of causative agents.

Incidence of urinary tract infections varies with age (6), and most of the prospective studies done have assessed the prevalance, and despite different methods of urine collection, the incidence of urinary tract infection in neonates has been remarkably consistent. In preterm newborns, Edelman et al (7) found an incidence of asymptomatic bacteriuria to be 3% while in the term infants was 1%. In newborn infants-one to four days old, McCarthy et al(8) found 1% incidence and for term infants both Littlewood et al (9) and Bergstrom et al (10) got 1.4%, while Randolph et al (11) obtained an overall incidence of 2% in females and non in males.

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Abbot (12) still obtained 1% incidence while Margileth et al (13) summarizes that asymptomatic (covert) neonatal urinary tract infection varies from 1 to 3.7% in boys and 0.3% to 2.1% in girls and that asymptomatic urinary tract infection during the first month of life, a disorder almost exclusively of boys is 1.4 per 1000 births, while urinary tract infection in older children occur more commonly in girls.

The greater proportion of male to female infections during the first month of life has also been shown by Smellie et al (4), Stansfeld (14) and Bergstrom et al (10). Autopsy series by Neumann et al (15) also revealed a predominance of infant males with pyelonephritis.

Quite a good number of investigators have also carried out screening surveys so as to bring to light the incidence of urinary tract infections in asymptomatic pre-school and school children. Kunin et al (16), screened 9878 children and discovered 56 cases, (1.1%) were girls while only 2 (0.04%) were boys. Meadow et al (17) after screening 2122 Birmingham School children found 10 cases of urinary tract infection in 1026 girls; an incidence of less than 1.0%. There was no significant infection discovered in 1096 boys screened. Savage et al (18) screened 943 Dundee primary school girls for bacteriuria and found 20 (2.1%) cases of confirmed urinary tract infection. Boothman et al (19) found 1% incidence in children aged 1 to 5 years, while Mclachlan et al (20) got 1.7% in school age children.

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In the same age group, savage et al [21] and Cain et al [22] both had 1.5%. Kunin et al [23] obtained 1.1% incidence in asymptomatic school girls and 0.03% of school boys.

Multiple problems are however involved in making a diagnosis of urinary tract infections in infants and children not only because urinary tract infections can be asymptomatic or present with various symptoms difficult to differentiate, but also children themselves are unable to communicate the classic symptoms as flank or abdominal pain, dysuria, and urinary frequency. Fever being a common accampaniment of most minor and major diseases, antibiotics are therefore used widely and may accidentally partially sterilize the urine and the patient may go undetected. Diagnosis must often be suspected from non-specific symptoms and signs such as irritability, severe diarrhoea, anorexia and failure to thrive (24).

In children, more than in adults, acute pyelonephritis can give rise to marked gastrointestinal symptoms such as nausea, loss of appetite, vomiting, diarrhoea, abdominal distension and pain, and these symptoms may actually overshadow the symptomatology referable to the urinary tract. The diagnosis of urinary tract infection in childhood is often not thought of because the symptoms are often gastrointestinal and non-specific.

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Smellie et al [4] in the analysis of 200 children with urinary tract infections, showed that the classical symptoms of acute pyelonephritis were uncommon under the age of 5 years; of the 200 children, 48 (24%) presented with diarrhoea and vomiting while 80 (40%) presented with fever and 44 (22%) did present with frequency and dysuria; The 44 (22%) were mostly in the 5 to 12 year age group.

Mond et al [25] while analysing the distribution of symptoms in both the infected and non infected patients in general practice, frequency accounted for 95% as a presenting symptom in both groups while dysuria accounted for 90% and 65% respectively. Wein et al (26) found failure to thrive and diarrhoea accounting for 25% and 7% respectively as presenting symptoms in 402 girls below the age of 15 years with recurrent urinary tract infection.

There is up to now no precise view regarding the exact relationship of diarrhoea and urinary tract infection among children, but diarrhoeal disease is receiving a lot of attention in communicable disease control programmes. Five to six hundred million diarrhoeal episodes occur annually in children under the age of 5 years, while 3 to 4% of these episodes end in death and others seriously interfere with the nutrition of the children.

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(27, 28) In 1980 (29) 3,734 children were admitted at the Muhimbili Medical Centre infections ward with diarrhoea and out of these, 233 (6.2%) died of diarrhoea; None had a diagnosis of urinary tract infection. The knowledge of the causation of diarrhoeal diseases has expanded considerably in the last few years. Rotavirus and enterotoxigenic Escherichia coli are now identified as major causes (30, 31) Kalya and Oduori (32) found 16% of children with diarrhoea admitted to Kenyatta National Hospital harbouring Enteropathogenic Escherichia coli, Shigella and Salmonella. Mutanda (33) while looking for the epidemiology of acute gastroenteritis in early childhood in Kenya found Rotavirus isolation constituting the majority; at the Kenyatta National Hospital Centre, Rotavirus alone was isolated from 66 (41%) of the patients followed by Escharichia coli 28 (17.5%) and Shigella 17 (10.6%). Wamola (34) in his 3 years study, Shigella species were the most predominant pathogenes encountered with an isolation rate of 51 - 54% of all pathogenes, followed by Salmonellae 24 - 35%; while Escherichia coli was isolated in a rate of 12 - 23%, but still in the majority of acute gastroenteritis no pathogens were isolated. New and exotic bacterial agents that have been included in the list of causes of acute diarrhoeas are Yersinia pathogenes that cause acute gastroenteritis include Astrovirus and Coronarivus (36, 37, 38, 39).

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How then, are these microbial agents causing diarrhoea in childhood not associated with urinary tract infection especially when one considers that the ascending route of infection is currently considered the most important pathway by which organisms invade and spread within the urinary tract. This mode of infection may be favoured more in children with diarrhoea especially in females in whom the short urethra and its anatomical location, increases liability to contamination with bacteria which may penetrate through it. Increased moisture, temperature conditions and faecal soiling in the perineal region are all favourable to bacterial growth. Pryles and Luders (40) looking for the relationship of these two conditions, screened 41 infants and children who had diarrhoea as a symptom, 3 (7%) out of 41 patients had significant bacteriuria and were considered to have urinary tract infection. Neumann et al (41) found 45 children with urinary tract infection had abnormal bowel habits. The fact that many children with urinary tract infection present with gastrointestinal symptoms, and lack of precise data indicating the true incidence/prevalance of urinary tract infection in children with gastroenteritis, it was felt that the magnitude of urinary tract infection in children presenting with gastroenteritis be found out. This prompted this study to be carried with the following objectives:-

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(1) To determine the incidence of urinary tract infection among children with gastroenteritis admitted in Paediatric Wards of Muhimbili Medical Centre, and compare with controls (other sick children without gastroenteritis).

(2) To find out the common pathogens responsible for urinary tract infection among this study group.

(3) To find out the drug sensitivity pattern of the isolated organisms.

(4) To see the other associated presenting features other ~~xxxxx~~ than gastroenteritis (among cases with proven/established urinary tract infection).

MATERIALS AND METHODS

The study was done at the Muhimbili Medical Centre starting from beginning of March 1981 to end of August 1981.

Study Population: Consisted of two groups. Group A. All children aged one month to seven years admitted in Paediatric Gastrointestinal Unit (Ward 17A) with a proven diagnosis of gastroenteritis were taken for this study. For each child, the presenting symptoms and diagnosis on admission, age and sex were noted on a special pre-prepared questionare form as per appendix A. Besides an information on previous antibiotic therapy prior to admission was sought from the admission note, parent or guardian who had accompanied the child. All children who had antibiotic therapy before admission except for penicillin were excluded from the study. Clinical examination for each child was done and all the necessary information obtained was recorded. Group B (control group) consisted of sick children aged one month to seven years seen at the paediatric out patient department with conditions other than gastroenteritis. As in group A, for each child the presenting symptoms, age and sex were noted on a special pre-prepared questionare form. Clinical examination was done for each child and information on previous antibiotic therapy was ontained.

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Collection of Specimen:

All the children included in the study had their genitalia cleaned before a mid stream urine of about 5 mls was collected. In girls the vulva, perineum, and inner thighs were cleansed with cotton swabs soaked in 0.9%. Normal saline from front to the back then wiped dry using sterile gauze. Urine was collected by the writer with the help of the mother or guardian. In boys the penis was cleansed with cotton swabs soaked also in 0.9%. Normal saline, special care was taken in uncircumscised boys where the prepuce was retracted and cleansing done under the foreskin; as far as possible a mid stream urine was collected with the foreskin retracted. All samples of urine were collected in empty sterile bottles supplied by the Department of Microbiology.

Transportation of Urine to the Laboratory and Storage:

Soon after collection urine was transported to the Microbiology Department within half hour to one hour and cultured immediately. In cases where the culture was not possible to be done immediately, specimen was kept at $4^{o}C$ and cultured with 24 hours. The specimens were divided into two portions, one for culture and the other portion was tested for sugar, proteins, and ketones using reagent strips for multipurpose urine tests produced by Ames Company, and examined for pus cells, casts, red blood cells and organisms.

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Pus cells were recorded as number of cells per high power field.

Culture:

A loop full of urine to hold 6 µl specimen was plated on MaConkey and Blood Agar Plates then incubated aerobically for 18 to 24 hours at 37°C, there after the plates were examined for colonies and if present counted. Growth of 10^5 colonies of organisms per ml was considered significant.

Growth of 10^3 to 10^4 colonies per ml or growth of two or more organisms of more than 10^5 colonies per ml were regarded as doubtful and a repeat midstream urine was done. Colony counts of less than 10^3 per ml were disregarded. [42, 43]

Identification of Organisms:

To all the significant colony forming organisms pure sub cultures were obtained on blood agar. From these cultures the colonial morphology, biochemical and fermentation sugar reactions for each organism isolated was studied. Using standard methods, [42] the properties of urinary tract bacterial pathogenes were identified.

Preparation of Materials:

The culture media, diagnostic sensitivity test media, fermentation and biochemical test reagents used for the study were prepared as recommended by the manufacturers, (44) and followed as by the mannual in current use in the Department of Microbiology/Immunology of Muhimbili Medical Centre. (42)

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Control Strains:

The strains used as control for all the investigations were E. Coli NCTC 10418, pseudomonas aeruginosa NCTC 10662 and Oxford staphylococcus aurens NCTC 6571, all from England. (42)

Drug Sensitivity Patterns and Drug Discs:

Drug sensitivity patterns of the organisms was done using diagnostic sensitivity agar (Oxoid) with 4% human blood added. 14 Discs with drug concentrations, appropriate for testing coliforms in urine as currently used in the Department of Microbiology/Immunology were applied an each test and control organisms. (42)

	Drug	Content per Disc	
1.	Ampicillin	25	Mg
2.	Tetracycline	30	Mg
3.	Sulphafurazole	100	Mg
4.	Cotrimoxazole	25	Mg
5.	Nalidixic Acid	30	Mg
6.	Nitrofurantoin	100	Mg
7.	Gentamicin	10	Mg
8.	Carbenicillin	100	Mg
9.	Polymyxin B	300	Mg

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	Drug	Content per Disc
10.	Cephaloridine	5 Mg
11.	Clindamycin	2 Mg
12.	Cloxacillin	10 Mg
13.	Methicillin	10 Mg
14.	Erythromycin	15 Mg

Sensitivity test Reading:

All the inoculated plates with drug discs were incubated for 18 - 24 hours at 37°C, then followed by comparing density of growth around the disc of the control and the test innocula. Semiconfluent of colonies was taken as the ideal density. The inhibition zone radius was measured by a millimetre rule from the edge of the disc to the zone edge. Results were reported sensitive when the inhibition zone radius was equal or more than that of the control organisms, intermediate when the zone was greater than 3 mm but smaller than that of the control and resistant when the zone was 3 mm or less. (42)

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RESULTS:

TABLE I

URINARY TRACT INFECTIONS (U.T.I) AMONG CHILDREN ADMITTED/SEEN AT MUHIMBILI MEDICAL CENTRE. MARCH - JULY 1981

AGE GROUPS	GROUP A		GROUP B	
	NO. SCREENED	POSITIVE U.T.I	NO. SCREENED	POSITIVE U.T.I
One month - six months	100 (63 M 37 F)	15 (15%)	75 (41 M 34 F)	8 (10.4%)
Six months - one year	250 (140 M 110 F)	16 (6.4%)	200 (127 M 73 F)	12 (6%)
One year - two years	100 (61 M 39 F)	8 (8%)	85 (49 M 36 F)	6 (7.1%)
Over two years	50 (29 M 21 F)	2 (4%)	40 (24 M 16 F)	4 (10%)
Totals	500 (293 M 207 F)	41 (8.2%)	400 (241 M 159 F)	30 (7.5%)

GRAND TOTAL OF CHILDREN SCREENED 900 (534 M 366 F) POSITIVE U.T.I 71 (7.9%)

$X^2 = 0.1471$ P = 0.5 No statistical difference between the two groups A and B

..../17..

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TABLE II

URINARY TRACT INFECTIONS AMONG CHILDREN ADMITTED WITH GASTROENTERITIS: SEX DISTRIBUTION

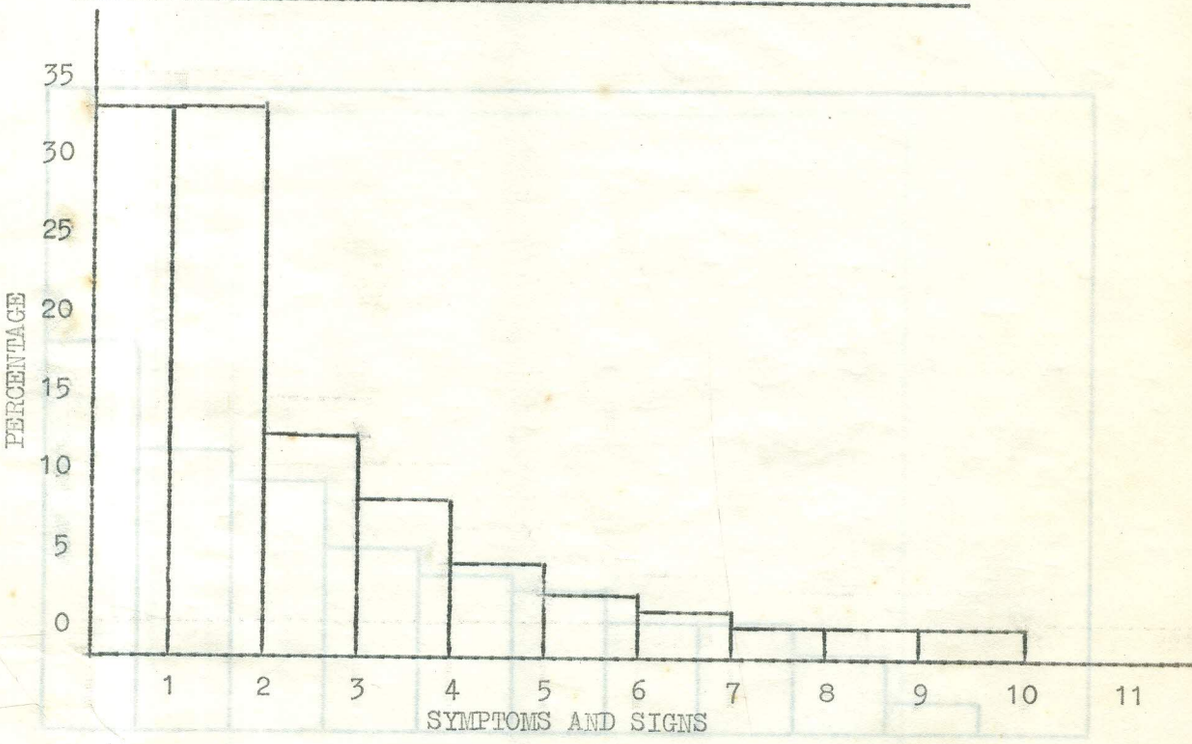
	GROUP A		GROUP B		
AGE GROUPS	MALE	FEMALE	MALE	FEMALE	TOTAL
One month - six months	7	8	4	4	23
Six months - 1 year	4	12	3	9	28
1 year - 2 years	5	3	2	4	14
Over 2 years	1	1	2	2	6
Totals	17	24	11	19	71
	(41.5%)	(58.5%)	(36.7%)	(63.3%)	

$X^2 = 0.154$ $P = 0.5$ There is significant statistical difference in the Male to Female ratio in the two groups A and B.

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HISTOGRAM 3(a).

HISTOGRAM SHOWING THE PRESENTING SYMPTOMS AND SIGNS FOR 41 GASTROENTERITIS CHILDREN WITH URINARY TRACT INFECTIONS



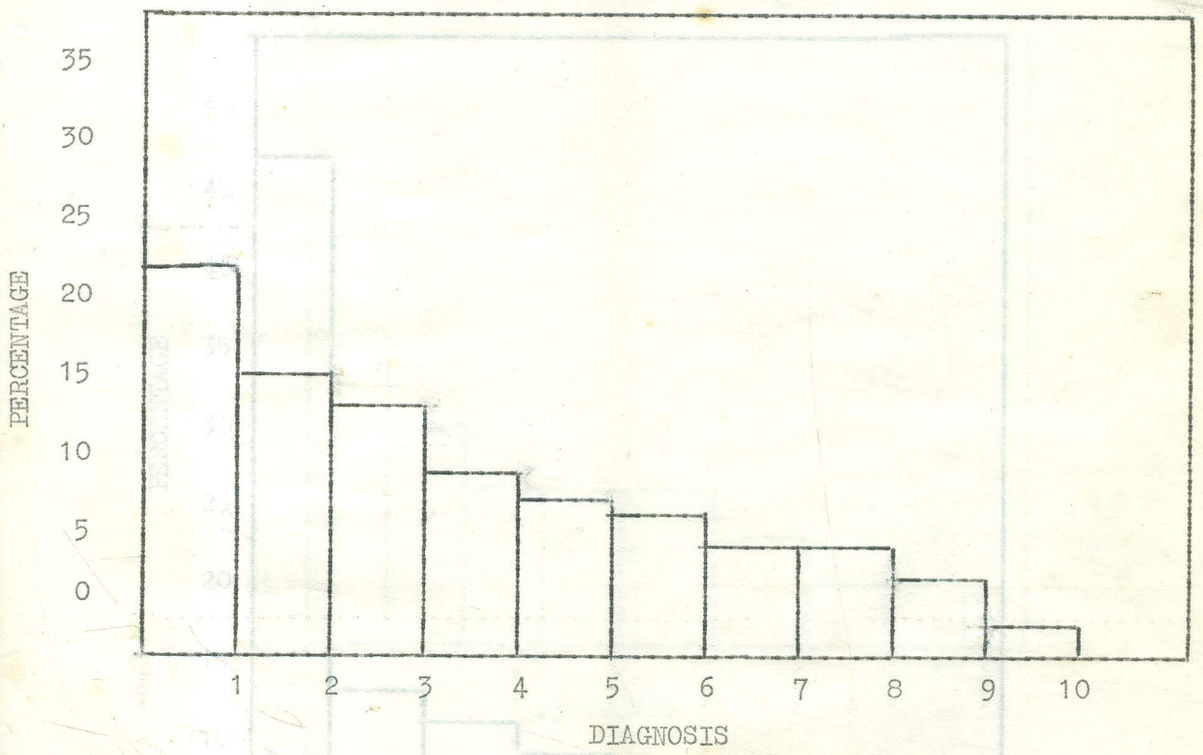
KEY

1 = Diarrhoea and vomiting
2 = Fever
3 = Screeming attacks and irritability
4 = Malnutrition and failure to thrive
5 = Anaemia including sickle cell
6 = Abdominal or flank pain
7 = Multiple abscess
8 = Diarrhoea
9 = Convulsions
10 = Frequency and Dysuria
11 = Vomiting

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HISTOGRAM 3(b).

HISTOGRAM SHOWING THE PRESENTING SYMPTOMS AND SIGNS IN 30 CONTROL CHILDREN WITH URINARY TRACT INFECTIONS



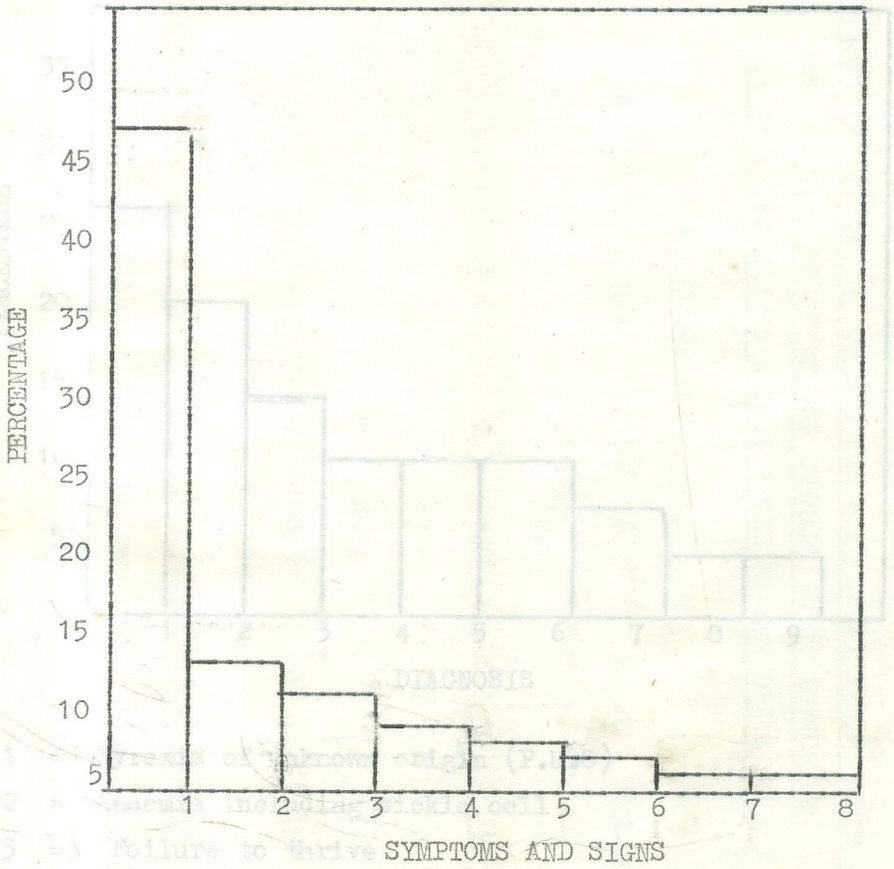
KEY

1 = Fever
2 = Passage of loose stools
3 = Screeming attack and irritability
4 = Malnutrition and failure to thrive
5 = Anaemia including sickle cell
6 = Abdominal or flank pain
7 = Convulsions
8 = Frequency and dysuria
9 = Vomiting
10 = Passage of milky urine

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HISTOGRAM 4(a).

HISTOGRAM SHOWING THE DIAGNOSIS ON ADMISSION IN 41 GASTROENTERITIS CHILDREN WITH URINARY TRACT INFECTIONS



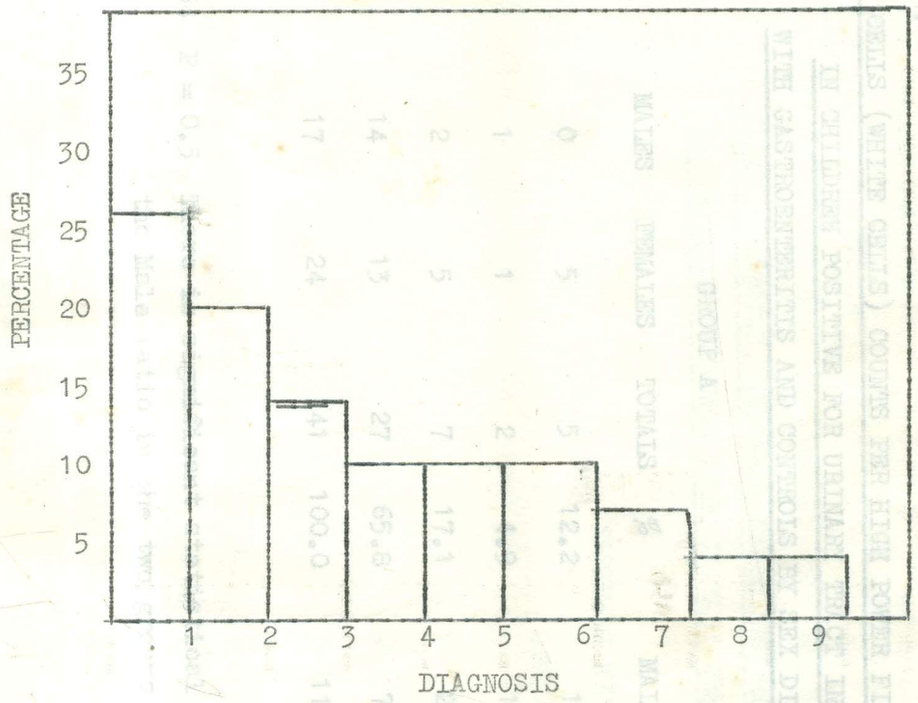
KEY

1 = Gastroenteritis
2 = Gastroenteritis and anaemia including sickle cell
3 = Gastroenteritis and failure to thrive
4 = Gastroenteritis and septiceamia
5 = Gastroenteritis and underweight
6 = Gastroenteritis and marasmus
7 = Gastroenteritis and bronchopneumonia
8 = Gastroenteritis and meningitis

..../21....

HISTOGRAM 4(b).

HISTOGRAM SHOWING THE DIAGNOSIS IN 30 CONTROL CHILDREN WITH URINARY TRACT INFECTIONS



KEY

1 = Pyrexia of unknown origin (P.U.O)
2 = Anaemia including sickle cell
3 = Failure to thrive
4 = Malnutrition (Kwashiorkor, Marasmus, Marasmic Kwashiokor)
5 = Bronchopneumonia and post measles bronchopneumonia
6 = Enteric fever
7 = Febrile convulsions
8 = Down's syndrome
9 = Urinary tract infection

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TABLE 5 (a).

PUS CELLS (WHITE CELLS) COUNTS PER HIGH POWER FIELD H.P.F (40X)
IN CHILDREN POSITIVE FOR URINARY TRACT INFECTION
WITH GASTROENTERITIS AND CONTROLS BY SEX DISTRIBUTION

NO OF PUS CELLS PER H.P.F. OF SPUN URINE	GROUP A				GROUP B			
	MALES	FEMALES	TOTALS	%	MALES	FEMALES	TOTALS	%
<1	0	5	5	12.2	1	2	3	10.0
1 - 5	1	1	2	4.9	1	1	2	6.7
5 - 10	2	5	7	17.1	2	2	4	13.3
<10	14	13	27	65.8	7	14	21	70.0
TOTALS	17	24	41	100.0	11	19	30	100.0

$X^2 = 0.154$ $P = 0.5$ There is significant statistical difference of the Female to the Male ratio in the two groups A and B

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TABLE 5 (b).

SUGAR, PROTEINS, KETONES, CASTS AND RED BLOOD CELLS IN URINE OF PATIENTS WITH URINARY TRACT INFECTION

	PATIENTS WITH URINARY TRACT INFECTIONS	
	GROUP A	GROUP B
Sugar	0 (0%)	1 (3.3%)
Proteins	2 (4.9%)	3 (10%)
Ketones	0 (0%)	0 (0%)
Casts	3 (7.3%)	1 (3.3%)
Red Blood Cells	6 (14.6%)	5 (16.5%)
Totals	11 (26.8%)	10 (33.1%)
TOTAL NO OF PATIENTS WITH U.T.I.	41	30

.../24..

TABLE 6.

BACTERIAL URINE COUNTS OF CHILDREN WITH GASTROENTERITIS

BACTERIA IN URINE SEDMENTS	GROUP A NO OF SAMPLES	GROUP A POSITIVE FOR U.T.I.	GROUP A NEGATIVE FOR U.T.I.	GROUP B NO OF SAMPLES	GROUP B POSITIVE FOR U.T.I.	GROUP B NEGATIVE FOR U.T.I.
5+	30	27 (90%)	3 (10%)	23	21 (91.3%)	2 (8.7%)
4+	18	10 (55.6%)	8 (44.4%)	11	8 (72.7%)	3 (27.3%)
3+	20	2 (10%)	18 (90%)	15	1 (6.7%)	14 (93.3%)
2+	30	2 (6.7%)	28 (3.3%)	25	0 (0%)	25 (100%)
1+	60	0 (0%)	60 (100%)	74	0 (0%)	74 (100%)
0	324	0 (0%)	324 (100%)	252	0 (0%)	252 (100%)
TOTALS	500	41 (8.2%)	459 (91.8%)	400	30 (7.5%)	370 (92.5%)

$X^2 = 1.397$ $P = 0.5$ There is no statistical difference of the bacteria in urine sedments in the two groups A and B.

..../25..

TABLE 7 (a).

URINARY TRACT PATHOGENS ISOLATED FROM PATIENTS WITH GASTROENTERITIS AND CONTROLS AT MUHIMBILI MEDICAL CENTRE

PATHOGENS ISOLATED	NO OF PATHOGENS ISOLATED		
	GROUP A	GROUP B	TOTAL ISOLATES
Escherichia Coli Species	16 (39%)	12 (40%)	28 (39.4%)
Klebsiella Species	22 (53.6%)	12 (40%)	34 (47.9%)
Pseudomonas auroginosa	2 (4.9%)	- (0%)	2 (2.8%)
Proteus species	- (0%)	3 (10%)	3 (4.2%)
Enterobacter species	1 (2.4%)	1 (3.3%)	2 (2.8%)
Enterococa species	- (0%)	1 (3.3%)	1 (1.4%)
Staphylococci	- (0%)	1 (3.3%)	1 (1.4%)
TOTALS	41 (100%)	30 (100%)	71 (100%)

X^2 = 0.395 P = 0.5 There is significant statistical different of the Escherichia Coli and Klebsiella species isolates in the two groups A and B.

.../26...

TABLE 7(b).

DISTRIBUTION OF THE URINARY TRACT PATHOGENS ISOLATED ACCORDING TO AGE GROUPS

AGE GROUPS	GROUP A ORGANISMS					GROUP B ORGANISMS						
	Esch. Coli Species	Kleb-siella Spacies	Pseudo-monas aergns.	Entero-bacter Spacies	TOTALS	Esch. Coli Species	Kleb-siella Species	Proteus Species	Entero-bacter Species	Entero-cocci Species	Staph-yloco-cci	TOTALS
One Month - Six Months	6 (14.6%)	8 (19.6%)	0 (0%)	0 (0%)	14 (34.1%)	4 (13.3%)	3 (10%)	1 (3.3%)	0 (0%)	0 (0%)	0 (0%)	8 (26.6%)
Six Months - One Year	9 (22%)	6 (14.6%)	1 (2.5%)	1 (2.5%)	17 (41.6%)	4 (13.3%)	4 (13.3%)	1 (3.3%)	1 3.3%)	1 (3.3%)	1 (3.3%)	12 (40%)
One Year - Two Years	1 (2.5%)	6 (14.6%)	1 (2.5%)	0 (0%)	8 (19.6%)	3 (10%)	3 (10%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)	6 (20%)
Over 2 Years	0 (0%)	2 (5%)	0 (0%)	0 (0%)	2 (5%)	1 (3.3%)	2 (6.7%)	1 (3.3%)	0 (0%)	0 (0%)	0 (0%)	4 (13.3%)
TOTALS	16 (39%)	22 (53.6%)	2 (5%)	1 (2.5%)	41 (100%)	12 (40%)	12 (40%)	3 (10%)	1 (3.3%)	1 (3.3%)	1 (3.3%)	30 (100%)

..../27

TABLE 8(a).

ANTIBIOTIC SENSITIVITY PATTERN OF THE URINARY BACTERIAL ISOLATES
FROM CHILDREN WITH URINARY TRACT INFECTION PRESENTING WITH GASTROENTERITIS

ORGANISMS	TOTAL ISOLATES	ANTIBIOTIC SENSITIVITY PATTERN							
		NT	NAL	COT	AMP	TET	SULPH	GENT	CARB	POLYB
Escherichia Coli Species	16	16(100%)	16(100%)	7(43.8%)	4(25%)	0 (0%)	1 (6.3%)	-	-	-
Klebsiella Species	22	20(90.0%)	22(100%)	6(27.3%)	2(9.1%)	1 (4.5%)	2 (9.1%)	-	-	-
Enterobacter Species	1	1(100%)	1(100%)	1(100%)	0(0%)	0 (0%)	0 (0%)	-	-	-
Pseudomonas aurogenosa	2	-	-	-	-	-	-	2(100%)	2(100%)	2 (100%)

KEY
NT = Nitrofurantoin
NAL = Nalidixic Acid
GENT= Gentamicin
POLYB= Polymixin B
COT = Cotrimoxazole
AMP = Ampicillin
\- = No sensitivity pattern done.
SULPH = Sulphafurazole
TET = Tetracycline
CARB = Carbenicilin

../28...

TABLE 8(b).

ANTIBIOTIC SENSITIVITY PATTERN OF THE URINARY BACTERIAL ISOLATES FROM THE CONTROL GROUP

ORGANISMS	TOTAL ISOLATES	ANTIBIOTIC SENSITIVITY PATTERN								
		NT	NAL	COT	AMP	TET	SULPH	CD	CLOX	ET
Escherichia Coli Species	12	12(100%)	12(100%)	6(50%)	4(33.3%)	0 (0%)	0 (0%)	-	-	-
Klebsiella Species	12	12(100%)	12(100%)	4(33.3%)	2(16.7%)	0 (0%)	0 (0%)	-	-	-
Proteus Species	3	3(100%)	3(100%)	3(100%)	0 (0%)	0 (0%)	0 (0%)	-	-	-
Enterobacter Species	1	1(100%)	1(100%)	1(100%)	0 (0%)	0 (0%)	0 (0%)	-	-	-
Enterococci Species	1	-	-	1(100%)	-	-	-	-	1(100%)	1(100%)
Staphylococci	1	-	-	-	0 (0%)	0 (0%)	-	1(100%)	1(100%)	1(100%)

KEY NT = Nitrofurantoin NAL = Nalidixic Acid COT = Cotrimoxazole AMP = Ampicillin
TET = Tetracycline SULPH = Sulphafurazole CD = Clindamycin CLOX = Cloxacillin
ET = Erythromycin - = Sensitivity test not done.

..../29.....

TABLE 9(a).

ANTIBIOTIC RESISTANTANCE PATTERN OF THE URINARY BACTERIAL ISOLATES FROM CHILDREN WITH GASTROENTERITIS

ORGANISMS	TOTAL ISOLATES	ANTIBIOTIC RESISTANCE PATTERN								
		NT	NAL	COT	AMP	TET	SUPH	GENT	CARB	POLYB
Escherichia Coli species	16	0 (0%)	0 (0%)	9 (56.2%)	12 (75%)	16 (100%)	15 (93.7%)	-	-	-
Klebsiella species	32	2 (9.1%)	0 (0%)	16 (72.7%)	20(90.9%)	21(95.5%)	20(90.9%)	-	-	-
Enterobacter species	1	0 (0%)	0 (0%)	0 (0%)	1(100%)	1 (100%)	1 (100%)	-	-	-
Pseudomonas auroginosa	2	-	-	-	-	-	-	0(0%)	0(0%)	0 (0%)

KEY NT = Nitrofurantoin NAL = Nalidixic Acid COT = Cotrimoxazole AMP = Ampicillin
TET = Tetracycline SULPH= Suphafurazole GENT= Gentamicin CARB= Carbenicillin
POLYB = Polymixin B - = No sensitivity pattern done.

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TABLE 9 (b).

ANTIBIOTIC RESISTANCE PATTERN OF URINARY BACTERIAL ISOLATES FROM THE CONTROL GROUP

ORGANISMS	TOTAL ISOLATES	ANTIBIOTIC RESISTANCY PATTERN								
		NT	NAL	COT	AMP	TET	SULPH	MET	ET	CLOX
Escherichia Coli species	12	0 (0%)	0 (0%)	6 (50%)	8 (66.7%)	12(100%)	12(100%)	-	-	-
Klebsiella species	12	0 (0%)	0 (0%)	8 (66.7%)	10(83.7%)	12(100%)	12(100%)	-	-	-
Proteus species	3	0 (0%)	0 (0%)	0 (0%)	3 (100%)	3 (100%)	3(100%)	-	-	-
Enterobacter species	1	0 (0%)	0 (0%)	0 (0%)	1 (100%)	1 (100%)	1 (100%)	-	-	-
Enterococci species	1	-	-	0 (0%)	-	-	-	-	0 (0%)	0 (0%)
Staphylococci	1	-	-	-	1 (100%)	1 (100%)	-	1(100%)	0 (0%)	0 (0%)

KEY NT = Nitrofurantoin NAL = Nalidixic acid COT = Cotrimoxazole
AMP = Ampicillin TET = Tetracycline SULPH = Sulphafurazole MET = Meth
ET = Erythromycin CLOX = Cloxacilin - Sensitivity pattern not done.

D I S C U S S I O N:

During the study period of six months, that is from March to August 1981, a total number of 900 children 534 (59.3%) males and 366 (40.7%) females with and without gastroenteritis were screened for urinary tract infection, 71 (7.9%) children, 28 males (3.1%) and 43 females (4.8%) were found positive for urinary tract infection. (Table I). Ages ranged one month to seven years, majority of the patients 450 (50%) were in the age group of six months to one year; while very few children 90 (10%), above the age of two years were seen. In group A, 500 children 293 (58.6%) males and 207 (41.4%) females were screened, and out of those, 41 (8.2%), that is 17 (41.5%) males and 24 (58.5%) females were positive for urinary tract infection (Table I and II).

In group B; 400 children, that is 241 (60.3%) males and 159 (39.7%) females were also screened and only 30 (7.5%) were positive for urinary tract infection: 11 (36.7%) males and 19 (63.3%) females (Table I and II). Sex ratio of females to males of those positive for urinary tract infection was 1.4:1 in group A and 1.7:1 in group B. (Table II). Comparing these results to previous studies done elsewhere, (see table below) the female to male ratio is seen to be quite comparable.

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SOURCE OF STUDY	NO OF CHILDREN FEMALES	MALES	RATIO F/M	SUBJECT OF STUDY
Kunin et al(18)	54	2	30:1	Bacteriuria
Pryles et al(46)	37	4	9:1	Genitourinary tract infection
Deluca et al(47)	894	385	2.3:1	Hospitalised patients with genitourinary tract infection
Macauley and Sutton (48)	22	10	2.2:1	Hospitalised patients with genitourinary tract infection
Neumann and Pryles (17)	22	40	1:2	Autopsies
Present study ggrand total study group	43	28	1.5:1	Screening for bacteriuria (Table II)
Group A	24	17	1.4:1	- " -
Group B	19	11	1.7:1	- " -

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Studies done elsewhere have established that the incidence of urinary tract infections in neonates (7), (8), (9), (10), (11), (12) and in preschool children (16), (17), (18), (19), (20), (21), (22), (23) is notably uniform apart from the different methods of specimen collection and diagnostic criteria. Urinary tract infections in children of higher age groups occur more frequently in the female sex (45). The incidence of non detectable bacteriuria in female children of 2 months up to puberty is between 0.5% and 2%, which is higher in the first year of life than in the following years (20).

In the present study (group A) there were more females; 20 (5.4%) below one year with significant bacteriuria as compared to only 11 (13.6%) males in the same study group (table II). This observation is slightly higher than that reported else where. (4), (9), (14), (15). This can be explained by the fact that only a small proportion of cases were studied; probably a further study to cover more children will have to be carried out to establish this fact. Another explanation which can be offered is that children in group A presented with gastro-enteritis and therefore higher chances of urine contamination in females especially in the younger age group is likely to have ocurred. The short urethra in females and the increased liability to feacal soiling could account for the female preponderance.

.....34.....

It has also been postulated that any break in the intergrity of the normal bowel mucosa by any means may lead to kidney infection. Bacterial being seeded in the kidney via the lymphatic or through haematogenous spread. Thus therefore in gastroenteritis there could be an increased incidence of urinary tract infection due to a break in the intergrity of the gastrointestinal mucosa. (I)

Presenting Symptoms:

Presenting symptoms and signs in both groups A and B (Histograms 3a and 3b) varied from gastroenteritis, fever, poor failure to thrive, anaemia including sickle cell disease and trait, bronchopneumonia and post measles complications. None of the children in the study group A was initially diagnosed as having urinary tract infection (Histogram 4a). Despite the fact that gastroenteritis accounted for 48.5% as a sole diagnosis in children with urinary tract infection (Histogram 4a), the remaining 51.5% did present with other diagnosis on top of the gastroenteritis. Only one child in the control group (Histogram 4b) had an initial diagnosis of urinary tract infection prior to laboratory confirmation, this accounted for less than 5% of diagnosis in group B.

In group A (Histogram 3a) both diarrhoea and vomiting and fever accounted for 32% as presenting symptoms; while other presenting symptoms in order of frequency were: Irritability and screening attacks (15%) failure to thrive (7%), anaemia including sickle cell disease (4%), abdominal pain or flank pain (3%), and only about 2% of children presented with frequency and dysuria as a symptom.

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In group B (Histogram 3b), fever accounted for 28% as a presenting symptom followed by passage of loose stools (15%), screening attacks and irritability (15%), malnutrition and failure to thrive 10%; while anaemia including sickle cell disease (8%) abdominal or flank pain (6%) frequency and dysuria accounted for (5%). In both groups dysuria and frequency, the classical symptoms of urinary tract infection, were not the commonest presenting symptoms. This accounted for only 2% and 5% in both group A and B respectively.

Although clinical characteristic features of urinary tract infection among children of higher age group is almost similar to those of adults, gastrointestinal symptoms and other non specific features are common in the younger age children (4). In neonates the clinical features may very from life threating septicaemia to occult pyeloneplritis (15). The non specific symptoms associated with urinary tract infection in the infancy and ealier childhood are fever, unsatisfactory weight gain, convulsions, pallor, cyanosis, icterus and gastrointestinal symptoms such as anorexia, vomiting and diarrhoea (10), (15). A lot of these manifestations are probable consequences of endotoxaemia secondary to septicaemia (10). In older children dysuria, frequency, enuresis, abdominal pain, fever and failure to sleep are the most common characteristics. The less common features are haematuria, vomiting and incontinence.

.../37....

In the present study diarrhoea, vomiting and fever accounted for 32% (group A) as presenting symptoms while (group B) fever and passage of loose stools accounted for 28% as presenting symptoms. All of these symptoms are not referable to urinary tract infection. All of these children in the study manifested with symptoms and signs other than those of urinary tract infection. Majority of the cases 48.5% (group A) (Histogram 4a) had principle diagnosis of gastroenteritis, while 26% (group B) had diagnosis of pyrexia of unknown origin followed by anaemia including sickle cell disease (20%); failure to thrive (15%) and 12% had principle diagnosis of protein calorie malnutrition followed by bronchopneumonia and postmeasles bronchopneumonia 12% (Histogram 4b). This observation agrees with the fact that in all these conditions there is increased susceptibility to infection resulting from decreased body defence mechanisms. Clinical features of urinary tract infection may be influenced by; age and sex of the patients, existence of complicating disorders of the urinary tract, localization of infection; that is whether infection is in the bladder (cystitis) or renal parenchyma (pyeloneplritis), number of earlier or previous infections, and time interval since last/previous infection (13).

In children the diagnosis of urinary tract infection is often not thought of. Three main reasons as to why the disease is infrequently recognized in the paediatric age grou are:

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(1) The symptoms as already seen are often gastrointestinal and non-specific.

(2) Physical signs are often scanty.

(3) One or two urine specimens may not reveal the presence of urinary tract infection (2).

A high index of suspicion on the part of the paediatricians and other physicians caring for children at this age group is therefore extremly important. The clinical diagnosis of urinary tract infection has to be confirmed by isolation of significant numbers of micro organisms from urine. Bacterial colony counts of 10^5 and over is taken as significant bacteriuria; while counts of between 10^3 - 10^4 is taken as doubtful and a repeat urine collectin and examination is required; and counts of less than 10^3 is taken as insignificant and disregaded 42, 43, 62. From these observations it is therefore very important to see to it that in any patient suspected of having urinary tract infection; bacterial isolation should be done first before drug therapy is started.

../39...

Bacteriuria and Pyuria:

Pyuria is a term used to describe the appearance of increased numbers of polymorphonuclear leucocytes in urine. Stansfeld (55), states that urine usually contains less than 10 leucocytes per cubic millimeter, and that over 50 cells per cubic millimeter are rarely found in urine in the absence of urinary tract disease. In uncentrifuged urine one cell per high power field (H.P.F) is equivalent to 250 - 500 cells per cubic millimeter. After centrifugation of 5 mls urine, an average of one cell per high power field in the deposit corresponds to 5 - 6 cells per cubic millimeter.

The microscopical examination of undiluted or centrifuged urine may provide the clinician with immediate information on the possible cases of urinary tract infection. Normal renal excfetion of polymorphonuclear leucocytes in urine is up to 400,000 cells per hour. Three to five white blood cells (W.B.C) per MM^3 are equivalent to an excretion rate below 400,000 cells per hour while counts of above 10 cells per MM^3 are definite indication of an increased white cell excretion (56).

In the present study a good relationship between pyuria (table 5), bacteriuria (table 6) and urinary tract infection was found. In group A 65.8% of the children with urinary tract infection had more than 10 W.B.C. per high power field. However statisticaly ($X^2 = 1.397$ $P = 0.5$) was not significant in ▪▪ between the two groups A and B.

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In group B 70% of children with urinary tract infection had more than 10 W.B.C. per high power field in their urines (table 5). In both groups A and B only 12.2% and 10% respectively of children with urinary tract infection had one or no W.B.C. in their urines (table 5).

Bacterial urine counts (table 6) of more than five bacteria per high power field accounted for 90% and 91.3% in both groups A and B respectively in children positive for urinary tract infection. Only 10% in group A and 8.7% in group B with bacterial counts of five or more were negative for urinary tract tract infection. The correlation between urinary tract infection and the presence of large numbers of bacterial in urine (3+, 4+, 5+) as in table 6, in the routinely prepared centrifuged urine sedment is an important finding and extremely helpful as a screening procedure for significant bacteriuria. Examination of the urine sedment in any patient with suspected renal disease is important and affords the physician the opportunity to look not only for leucocytes and bacteria, but also for other formed elements especially red blood cells and casts.

In group A; 6 children (14.6%) and in group B; 5 children (16 5%) with urinary tract infection had red cells in their urine sedments (table 7). As for urine ketones, and casts there was no correlation between their presence and urinary tract infection (table 7).

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The absence of sugar in patients with urinary tract infection is an important finding. Only one child (3.3%) in group B (table 7) with urinary tract infection had sugar in the urine, but was not a diabetic. Glucose test in urine is one of the chemical screening tests for urinary tract infection, but it is quite unreliable (57).

Possible combinations of pyuria and bacteriuria with suggested inter pretations by Stansfeld (1962) (55) is given in table below after clean voided midstream urine or catheter urine.

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Pyuria over 10_3 WBC per mm^3	Bacteriuria over 100,000 organisms per ml	Interpretations
+	+	Urinary tract infection
0	0	No urinary tract infection
+	0	Urinary tract infection is possible but bacterial growth inhibited by antibiotics or limited because of short time in bladder. Or on urinary tract infection, cells seen are from contamination, that is cleansing inadequate or due to extraurinary tract infection or non infections renal disease.
0	+	Urinary tract infection possible, cells destroyed by alkaline urine or no urinary tract infection but only bacterial contamination and growth before examination.

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Siegel S.R et al (1973) 24, found poor correlation between bacteriuria, pyuria and proteinuria in diagnosing urinary tract infection. This lack of correlation has also been shown frequently in other studies 11, 16, 58, 59. Rosalind Maskell and A. Polak, (60) found that pyuria proved to be a useful pointer to the presence of infection. 87% of specimens showing more than 10 white cells per high power field were found to be infected as against only 10% of those with less than 2 cells. This positive correlation between increased white cell excretion (pyuria) and significant bacteriuria in symptomatic patients has also been shown by Brumfit and Percival (61). These findings agree well with those of the present study. 65.8% of the specimens (group A) showing more than 10 white cells per high power field (table 5) were positive for urinary tract infection while only 15.1% with less than 5 cells were found to be infected. The same percentage was found in group B; (table 5) 70% with more than 10 cells per high power field were infected as against only 16.7% of those with less than 5 cells per high power field. Thus therefore a doctor who microscopes a fresh midstream urine can greatly improve the accuracy of the diagnosis of urinary tract infection.

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The only circumstances in which pyuria may be misleading is the heavy contamination of urine, and this seldom happens if the total quantity voided is sufficiently large (60). Although pyuria may be of diagnostic help in urinary tract infection, it still can occur in other conditions (62):

(1) Under extreme dehydration of pyloric obstruction, low fluid intake and acute toxaemia.

(2) Trauma caused by instruments or calculi.

(3) When infection has dissappeared but an irritating agent remains.

(4) In chemical inflammation.

(5) In renal tuberculosis.

(6) In acute glomerulonephritis for days or rarely weeks prior to the appearance of haematuria and/or proteinuria.

(7) After administration of polio vaccine.

(8) In non specific (Nonbacterial) gastroenteritis and respiratory tract infections.

(9) In hyper chloremic renal acidosis.

However in his findings Pryles 62, showed that approximately one quarter to two thirds of patients with pyuria may have associated bacteriuria.

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This finding therefore should always alert the clinicians to the possibility of urinary tract infection. On the other hand it is clearly evident that the absence of pyuria in any single specimen cannot be taken as evidence of the absence of bacteriuria. The results of microscopical examination need to be correlated quite well with the clinical symptoms and signs. Should they be indicative of urinary tract infection, therefore the attending doctor should thoroughly well collect urine and do cultural methods for bacterial isolation and identification.

Urine Collection:

Collection of urine from the patient, time taken to culture it, and the interpretation of the bacterial growth is of utmost importance in the bacteriological diagnosis of urinary tract infection. Urine which is usually sterile, may be heavily contamined with bacteria either from the urethra or perineum during micturation. In order to minimize contamination which may interfere with subsequent tests it is essential that a strict procedure is employed for sample collection. The perineum should be cleansed with sterile water. In case of un circumsiced boys the foreskin should be retracted and cleansing done under the foreskin and possibly collecting the urine with the foreskin still retracted. In females cleansing should be done in the downward direction in order to avoid vaginal contamination from the anal opening.

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Soaps containing (phisottex) should not be used because of their antibacterial effect on the culture results when a small amount gets into urine.

The clean voided technique has the major advantage of decreasing the risk of introducing infections as compared with catheterization. Collection of clean-catch midstream urine specimens in males posses no particular problems. In females one need to be extra careful; washing of vulva from front to back with three separate gauze sponges, the first two soaked in sterile distilled water and the third is used as a rinse. Urine is then collected when thighs are wide apart.

Suprapubic vesicopuncture has one main advantage that, there is virtually complete absence of contamination during collection of urine. Only one specimen is required to establish the diagnosis of bacteriuria. Growth of even one colonie per ml of a single species of bacteria is considered significant (2).

A study by Aronson et al (63) in which simultaneous urine cultures were done on suprapubic bladder aspirations and clean voided specimens, gave misleading information in 39 (32%) of 120 patients; that is 31 of 61 culture positive of clean voided specimens were false positive and 8 of 59 culture negative of clean voided specimens were false negative.

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This clearly shows the importance of method used in collecting the urine specimen, as it can greatly influence the results, and it may well explain the high percentage of the prevalence rate found in the present study. Probably the prevalence would have been lower if a suprapubic bladder aspiration method of urine collection was employed. The reliability of bacteriologic results from urine cultures depends largerly on the method of urine collection. The simplest method was used in the present study, but confidence level of diagnosing significant bacteria does not exceed 80 - 90% with single clean voided samples and 95% with two samples (62). Thus the results of this study may still hold true despite the explanation given above.

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Bacteriology:

In both groups A and B (table 7a), the most common bacterial isolates were klebsiella (49.9%) and Escherichia coli (39.4%). Other bacterial isolates were proteus species (4.2%), pseudomonas auroginosa (2.8%). Enterobacter species (2.8%), Enterococci species (1.4%) and staphylococci (1.4%). In group A klebsiella species accounted for 53.6% followed by Escherichia coli which was responsible for 39.0% of the total bacterial isolates in that group. Other organisms isolated in the group were Preudomonas auroginosa 4.9%; and Entebacter species 2.4%. In group B, both Klebsiella and Escherichia coli species, each accounted for 40% of the total bacterial isolates in that particular group. Other organisms encountered in this group were Proteus pecies 10%, Enterobacter species 3.3%, Enterococci species 3.3% and Staphyloccoci 3.3%. No Pseudomonas was isolated. There was significant statistical difference involving Escherichia coli and Klebsiella species between the two groups ($X^2 = 0.395$ $P = 0.5$) other isolates were too few to be of any statistical difference.

In group A the commonest bacterial isolates were in the age group of six months to one year, with an isolation rate of 41.6% (17 isolates) followed by 34.1% (14 isolates) in the one month to six months age group. Escherichia coli 9 isolates (22%) were commoner in six months to one year age group, while klebsiella species 8 isolates (19.6%) was common in the one month to six months age group (table 7b).

../49...

In group B bacterial isolates were again commoner in the six months to one year age group, with an isolation rate of 40% (12 isolates) followed by 26.6% (8 isolates) in the one month to six months age group. Escherichia coli, 4 isolates (13.3%) were equally seen in both one month to six months age group and six months to one year age group. Klebsiella species 4 isolates (13.3%) were commoner in the six months to one year age group as compared to 3 isolates (10%) in the one month to six age group. (Table 7b). These results are quite comparable to those of kunin 49. During a ten year study of bacteriuria in school girls; organisms encountered initially and on each recurrence were Escherichia coli 72.1%; followed by Klebsiella 16.5%, Proteus 5% Staphylococcus 5%, other bacterial 1.2%. Pseudomonas was rarely isolates.

Siegel et al (50), found Protens species accounting for 43% of total bacterial urinary isolates followed by Escherichia coli 39%, Pseudomonas 7%, Staphylococcal aureus 40%, unidentified 7%. Escherichia coli was responsible for 67% of the symptomatic patients, and 22% of the asymptomatic patients. Proteus was found in 25% of the symptomatic and 57% of the asymptomatic patients.

It is now generally accepted that most urinary infections are caused by organisms originally coming from the bowel (51), (66).

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The commonest urinary pathogen is Escherichia coli, and others include Proteus mirabilis frequently seen in boys and in children with renal stones; klebsiella species, Enterococci and Micrococci, all these are normal bowel commensals (2). The same pattern of bacterial isolates has been found by Wein et al (26). In the 402 girls studied and diagnosed as cases of urinary tract infection, Escherichia coli was isolated in 56% of the patients, followed by Proteus 26%, Aerobacter 8% and Pseudomonas 4%, others 6%.

Forbes et al (52), Escherichia coli accounted for 70% of the total isolates (in 55 girls and 10 boys), this was followed by Paracolobacterum 20% (in 15 girls and one boy), Aerobacter 3% Proteus 2.5%, Staphylococcus and Micrococci 1% each; others 3.5%.

Cohen (53) found Escherichia coli accounting for 88% of the bacterial isolates from his 706 patients seen in the out patient department with diagnosis of urinary tract infections. Other isolates in order of frequency were Klebsiella 6%, Aerobacter 6%, Proteus 3% and Enterococci 1%.

These results are quite comparable to those of the present study.

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Maselle et al (54), found that, of the 3,4000 coliforms isolated from urine specimens investigated in the department of Microbiology Muhimbili Medical Centre (all age groups) Escherichia coli (1,600 isolates) were the commonest, followed by Klebsiella, Enterobacter species (1000 isolates), Proteus species (400 isolates), other coliforms (200 isolates) and Pseudomonas (200 isolates), were also seen.

Most uncomplicated urinary tract infections are due to Escherichia coli even after repeated courses of antimicrobial therapy. About one half of the strains of Escherichia coli found in urinary infections in both children and adults are typeable with the O antigen. The most common O type reported in all patients populations are O1, O4, O6, O7 and O75, but almost any of the approximately 150 groups can be found in urinary tract infections (49). Enteropathogenic Escherichia coli are almost never found. Occassionally an unusual strain may appear in a hospital setting (49).

Unfortunately in the present study no typing of the different urinary bacterial isolates was done (with special reference to Escherichia coli). Absence of facilities made it difficult to type the isolates. Again no stool bacterial isolates were done during the study as a result no correlation between stool and urinary bacterial isolates can be derived at in this study.

../52..

A more elaborate study is therefore needed to correlate well the urinary tract bacterial pathogens and stool isolates in patients presenting with gastroenteritis.

This may help us know the type of Escherichia coli that may be responsible for hospital acquired and domicilliary acquired. Antibiotic sensitivity and resistency pattern of the hospital and domicilliary acquired infection can then be compared. It is clearly seen from this study that the bacterial isolates in different age groups should be known. The pattern and the frequency of the isolates in a hospital setting will help the clinician to predict what type of bacteria he may be dealing with in a patient with urinary tract infection even before isolation of the organism is done.

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Antibiotic Sensitivity Pattern:

Tables 8a and 8b shows that in both groups A and B Escherichia coli isolates were between 90.9% to 100% sensitive to Nitrofurantoin and Nalidixic acid, but had a lower sensitivity rate of between 0% and 33.3% to Sulphafurazole, Tetracycline and Ampicillin. Cotrimoxazole was intermediate with 43.8% to 50% sensitivity rate. None of the Escherichia coli isolates were resistant to Nitrofurantoin and Nalidixic acid in both groups (Tables 9a and 9b). However in both groups (Tables 9a and 9b) Escherichia coli isolates were 100% to 75% resistant to sulphafurazole, Tetracycline, and Ampicillin. For cotrimoxazole the Escherichia coli were intermediate with a 50% to 56.2% resistancy. (Tables 9a and 9b).

Klebsiella species had almost similar pattern of sensitivity and resistancy to the drugs tested. Between 90.9% and 100% of the Klebsiella species isolated were sensitive to Nitrofurantoin and Nalidixic acid; only 0% to 9.1% were resistant (Tables 8a, 8b, 9a, 9b). Sulphafurazole, Tetracycline, and Ampicillin had a sensitivity rate to Klebsiella isolates of between 4.5% to 16.7% and a resistancy rate of 83.7% to 100%. Furadantoin was the most active drug followed by Nalidixic acid, Cotrimoxazole, Ampicillin, Tetracycline and Sulphafurazole, in that descending order.

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Maselle et al (54), found that between 50% to 90% of all the coliforms isolated were resistant to Ampicillin, Tetracycline and Sulphonamide. About 10% to 20% of the coliform isolates were resistant to Nitrofurantoin Nalidixic acid and Cotrimoxazole; of the first line drugs Furadontoin was found to be the most active followed by Nalidixic acid, Cotrimoxazole, Ampicillin, Tetracycline and Sulphafurazole in that descending order as found in the present study.

Enterobacter species, one isolate, in each group A and B were 100% sensitive to Nitrofurantoin, Nalidixic acid and Cotrimoxazole but were 100% resistant to Ampicillin, Tetracycline and Sulphafurazole. (Tables 8a, 8b, 9a and 9b). Pseudomonas auroginosa, two isolates in group A (table 8a) were 100% sensitive to gentamycin, carbenicillin and polymixin B. There was no resistancy to the antibiotics tested. In group B, the Proteus species, 3 isolates (table 8b) were all 100% sensitive to Nitrofurantoin, Nalidixic acid, and Cotrimoxazole; but were also 100% resistant to Ampicillin, Tetracycline and Sulphafurazole.

Enterococci and Staphylococci species one isolate each in group B, were both 100% sensitive to Cloxacillin and Erythromycim (table 8b) these findings still tie up well with those of Maselle et (54). Majority of the coliform isolates are sensitive to Nitrofurantoin, Nalidixic acid and Cotrimoxazole; while Ampicillin, Tetracycline and Sulphafurazole are in the majority of cases resistant.

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Bose et al (64), in a controlled trial of cotrimoxazole in children with urinary tract infection, 11 out of 40 children treated with ampicillin developed recurrent bacteriuria, while only 3 out of 55 children cotrimoxazole treated group developed recurrency.

Calvin M. Kunin (49) in a ten year study of bacteriuria in school girls, Nitrofurantoin emerged as the most commonly used drug in patients with frequent recurrences. This agent was used frequently because the in vitro sensitivity tests demonstrated less tendency for organisms to develop resistant to Nitrofurantoin than to other drugs, despite repeated use in the same patient. Ampicillin although bactericidal in activity did not appear to be effective. One possible reason for the efficacy of Nitrofurantoin is that little or no drug is excreted in the stools. In cases of Sulphonamide, Tetracycline and Ampicillin, the drugs are excreted in the stools, and therefore normal bowel comensals that usually cause urinary tract infection may become resistant to the drugs. Maselle et al (54) urged that the reason as to why most of the urinary coliform isolates were between 50% and 90% resistant to Ampicillin, Tetracycline and Sulphonamide, may be due to over use of most of these drugs. In 1978 - 1980 for instance, 1.25 tonnes of Tetracycline were used as opposed only to 10 kgms of Nitrofurantoin. Indeed resistance was only 10.3% with all antimicrobials whose anual consumption was less that 10 kgms. (10 kgms of Cotrimoxazole were used).

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From the present study it is seen that Nitrofurantoin, Nalidixic acid and Cotrimoxazole are the most active urinary antiseptics and antibiotic against the isolates encountered. Therefore the drug of choice for the treatment of urinary tract infection should depend on the sensitivity pattern of the bacterial isolates. However, the drug of choice should fulfil the following Criteria (65):

(1) one which is highly absorbed in the alimentary tract

(2) one which is excreted in high concentrations in the urine

(3) one which is not causing resistance in the flora of the lower bowel.

Two drugs which fulfil the above three criterion are Cotrimoxazole and nitrofurantoin.

Nitrofurantoin has, however, one disadvantage that it often causes nausea and vomiting even at a low dose.

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In most children treatment can wait the results of bacteriological sensitivity tests, but when the condition of the patient warrants immediate treatment; cotrimoxazole is the drug of choice 65. The results of sensitivity tests to the cultured organisms will then show whether a different drug is needed or not. The full therapeutic dose must continued for 14 days, and urine should be cultured 3 and 10 days after start of treatment to check whether the infection has been eliminated. Urine should be sterile 3 days after start of treatment 65.

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Resistance:

It is now generally accepted that most urinary tract infections are caused by organisms originating from the bowel (51), (66).

Changes in antibiotic sensitivities of faecal organisms in response to treatment in children with urinary tract infection has been taking place. Approximately two thirds of children on Sulphonamide and one thirds of children on Ampicillin their rectal flora is found to be antibiotic resistant when on prophylaxis with these drugs 67. There is evidence that the incidence of resistanct in normal bowel commensal Escherichia coli strains which has been raising over the years may be due to R-factors 68, 69.

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Radiological investigation:

No radiological investigation was done in any of the children with confirmed urinary tract infection. This is attributed to limited time of the study, the over loaded radiology department (breadown at the time of study) and failure of children to turn up for radiological screening. However in all children who have confirmed urinary tract infection need an intravenous pyelogram (I.V.P.). Micturating cystourethrography is performed after infection has been eradicated in the following group of patients 65;

(1) infants and children below five years

(2) children with an abnormality detected on the intravenous pyelogram

(3) children aged over five years with recurrent infection

micturating cystourethrography is also advisable in children with a family history of chronic pyelonephritis, renal failure, or severe ureteric reflux. However in all the above situations, the child should be protected by chemotherapy during the investigation.

Follow up:

At the end of the study, that is six months period, the overall recurrence rate was 14% (10 children). It is quite possible that with a longer follow up period, the recurrence rate would have been higher than this, since about 9.9% (7 children), the first recurrence was seen at the end of the two months (eight weeks).

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In 3 patients a different organism was found, other than the first original grown organism. In the other 7 children, Escherichia coli was cultured in both the initial and the recurring infection, but unfortunately serotyping was not done. It is therefore not known whether this represented persistence of the original organism or a new infection. The importance of follow up cultures is therefore emphasized. Follow up cultures after treatment are essential in view of the recurrent nature of urinary tract infections. The following schedule is recommended by Cohen 53.

(1) One weekly urine cultures after completion of therapy

(2) Monthly urine cultures for six months

(3) Every second month urine cultures for the next six months

(4) Every third month urine cultures during the following two years.

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CONCLUSIONS AND RECOMMENDATIONS:

(1) Urinary tract infections is one of the major paediatric problems in Muhimbili Dar es Salaam, only if it is look for.

(2) Children presenting with gastroenteritis, if carefully screened for urinary tract infection, the incidence of this disease in this group of patients is almost the same as in the general paediatric age groups.

(3) The non-specific symptoms associated with urinary tract infection in infancy and childhood should always alert the attending paediatrician for the possibility of urinary tract infection.

(4) Meticulous and clean methods of urine collection, prompt handing over the specimen to the laboratory for immediate culture and correct interpretation of the bacterial growth is of utmost importance in making a correct diagnosis of urinary tract infection.

(5) Knowledge of the pattern of the bacteriology both domicilliary and hospital acquired and the autibiotic sensitivity pattern is important.

This will eliminate unecessary time wasting (duration of therapy), costs and reduce incidence of resistance.

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(6) Follow up of urine cultures of patients with urinary tract infection is necessary, in order to determine relapse and re infection rates.

(7) Another study to collerate well the relationship of bowel bacterial and those that cause urinary tract infection by doing concurrent stool and urine cultures is recommended. Serotyping in both groups is also advocated.

(8) Despite the fact that Nitrofurantoin and Nalidixic acid emerged as the most active urinary antiseptics; Cotrimoxazole with all its properties would be the drug of choice in the treatment of urinary tract infection.

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../64..

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APPENDIX A:

URINARY TRACT INFECTION AMONG CHILDREN ADMITTED IN PAEDIATRIC WARD MUHIMBILI MEDICAL CENTRE DAR ES SALAAM WITH GASTROENTERITIS.

PROFORMA:

Identity

Name: ..... Age: ..... Sex: .....

IP No: ..... OP No: .....

Date of Admission: ..... Date 1st seen at O.P.D: .....

PREVIOUS ANTIBIOTICS GIVEN BESDES PENICILLIN ..... YES/NO

Symptoms on Admission/when 1st seen at O.P.D. (Cross Yes or No).

1. Diarrhoea and Vomiting ..... YES/NO
2. Diarrhoea ..... YES/NO
3. Vomiting ..... YES/NO
4. Fever ..... YES/NO
5. Failure to thrive and Malnutrition (PEM) ..... YES/NO
6. Convulsions ..... YES/NO
7. Haematuria ..... YES/NO
8. Frequency or Flanic pain ..... YES/NO
9. Abdominal or Flanic pain ..... YES/NO
10. Enuresis ..... YES/NO
11. Screaming attacks and irritability ..... YES/NO

.../76...

Clinical Diagnosis on Admission/When 1st seen at O.P.D. (tick):

1. Gastroenteritis ..... ( )
2. Post measles B-pneumonia ..... ( )
3. Kwashiokor ..... ( )
4. Marasmic Kwashiokor ..... ( )
5. Marasmus ..... ( )
6. Bronchopneumonia ..... ( )
7. Meningitis ..... ( )
8. Urinary tract infection ..... ( )
9. Any other diagnosis ..... ( )

Method of urine collection (tick):

1. Clean catch method (M.S.U) ..... ( )
2. Urinal bag ..... ( )
3. Suprapubic bladder puncture ..... ( )

Laboratory tests (cross out):

1. Casts ..... YES/NO
2. Protein ..... YES/NO
3. R.B.C.S. ..... YES/NO
4. Bacteria
   - 5+ ..... ( )
   - 4+ ..... ( )
   - 3+ ..... ( )
   - 2+ ..... ( )
   - 1+ ..... ( )
   - 0+ ..... ( )

.../77 ....

5. WBC per High Power field (tick) below:

1 ..... ( )

1 - 5 ..... ( )

5 -10 ..... ( )

more than 10 ..... ( )

Organisms Isolated (write down):

1. .....

2. .....

3. .....

4. .....

Sensitivity pattern of isolated organisms (write down):

Sensitive	Resistant
1.	1. .....
2.	2. .....
3.	3. .....
4.	4. .....
5.	5. .....

Radiological Results:

(1) I.V.P: a) No abnormality seen ..... ( )

b) Abnormality noted ..... ( )

(1) .....

(2) .....

(3) .....

(2) Micturating Cystourethrography:

(a) No abnormality noted ..... ( )

(b) Abnormality noted .....( )

(1) .....

(2) .....

(3) .....

Follow Up:

1. Since ..... days or ..... months from when 1st seen or 1st visit.

2. Organisms grown/not grown

(1) .....

(2) .....

(3) .....

(4) .....

3. Sensitivity pattern of the isolated organisms (write down drugs):

Sensitive	Resistant
(1)	(1) .....
(2)	(2) .....
(3)	(3) .....
(4)	(4) .....

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