A DISSERTATION ON

CLINICAL, LABORATORY AND RADIOLOGICAL PROFILE OF URINARY TRACT INFECTION IN CHILDREN

M.D (BRANCH VII)

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CONTENTS

INTRODUCTION

Urinary tract infection (UTI) is a common problem in children[1] .The incidence varies according to age, race and sex of children[2,3]. UTI occurs in about 1% of boys and 3-5% of girls [4]. In girls the first UTI occurs by the age of 5 years with peaks during infancy and toilet training. After the first UTI 60-80% 0f the girls will develop a second UTI within 18 months. In boys most UTIs occur during the first year of life .UTI is much more common in uncircumcised males. The prevalence of UTI varies with age. During the 1st year of life; the male to female ratio is 2.8-5.4:1.Beyond 1-2 years there is a striking female preponderance , with a male to female ratio of 1:10.

Three to five percent of febrile children are found to have UTI [6]. Symptoms of UTI may be minimal and non-specific in infants and small children [7]. In most cases the first episode of UTI occurs in the 1st year of life and it is believed that young growing kidneys are more vulnerable to renal parenchymal damage. UTI may lead to life threatening complications like sepsis and renal scarring. Renal scarring is the most common cause of hypertension in later childhood and renal failure in adulthood [2,7].

Recognition of UTI in children should be made as early as possible to prevent these complications [7]. Therefore, investigations for early diagnosis of UTI are of outmost importance [5]. In the pediatric population the recurrence rates for UTI are very high.

Within 1 year of a first infection, approximately 30% of boys and 40% of girls will develop a repeat UTI [8.] .After the first episode, children can expect a recurrence rate of 30%. This rate will double for each subsequent infection [9].Anatomic obstruction (posterior urethral valves, ureteropelvic junction obstruction, ureterovesical obstruction, and ureterocele) as an etiology for UTI is seen in 2% to 10% [10] and 30% to 50% will have vesicoureteral reflux [11].

This study was conducted to analyse the common presenting features, laboratory characteristics and radiological abnormalities commonly seen in children with urinary tract infection.

REVIEW OF LITERATURE

Literature on pediatric Urinary tract infection is extensive and studies have been performed worldwide on the clinical characteristics, microbiological analysis and imaging for UTI.

In the study by Thaer al Momani et al [12], Urinary tract infection was more common in the 1-5 years age group (49%) and least common in 0-1 year age group

N.Choudari et al [13] in his study showed that UTI was more common in male children (53.6%) when compared to the female children (46.4%).

In Anis-ur-Rehman et al [14] study on the frequency and clinical presentation of UTI , almost half of them 48.5% were less than 3 years old, fever was the commonest presentation 91%, followed by dysuria in 65%,Failure to thrive in 40%, vomiting in 28%, abdominal pain in 22%, poor stream in 15% and previous episodes of UTI in 30 %.

Azhar Munir Qureshi et al [15], study on the clinical presentation of UTI ,UTI was more common in the female children except in the neonatal period. Dysuria was the most common clinical

presentation accounting to 98% followed by fever 92%, recurrent UTI in 28%, vomiting in 26%, poor stream in 20% and failure to thrive in 31%.

Malla K K et al [16], on the clinical profile, bacterial isolates and antibiotic susceptibility patterns, dysuria was found in 23.8%, fever 86.9%, abdominal pain in 46.4%, vomiting in 39.2%, diarrhea in 14.28% and febrile seizures in 13% and culture positivity in 57%.

S.Fouzas et al [17] in his study has shown that significant pyuria was found only in 32.7% of the children with febrile UTI. G.K.Rai [18] et al on causative agents of UTI in children, found significant bacteriuria in 28.6% of children with no significant differences in growth positive rates between male 51.7% and female 48.3%.

Many studies have been done on the urine culture pattern in UTI and Escherichia coli is the most common organism grown and the growth pattern of other organisms varies from study to study.

In the study by Neelam Taneja et al [19], pyuria was detected in 53.6% and Escherichia coli was the commonest organism grown in urine culture 47.15%, followed by Klebsiella species 15.6%, Enterococcus Fecalis 8.7%, Pseudomonas aeruginosa 5.9% and Candida species in 5.5% .

Fakhrossadat Mortazavi et al [20] found Esherichia coli in 63% cultures, Klebsiella pneumoniae in 19.4%, Proteus mirabilis in 3.9%,Stapylococcus aureus in 0.4%, Providencia in 0.4%.,Enterococcus fecalis in 2.2%, Pseudomonas aeruginosa in 4.7% and Enterobacter in 6% of children with UTI.

Abdollah Karimi et al [21] study shows Citrobacter in 1.9% and other organisms including Morganella, Acinetobacter, Providentia, Edwardsiella and Corynebacterium accounting for 2.1%.

Nasim Kashef et al [22] on the antimicrobial susceptibility patterns found maximum sensitivity of E.Coli to Nitrofurantoin, Klebsiella to Norfloxacin, Staphylococcus to Gentamycin and Vancomycin ,Pseudomonas to Ceftazidime, Proteus to Ciprofloxacin, Citrobacter to Fluroquinolones, Nalidixic acid,Gentamycin and cotrimoxazole, Enterococcus to Nitrofurantoin and Enterobacter to Fluroquinolones and cotrimoxazole.

Sharifian et al [21] study reveals maximum E.Coli susceptibility to Ceftriaxone, Staphylococcus to Cephalexin, Pseudomonas and Klebsiella to Ciprofloxacin.

In the study by Malla et al [16], 100% susceptibility were found for E.coli, Klebsiella, Proteus, Citrobacter, Enterobacter and Staphylococcus aureus to Amikacin. The study also shows 100%

susceptibility for Klebsiella, Proteus, Enterobacter and Staphylococcus and Pseudomonas to Ciprofloxacin. Pseudomonas also showed 100% susceptibility to Ceftriaxone, Ceftazidime and Cefazolin.

P Senguttuvan et al [23] on Infections encountered in childhood nephrotics. found Urinary Tract Infection as the commonest infection in children with Nephrotic syndrome amounting to 22.4% of male and 24.1% of female nephrotics.

Alejandro Hoberman et al [24] on imaging studies in UTI found normal ultrasonogram in 88%, Vesicoureteric reflux 39% in micturiting cystourethrogram and 9.5% renal scarring in DMSA scan.

Ali Ahmedzadeh et al [25] found vesicoureteric reflux 39.6% as the commonest abnormality in imaging in UTI, followed by calculus in 8% and PUJ obstruction in 6.3%

L.Pead et al [26] found newly diagnosed urinary tract abnormalities in 114 children with Urinary tract infection , 48 boys (21% of those investigated) and 66 girls (12% of those investigated), Vesico Ureteric Reflux in 40%, Pelvi ureteric junction obstruction in 1.7%, Hydronephrosis in 2.6% and absent kidney in 4.3%.

DEFINITIONS

SIMPLE UTI

Significant UTI with resolution on treatment without recurrences and renal scarring.

COMPLICATED UTI:

Definition 1:

The presence of fever >39° C, marked toxicity, persistent vomiting, dehydration and renal angle tenderness suggests complicated UTI.

Definition 2:

UTI occurring in a patient with functional or structural abnormalities of the genitourinary tract.

SYMPTOMATIC UTI:

Significant bacteriuria in a child with symptoms like dysuria, frequency, urgency, vomiting, fever, flank pain.

LEUKOCYTURIA:

Presence of >5 white cells/high power field in a centrifuged urine sample or more than 10 white cells/mm3 in uncentrifuged urine.

SIGNIFICANT BACTERIURIA

A colony count of more than 10^5 of a single organism in a mid stream urine sample.

Depending on the method of urine sample collection,

METHOD	COLONY COUNT (CFU/ml)
Mid stream clean catch	>10^5
Catheter sample	>5*10^4
Suprapubic aspiration	Any number

FALSE POSITIVE CULTURES
Inadequate sample Procedure delay Vaginal or foreskin contamination
FALSE NEGATIVE CULTURES
pH< 5 Urinary dilution Bacteriostatic agents for genitalia asepsis Use of antibiotics

COLLECTION OF URINE FOR CULTURE [41]

The specimen for urine culture should be obtained carefully to prevent contamination by commensal flora, especially in females. A clean-catch specimen is most widely used in toilet-trained older children. Early morning urine samples harbor greater bacterial counts. In neonates and infants, the best technique for obtaining an uncontaminated specimen is suprapubic aspiration from the bladder. It can be performed safely using a 21gauge needle, 1-2 cm above the pubic symphysis. Occasionally parents may succeed in collecting a clean catch sample in a male infant, the sensitivity and specificity of which approaches that of suprapubic aspiration. Urine specimen can also be collected by temporary transurethral catheterization or from a bag applied to the perineum.Bag specimens have unacceptably high contamination rate, even with thorough cleaning of the prepuce or perineum, and are not recommended**.** In children with indwelling catheters urine can be aspirated from the catheter using a sterile needle and syringe. Urine specimen from patients with ureterostomy or vesicostomy are obtained by catheterization of the stoma under asepsis.

CLASSIFICATION [4]

1) PYELONEPHRITIS:

Infection of renal parenchyma and renal pelvis presenting with abdominal or flank pain, fever, malaise, nausea, vomiting and diarrhea. Results in pyelonephritic scarring.

PYELITIS:

Infection of renal pelvis alone.

ACUTE LOBAR NEPHRONIA:

Localised renal bacterial infection involving more than one lobe.

2) CYSTITIS

Indicates bladder involvement and symptoms include dysuria, urgency, frequency, suprapubic pain, incontinence and malodorous urine. Does not result in renal injury.

Acute hemorrhagic cystitis

Eosinophilic cystitis

Interstitial cystitis

3) ASYMPTOMATIC BACTERIURIA:

Positive urine culture without any manifestation of infection. This condition is benign and does not cause renal injury.

ETIOLOGY [29]

GRAM NEGATIVE BACTERIA

Escherichia Coli

Klebsiella pneumoniae

Proteus mirabilis

Enterobacter aerogenes

Pseudomonas aeruginosa

Serratia marcescens

GRAM POSITIVE BACTERIA

Staphylococcus epidermidis

Staphylococcus aureus

Staphylococcus saprophyticus

Enterococcus

OTHERS

Adenovirus 11 & 12

Influenza A

Polyomavirus BK

Herpes simplex, Herpes zoster

Candida albicans

Schistosomiasis, Mycobacterium

PREDISPOSING FACTORS [4]

Female gender

Uncircumcised male

Vesicoureteric reflux

Toilet training

Voiding dysfunction

Obstructive uropathy

Urethral instrumentation

Wiping from back to front in female

Tight clothing

Constipation

Anatomical abnormalities

Neuropathic bladder

Pin worm infestation

CLINICAL FEATURES [29]

LOWER URINARY TRACT

CLASSIC	NON SPECIFIC
Frequency	Poor appetite
Urgency	Irritability
Dysuria	Lethargy
Hematuria	Vomiting
Incomplete emptying	Diarrhoea
Dribbling	Abdominal distension

UPPER URINARY TRACT

CLASSIC	NON SPECIFIC
Fever	Poor appetite
Flank pain	Irritability
Dysuria	Lethargy
Hematuria	Vomiting
Frequency	Diarrhoea
Urgency	Abdominal distension

INVESTIGATIONS

URINE ANALYSIS

1) Urine microscopy

2) Urine culture

BLOOD INVESTIGATIONS:

1) Urea

2) Creatinine

3) Total and differential white cell count

4) Erythrocyte Sedimentation rate

5) C- Reactive protein

6) Blood culture (in complicated UTI)

IMAGING

1) X ray KUB and lumbar spine

2) Ultrasound examination of the abdomen

3) Intravenous urography

4) Voiding cystourethrogram

5) Radionuclide scans- DMSA, DTPA

6) CT abdomen, MRI

7) Urodynamic studies

IMAGING PROTOCOLS FOLLOWING

FIRST UTI [41]

RECOMMENDATIONS

	USG	**MCU**	**DMSA scan**
Indian pediatric nephrology group 2001	All	<2 years	<5 years
American academy of pediatrics 1999	<2 years	<2 years	Not recommended
Royal college of physicians London 1991	All	<1 year	1-7 years

VESICOURETERAL REFLUX[4]

Retrograde flow of urine from the bladder to the ureter and renal pelvis is referred to as vesicoureteral reflux.

Reflux severity is graded using the International study classification of I to V based on the appearance of the urinary tract on a contrast voiding cystourethrogram.

The higher the reflux grade, the greater the likelihood of renal injury. Reflux severity is an indirect indication of the degree of abnormality of the ureterovesical junction.

CLASSIFICATION OF VESICOURETERAL REFLUX

1) Primary
2) Primary associated with other malformations of the uretero vesical junction
3) Secondary to increased intravesical pressure
4) Secondary to inflammatory processes
5) Secondary to surgical procedures involving the ureterovesical junction

GRADING OF VESICOURETERAL REFLUX [4]

GRADE I

Reflux into a nondilated ureter

GRADE II

Reflux into the upper collecting system without dilatation

GRADE III

Reflux into dilated ureter and/or blunting of calyceal fornices

GRADE IV

Reflux into a grossly dilated ureter

GRADE V

Massive reflux with significant ureteral dilatation and tortuousity and loss of the papillary impression.

RESOLUTION OF REFLUX

For grades 1 and 2 reflux, the likelihood of resolution is similar regardless of the age at diagnosis and whether it is unilateral or bilateral.

For grade 3, a younger age at diagnosis and unilateral reflux usually are associated with a higher degree of spontaneous resolution.

Bilateral grade 4 reflux is much less likely to resolve than is unilateral grade 4 reflux.

Grade 5 reflux rarely resolves.

The mean age of reflux resolution is 6 years.

Children with high grade reflux who acquire a UTI are at significant risk for pyelonephritis and renal scarring.

POSTERIOR URETHRAL VALVES

Posterior urethral valves (PUV) are the most frequent cause of congenital bladder outlet obstruction. PUV are obstructing, membranous folds within the lumen of the prostatic urethra and only occur in boys. Antenatal ultrasound showing a distended, thick-walled fetal bladder and bilateral hydronephrosis is suggestive of PUV. Clinical presentation after birth includes respiratory difficulty, sepsis, renal failure, and a distended bladder. Less affected boys can present with recurrent UTI or urinary incontinence. One half to one-third of boys with PUV also have VUR and/or renal dysplasia.

TREATMENT

UNCOMPLICATED UTI

Oral drugs for a duration of 7 to 10 days

DRUGS AND DOSAGE

CEPHALEXIN : 30-50 mg / kg /day in 3 divided doses

CEFIXIME : 10 mg / kg /day in 2 divided doses

AMOXICILLIN : 30-40 mg / kg /day in 3divided doses

CEFADROXIL : 30-40 mg / kg /day in 2 divided doses

CIPROFLOXACIN: 10-20 mg / kg /day in 2 divided doses

COMPLICATED UTI

Parenteral antibiotics for 10-14 days

DRUGS AND DOSAGE

AMIKACIN : 15-20 mg / kg /day in 1-2 divided doses

GENTAMICIN : 5-6 mg / kg /day in 2 divided doses

CEFOTAXIME : 100 mg / kg /day in 3 divided doses

CEFTRIAXONE : 75-100 mg / kg / day in 1-2 divided doses

AMPICILLIN : 100 mg / kg / day in 1-2 divided doses

DRUG PROPHYLAXIS

INDICATIONS:

Complicated UTI

Recurrent UTI

UTI with VUR

DMSA scan showing scars

DURATION: 6months to 2 years or till the child reaches 5 years

DRUG DOSAGE

COTRIMOXAZOLE: 1-2mg / kg /day

NITROFURANTOIN: 1-2 mg / kg /day

CEPHALEXIN: 10 mg / kg / day

CEFIXIME: 2 mg / kg / day

CEFADROXIL: 3- 5 mg / kg / day

TREATMENT OF CYSTITIS

Acute hemorrhagic cystitis:

Self limiting

No treatment needed.

Eosinophilic cystitis:

Antihistamines

Non Steroidal Anti Inflammatory Drugs

Intravesical dimethyl Sulphoxide

Interstitial cystitis:

Bladder hydrodistension

Laser ablation of ulcerated region

TREATMENT OF VESICOURETERIC REFLUX [4]

GRADE	AGE	SCARRING	INITIAL TREATMENT	FOLLOW UP
I-II	Any	Yes/No	Antibiotic prophylaxis	No consensus
III-IV	0-5	Yes/No	Antibiotic prophylaxis	Surgery
III-IV	6-10	Yes/No	Unilateral: Antibiotic prophylaxis Bilateral: Surgery	Surgery
V	1-5	No	Unilateral: Antibiotic prophylaxis Bilateral: Surgery	Surgery
V	1-5	Yes	Surgery	
V	6-10	Yes/No	Surgery	

SURGERY FOR VUR[4]

- Open surgical management

  Politano-Leadbetter

  Cohen transtrigonal

  Glenn-Anderson

- Extra vesical approach

  Lich-Gregoir detrusorrhaphy

- Endoscopic repair of reflux:

  Deflux (subureteral injection)

- Nephrectomy

- Nephroureterectomy

- Vesicoscopic reflux correction

SURGERY FOR PUV

- Transurethral ablation of the valve leaflets

- Vesicostomy

AIM OF THE STUDY

- To study the clinical presentation, laboratory characteristics and radiological profile of Urinary Tract Infection in hospitalized children between 1 month and 12 years of age.

MATERIALS AND METHODS

STUDY CENTER:

The study was conducted at the Institute of Child Health and research Center, Government Rajaji Hospital, Madurai

STUDY PERIOD:

The study was conducted prospectively from February 2009 to September 2010.

STUDY DESIGN:

Prospective observational study

STUDY POPULATION

Children admitted in Govt. Rajaji Hospital, Madurai Medical College , Madurai

SAMPLE SIZE:

246 children.

INCLUSION CRITERIA:

Children between 1 month to 12 years presenting with features of urinary tract infection- dysuria, dribbling, lower abdominal pain/supra pubic pain, diarrhoea, fever, febrile convulsions ,vomiting, poor stream and recurrent UTI.

EXCLUSION CRITERIA:

1) Age <1 month and >12 years
2) Pre existing urinary tract anomalies

CONFLICT OF INTEREST : Nil

FINANCIAL SUPPORT : Nil

ETHICAL COMMITTEE CLEARANCE: Obtained

METHODOLOGY

For all children admitted with the above mentioned criteria, a detailed history, general examination and system examination were done. Children with pre existing urinary tract anomalies were excluded after history taking. Measurement of weight and blood pressure was done. Urine analysis by microscopy and culture of the clean catch mid stream urine specimen was done and the growth pattern of organisms and their susceptibility pattern to antibiotics determined. Based on history, examination and laboratory results the comorbidites were identified. All children were subjected to Ultrasound examination of the abdomen and micturiting cystourethrogram, and antibiotic prophylaxis was started for those with mild degrees of vesicoureteral reflux and those with abnormalities requiring surgical management were transferred to pediatric surgical department and necessary treatment given and followed up.

STATISTICAL METHODS

The information collected regarding the selected cases were recorded in a Master chart. Data analysis was done with the help of computer using SPSS software. Using this software, frequencies, percentages, mean and standard deviation, Chi square, 'p' and coefficient of correlation were calculated. A 'p' value less than 0.05 is taken to denote significant relationship. If the coefficient of correlation (r) is more than 0.5 then the two variables are taken to be correlated.

ANALYSIS:

Data will be spread in excel spread sheet and analysed using simple descriptive statistics.

RESULTS

The study population consisted of 246 children with urinary tract infection.

TABLE – 1

AGE GROUP

Age group	CASES	%
<1 year	15	6.1
1-4 years	100	40.7
5-8 years	75	30.5
9-12 years	56	22.7
TOTAL	246	100

15 were less than 1 year of age, 100 between 1-4 years, 75 between 5-8 years and 56 between 9-12 years.

SEX DISTRIBUTION

Of the 246 children, 143 were male and 103 were female

TABLE- 2

SEX	NUMBER	%
Male	143	58.1
Female	103	41.9
TOTAL	246	100

AGE AND SEX DISTRIBUTION

TABLE 3

AGE	MALE	%	FEMALE	%
<1 year	12	8.5	3	2.9
1-4 years	67	46.7	33	32
5-8 years	40	28.3	35	34
9-12 years	24	16.5	32	31.1
TOTAL	143	100	103	100

In the < 1 year and 1-4 years age group UTI was more common in male children. After 5 years UTI is more common in the female children. This is statistically significant (p value <0.005).

CLINICAL PROFILE

TABLE 4

CLINICAL FEATURES	NUMBER	%
Dysuria	220	89.4
Fever	208	84.5
Vomiting	56	22.7
Abdominal pain	53	21.5
Diarrhea	61	24.8
Febrile seizures	16	6
Dehydration	8	3.3
Flank pain	2	0.8
Recurrence	15	6.1
Dribbling	2	0.8
Poor stream	15	6.1

Dysuria was the commonest symptom followed by fever**,** diarrhea, vomiting and abdominal pain. Febrile seizures was present in 16 children. 8 children had dehydration, 2 children had flank pain. Recurrence of UTI was found in 15, dribbling in 2 and poor stream in 15 children.

CLINICAL PROFLIE- SEX DISTRIBUTION

TABLE 5

	MALE	%	FEMALE	%
Dysuria	128	90	92	89
Fever	125	87.2	83	80.8
Vomiting	27	19.2	29	28.2
Abdominal pain	22	15.1	31	29.8
Diarrhea	38	26.5	23	22.5
Febrile seizures	9	6.3	7	6.8
Dehydration	3	2.1	5	5.4
Flank pain	2	1.4	0	0
Recurrence	9	6.3	6	5.8
Dribbling	2	1.39	0	0
Poor stream	15	10.4	0	0

Dysuria and fever were the commonest symptoms in both sexes while vomiting and abdominal pain was more common in females.

MALNUTITION AND UTI

TABLE 6

IAP GRADES	MALE	FEMALE	TOTAL	%
NORMAL	29	36	65	26.4
GRADE I	85	49	134	54.3
GRADE II	17	13	30	12.2
GRADE III	9	5	14	5.9
GRADE IV	3	0	3	1.2
TOTAL	143	103	246	100

UTI was found in 26.4% of children with normal weight while the remaining 73.6% of children were malnourished. Majority of the children (54.3%) fell into the grade I PEM group.

SIGNIFICANT PYURIA

TABLE 7

PYURIA	NUMBER	%
POSITIVE	94	38
NEGATIVE	152	62
TOTAL	246	100

Significant pyuria defined as more than 10 pus cells in uncentrifuged urine was found in 94 children while 152 children had insignificant pyuria.

SIGNIFICANT PYURIA

TABLE 8

PYURIA	MALE	%	FEMALE	%
Positive	51	35.6	43	41.7
Negative	92	64.4	60	58.3
Total	143	100	103	100

Significant pyuria was found in 51 male and 43 female children.

SIGNIFICANT BACTERIURIA

TABLE 9

CULTURE	NUMBER	%
POSITIVE	146	59.3
NEGATIVE	100	40.7
TOTAL	246	100

Significant growth of bacteria was seen in 146 children and insignificant or no growth was found in 100 children.

SIGNIFICANT BACTERIURIA

TABLE 10

CULTURE	MALE	%	FEMALE	%
POSITIVE	84	58.3	62	60.2
NEGATIVE	59	41.7	41	39.8
TOTAL	143	100	103	100

58.3% of male children and 60.2% of the female children had significant bacteriuria.

BACTERIOLOGICAL GROWTH PROFILE

TABLE 11

ORGANISM	NUMBER	%
Escherichia coli	80	54.7
Klebsiella pneumoniae	10	6.8
Klebsiella oxytoca	8	5.4
Staphylococcus aureus	22	15
CONS	8	5.4
Proteus mirabilis	2	1.3
Proteus vulgaris	2	1.3
Pseudomonas aeruginosa	3	2
Enterococcus fecalis	4	2.7
Acinetobacter	2	1.3
Citrobacter	4	2.7
Providencia	1	1.4
TOTAL	146	100

E.Coli was grown in 80 children, Klebsiella species in 18, Staphylococcal group in 30, Proteus species in 4, Pseudomonas in 3,E.fecalis in 4,Acinetobacter in 2, Citrobacter in 4 and Providencia in 1.

BACTERIOLOGICAL GROWTH PROFILE

SEX DISTRIBUTION

TABLE 12

ORGANISM	MALE	%	FEMALE	%
Escherichia coli	44	52.4	36	58.1
Klebsiella pneumoniae	7	8.3	3	4.8
Klebsiella oxytoca	4	4.7	4	6.5
Staphylococcus aureus	13	15.5	9	14.6
CONS	5	5.9	3	4.8
Proteus mirabilis	2	2.4	0	0
Proteus vulgaris	1	1.2	1	1.6
Pseudomonas aeruginosa	2	2.4	1	1.6
Enterococcus fecalis	2	2.4	2	3.2
Acinetobacter	1	1.2	1	1.6
Citrobacter	2	2.4	2	3.2
Providencia	1	1.2	0	0

E.coli was the commonest organism grown in 44 male children and 36 of female children. Proteus mirabilis and Providencia was seen in male children only.

CULTURE AND SENSITIVITY PATTERN

TABLE 13

ORGANISM	SENSITIVITY PATTERN	NUMBER	%
Escherichia coli	Amikacin	51	88
Klebsiella pneumoniae	Ciprofloxacin	7	72
Klebsiella oxytoca	Norfloxacin	5	69
Staphylococcus aureus	Ciprofloxacin	17	80
CONS	Ofloxacin	7	86
Proteus mirabilis	Amikacin	1	50
Proteus vulgaris	Ofloxacin	2	100
Pseudomonas aeruginosa	Ceftazidime	2	83
Enterococcus fecalis	Cotrimoxazole	3	76
Acinetobacter	Amikacin	1	50
Citrobacter	Norfloxacin	2	42
Providencia	Ciprofloxacin/Ofloxacin/ Norfloxacin	1	100

RADIOLOGICAL PROFILE

TABLE 14

DIAGNOSIS	MALE	FEMALE	TOTAL	%
Cystitis	55	12	67	60.9
Hydroureteronephrosis	6	4	10	9.2
PUJ obstruction	4	2	6	5.4
Posterior urethral valve	5	0	5	4.5
Vesico ureteric reflux	9	5	14	12.8
Calculus	4	0	4	3.6
Pyelonephritis	2	0	2	1.8
Medical renal disease	0	2	2	1.8
TOTAL	85	25	110	100

110 of the 246 children had radiological abnormalities in Ultrasonogram. Micturiting cystouretherogram was done in 142 children and VUR was made out in 14 children.

COMORBIDITY IN UTI

TABLE 15

DISEASE	MALE	FEMALE	TOTAL	%
Enteric fever	1	5	6	2.4
Nephrotic syndrome	5	3	8	3.2
Heart disease	0	2	2	0.8
Hypertension	1	1	2	0.8

6 children had coexistent Enteric fever, 8 were known nephrotic syndrome patients, while 1 child had Patent ductus arteriosus and 1 child had ventricular septal defect.2 children had hypertension.

DISCUSSION

This study included 246 children in the age group between 1 month to 12 years. 15 (6.1%) were less than 1 year, 100 (40.7%) were between 1 to 4 years, 75 (30.5%) were between 5 to 8 years and 56 (22.7%) between 9 to 12 years of age. Urinary tract infection was more common in the 1 to 4 years age group in this study and this is supported by other studies by Thaer-Al-Momani et al [12] where 49 % were in the 1 to 4 years age group and Neelam et al [19]where 38.7% belonged to the same age group.

Of the 246 children 143 (58.1%) were males and 103 (41.9%) were females. The male to female ratio in this study is 1.3:1. This is in contrast to the other studies (15, 16) which show a female preponderance. The study by Malla et al [16]also shows a male to female ratio of 1:2, 67.2% being females. N.Choudhuri et al[13] study on community acquired UTI ,with a male preponderance (53.6%) when compared to the females(46.4%) supports our study .Another study by G.K.Rai et al [18]had 53.3% males and 46.7% females with UTI.

Under the less than 1 year age group UTI was more common in the male children (8.5%) as reported in other studies [17]. In children more than 5 years UTI was common among the females (34%) and this is supported by other studies [4,18].

CLINICAL PROFILE

The clinical profile of UTI is varied. Symptoms of UTI may be minimal and non-specific in infants and small children. Febrile children not suspected of having UTI are as likely to have UTI as those who are suspected of having UTI. Many studies have been done to study the clinical characteristics of UTI in children and fever is the most common symptom in younger children while dysuria and fever is more common in older children .

In this study dysuria is the commonest symptom found in 89.4% followed by fever accounting for 84.5% diarrhea in 24.8%, vomiting in 22.7%, abdominal pain in 21.5%, febrile seizures in 6%, dehydration in 3.3%, flank pain in 0.4%, recurrences in 6.1% dribbling in 0.8% and poor urinary stream in 6.1%.

Azhar Munir Qureshi et al [15]study shows dysuria in 98%, fever in 92%, recurrence in 28%, vomiting in 26%,poor stream in 20% and failure to thrive in 31%.

Anis- ur- Rahman et al [14] study on the clinical presentation of UTI, fever was seen in 91% dysuria in 65% previous episodes in 30%,vomiting in 28%, abdominal pain in 22% poor urinary stream in 15%.

Malla et al [16] study shows fever in 86.9%, dysuria in 40%, pain abdomen in 46.4% vomiting in 39.2%, diarrhea in 14.28% .

Dysuria is the most common clinical presentation in this study in contrast to the above 2 studies which show fever as the most common clinical feature followed by dysuria.

In this study diarrhea formed a feature in 24.8% and the study by M.H.Fallahzadeh et al [30] supports this with diarrhea found in 25% of children with UTI. The association of diarrhea with urinary tract infection has also been shown in other studies by Thakar et al [31] and Pryles C V et al [32].

Febrile seizures with UTI in this study is 6% while other studies by Mc Intyre et al [33] shows 2.6%, Lee P et al [34] study shows 3.9% and Malla et al [16] shows 13% occurrence of febrile seizures.

Recurrence if found in 6.1% in this study. There have been many studies on the causes for recurrence in UTI in children but there are only few studies on the recurrence rates. The study by Gerald

C .Mingin [35] on the factors predictive of UTI recurrence , shows a recurrence rate of 24% which is very high when compared to this study.

Schlager et al study [9] shows that recurrence is more common in girls regardless of the presence or absence of urinary tract abnormality. It also states that among the males one third have recurrent UTI.

In this study recurrence was found in 15 children - 9 male (6.3%) and 6 female (5.8%) and urinary tract abnormalities was found in majority of them in the form of Posterior urethral valves ,vesico ureteric reflux and cystitis.

On analysis, normal weight was found only in 26.4% of the children with UTI while the remaining 73.6 % fall in the malnourished group with 54.3% in grade I, 12.2% in grade II, 5.9% in grade III and 1.2% in grade IV malnourishment of the IAP grading. Similar results are found in other studies.

In a study on the frequency and clinical presentation of UTI [15] failure to thrive was found in 40% of the children. Dayal et al[36] and Brooke et al [37] studies show failure to thrive in 26% and 9.5% respectively in children with UTI.

LABORATORY PROFILE

Significant pyuria defined as more than 10 pus cells in uncentrifuged urine sample was found in 38% of children. S.Fouzas et al [17] study shows significant pyuria in 67.3%.Another study [19] shows significant pyuria 53.6%.

Significant bacteriuria was found in 146 (59.3%) and the urine culture was negative or showed insignificant bacteriuria in 100(40.7%) children. This is supported by a study [16] where culture positivity was found in 57%. But another study[18] showed positive culture in 28.6% .

62(60.2%) of the females and 84 (58.3%) of the males showed significant growth in urine culture. This is similar to the study by G.K.Rai et al [18] which showed no significant difference in growth positive rates in 2 genders (Male 51.7% and female 48.3%).

The commonest pathogen grown in culture in this study was Escherichia coli 54.7% .

Klebsiella pneumoniae was found in 6.8%, Klebsiella oxytoca in 5.4%, Staphylococcus aureus in 15%, Coagulase negative staphylococcus in 5.4%, Proteus mirabilis in 1.3%, Proteus vulgaris in 1.3% Pseudomonas aeruginosa in 2%, Enterococcus fecalis in 2.7%,

Acinetobacter in 1.3%,Citrobacter sp. in 2.7%,Providencia species in 1.4%.

Another study [17] shows culture pattern as follows: E.coli 47.1%, Klebsiella pneumoniae 15.6% Klebsiella oxytoca 1%, Proteus mirabilis 5.9%, Proteus vulgaris in 0.3%, Staphylococcus aureus in 1.7%, Enterococcus fecalis 8.7%, Acinetobacter 2.8% and Citrobacter 1.4%

E.coli was grown in 93.3%, Klebsiella in 1.5% Proteus in 2.3%, Citrobacter in 0.7%, Staphylcoccus aureus in 0.7%, Pseudomonas in 0.7%, Salmonella in 0.2% and Enterobacter in 0.6% in study by Rai et al.

Fakhrossadat et al [20] studies showed E.coli in 63%, Klebsiella in 19.4%, Enterobacter 6%, Pseudomonas 4.7%, Proteus mirabilis in 3.9%, Enterococcus fecalis in 2.2%, Staphlyococcus aureus in 0.4%, Providentia in 0.4% .

One study showed growth of Coagulase negative staphylococcus in 1.1%.

On analysis Escherichia coli was the commonest organism in most of the studies and ranged from 47% to 93% supporting this study.

While Klebsiella species forms the second most common organism in other studies ranging from 1.5% to 16%, Staphylococcus aureus forms the second most common urinary pathogen in this study (14.6%)

Staphylococcus aureus growth ranged from 0.4% to 10% in other studies. S.K.Abdulhadi et al [38] study showed Staphylococcus aureus in 10% of children with UTI.

The drug sensitivity pattern of the urinary pathogens are as follows : E.Coli sensitive to Amikacin in 88%, Klebsiella pneumoniae to Ciprofloxacin in 72%, Klebsiella oxytoca to Norfloxacin in 69%, Staphylococcus aureus to Ciprofloxacin in 80% ,Pseudomonas to Ceftazidime in 83% and ciprofloxacin in 70% ,Proteus mirabilis was sensitive to amikacin in 50%,Proteus vulgaris to Ofloxacin in 100% CONS sensitive to Ofloxacin in 86%,Enterococcus fecalis showed maximum sensitivity to Cotrimoxazole in 76%,Citrobacter to Norfloxacin in 42%, Acinetobacter to Amikacin in 50% and Providencia to ciprofloxacin, Ofloxacin and Norfloxacin in 100% .

Nasim Kashef et al [22] study on the sensitivity pattern of urinary pathogens to drugs showed maximum susceptibility of E.Coli to Nitrofurantoin (71.3%) and Ciprofloxacin (68.1%), Klebsiella to

Norfloxacin (91.7%), Staphylococcus aureus to Gentamicin (100%), Vancomycin (100%), Nitrofurantoin (75%) and Cotrimoxazole (75%). Proteus was sensitive to Ciprofloxacin (71.2%), Pseudomonas to Ceftazidime (83.3%) and Norfloxacin (80%) ,CONS to Norfloxacin, Genatmicin, Nitrofurantoin and Cotrimoxazole in 88.9%, Citrobacter was 100% sensitive to Ciprofloxacin, Norfloxacin, Nalidixic acid, Gentamicin, Nitrofurantoin and Cotrimoxazole.

Fakhrossadat et al [20] study showed E.Coli sensitivity to Nitrofurantoin in 90.4% and Amikacin in 84.2% and Klebsiella to Ciprofloxacin in 77% and Nalidixic acid in 64%.

Sharifian et al study [21] shows maximum sensitivity of E.Coli to Ceftriaxone (97.8%) and Cefotaxime (95.2%), Staphylococcus to Cephalexin in 90.5% and Ciprofloxacin in 89.7%, Pseudomonas to Ciprofloxacin in 94.7% and Amikacin in 83.9%, Klebsiella to Ciprofloxacin in 95.1% and Ceftriaxone in 90.7%.

RADIOLOGICAL PROFILE

Ultrasonogram was done in all patients admitted with UTI and micturiting cystourethrogram was done in 142 children. 140(55%) children had normal ultrasound while 110 (45%) had radiological abnormalities. Cystitis was the commonest radiological feature found in 67 (60.9%) children (55 male and 12 female). Hydroureteronephrosis in 10 (9.2%),6 male and 4 female children, Pelvi ureteric junction abnormalities in 6(5.4%), Posterior urethral valve in 5(4.5%), Vesicoureteric reflux in 14 (12.8%) ,calculus in 4(3.6%), Pyelonephritis in 2(1.8%) and Medical renal disease in 2(1.8%). were the other radiological abnormalities found. Grade I VUR was seen in 9 children grade II in 2 grade IV in 1 and grade V in 2 children. Children with grade I and II VUR were given antibiotic prophylaxis and children in grade IV and V were referred for surgical management. Anatomical abnormalities were more commonly found in the male children than the female children.

Jothilakshmi et al [39] in her study on the radiological evaluation of urinary tract in children with urinary infection found abnormalities in 22.9% male and 15.9% of the female children.

Pui Meng Mok et al [40] found normal radiology in 63.9% and abnormalities in 36.1%.Neelam et al [19] in her studies found VUR in 19.9% and PUV in 27.6% of children with UTI.

In a study by Ali Ahmedzadeh [25], VUR was seen in 40%, Calculus in 8%, PUJ obstruction in 6.3%, PUV in 2 boys and double collecting system in 2 girls.

COMORBIDITIES

Nephrotic syndrome was the commonest comorbidity in this study found in 8 children, enteric fever in 6 children, congenital heart disease in 2 and hypertension in 2 children.

CONCLUSIONS

- Urinary tract infection was more common in children between 1 to 4 years.
- In children less than 5 year UTI is common in male children and more common in female children in the 5 to 12 years age group.
- Dysuria was the most common clinical presentation followed by fever.
- 54.3% of children fell into the Grade I malnutrition group.
- Significant pyuria was found in 38%.
- 59.3% showed significant bacteriuria.
- Escherichia Coli was the commonest urinary pathogen and showed maximum sensitivity to Amikacin.
- Radiological abnormalities were found in 43% of the children.
- Cystitis was the commonest radiological finding.
- Vesicoureteric reflux was documented in 13.2%.
- Nephrotic syndrome was the most common comorbidity.

LIMITATIONS OF THIS STUDY

- Follow up could not be done for all children.
- Sensitivity pattern of the cultured organism varied from time to time during the study period due to differences in the sensitivity discs used in the microbiology lab.
- MCU was not done in all children due to technical difficulties and loss of follow up.
- DMSA scan was not done due to non availability of the investigation in the institution and financial constraints.

RECOMMENDATIONS

1) Urine culture should be sent to all infants with fever and non specific symptoms.
2) Micturiting cystouretherogram to be done in children less than 5 years of age.
3) Micturiting cystouretherogram to be done to all children with abnormalities in the ultrasonogram**.**

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PROFORMA

GOVT RAJAJI HOSPITAL, MADURAI

CLINICAL, LABORATORY AND RADIOLOGICAL PROFILE OF URINARY TRACT INFECTION IN CHILDREN

NAME : AGE/SEX :

IP NO : UNIT :

ADDRESS :

SYMPTOMS:

DYSURIA □ FEVER □

VOMITING □ DIARRHOEA □

ABDOMINAL PAIN□ FLANK PAIN □

HEADACHE □ CONVULSIONS □

DRIBBLING □ POOR STREAM □

PREVIOUS EPISODES :

ANTHROPOMETRY AND VITALS :

WEIGHT :

BLOOD PRESSURE :

LAB PROFILE :

URINE ALBUMIN :

DEPOSITS :

CULTURE AND SENSITIVITY:

USG ABDOMEN :

MCU :

COMORBIDITIES :

FOLLOW UP :

ABBREVIATIONS

UTI	-	URINARY TRACT INFECTION
USG	-	ULTRASONOGRAM
MCU	-	MICTURITING CYSTOURETHROGRAM
CT	-	COMPUTERISED TOMOGRAPHY
MRI	-	MAGNETIC RESONANCE IMAGING
PEM	-	PROTEIN ENERGRY MALNUTRITION
DMSA	-	DI-MERCAPTO SUCCINIC ACID
E.Coli	-	ESCHERICHIA COLI
CONS	-	COAGULASE NEGATIVE STAPHYLOCOCCUS

MASTER CHART ABBREVIATIONS

SEX

1 - MALE

2 - FEMALE

FEVER, DYSURIA, ABDOMINAL PAIN, VOMITING, DIARRHOEA

1 - PRESENT

2 - ABSENT

POOR STEAM, DRIBBLING, FLANK PAIN, SEIZURES

1 - PRESENT

2 - ABSENT

DEHYDRATION, RECURRENCE

1 - PRESENT

2 - ABSENT

WEIGHT

1 - NORMAL

2 - GRADE I PEM

3 - GRADE II PEM

4 - GRADE III PEM

5 - GRADE IV PEM

PYURIA

1 - SIGNIFICANT

2 - INSIGNIFICANT

ORGANISM

1 - E.COLI

2 - KLEBSIELLA PNEUMONIAE

3 - KLEBSIELLA OXYTOCA

4 - STAPHYLOCOCCUS AUREUS

5 - PROTEUS MIRABILIS

6 - PROTEUS VULGARIS

7 - PSEUDOMONAS AERUGINOSA

8 - ENTEROCOCCUS FECALIS

9 - ACINETOBACTER

10 - PROVIDENCIA

11 - COAGULASE NEGATIVE STAPHYLOCOCCUS AUREUS

12 - CITROBACTER

13 - NEGATIVE OR NO SIGNIFICANT GROWTH

AMINOGLYCOSIDES

1 - AMIKACIN

2 - GENTAMICIN

FLUOROQUINOLONES

1 - CIPROFLOXACIN

2 - NORFLOXACIN

3 - OFLOXACIN

CEPHALOSPORINS

1 - CEFTRIAXONE

2 - CEFOTAXIME

3 - CEPHALEXIN

4 - CEFTAZIDIME

OTHERS

1 - COTRIMOXAZOLE

2 - VANCOMYCIN

3 - NALIDIXIC ACID

COMORBIDITY

1 - ENTERIC FEVER

2 - HEART DISEASE

3 - HYPERTENSION

4 - NEPHROTIC SYNDROME

USG/MCU

1 - NORMAL

2 - CYSTITIS

3 - VESICOURETERIC REFLUX

4 - PYELONEPHRITIS

5 - MEDICAL RENAL DISEASE

6 - HYDROURETERONEPHROSIS

7 - PUJ OBSTRUCTION

8 - POSTERIOR URETHRAL VALVE

9 - CALCULUS

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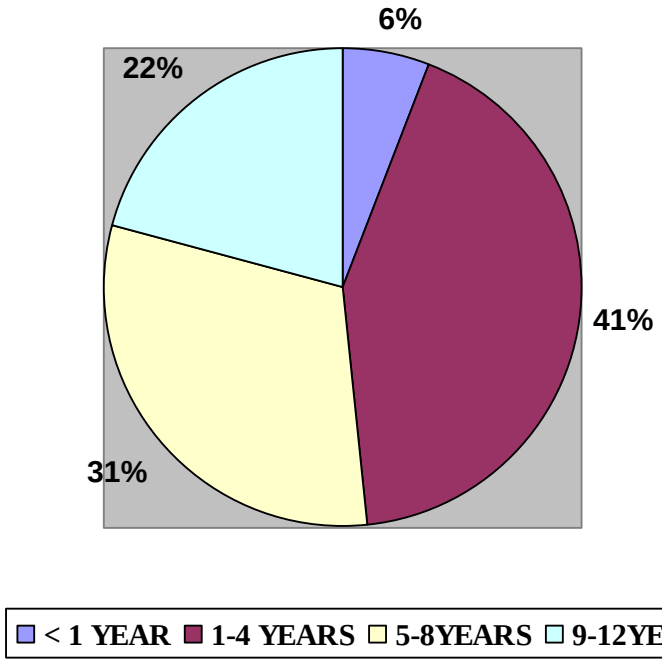
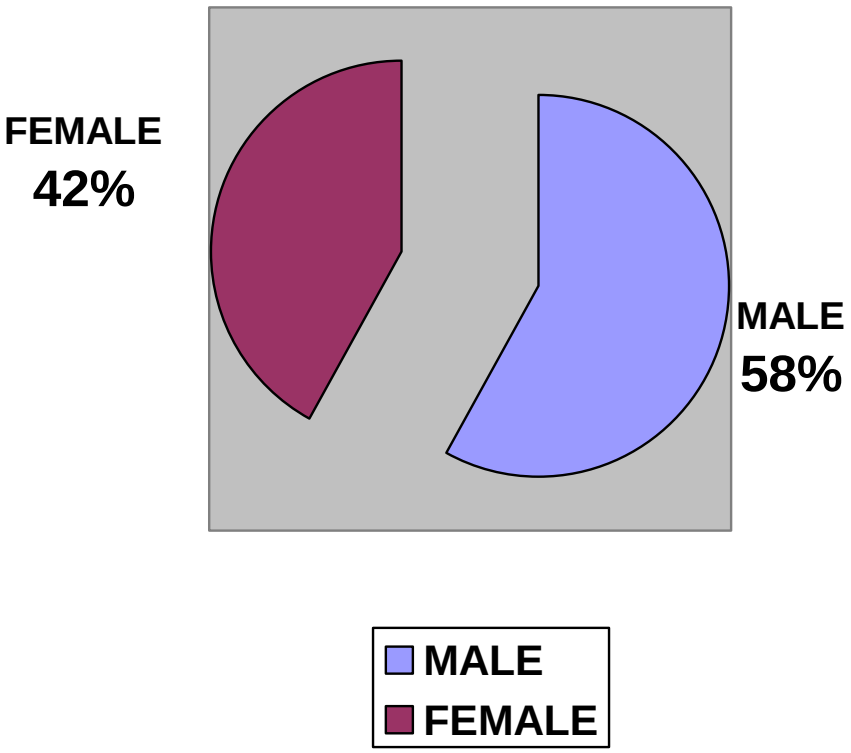
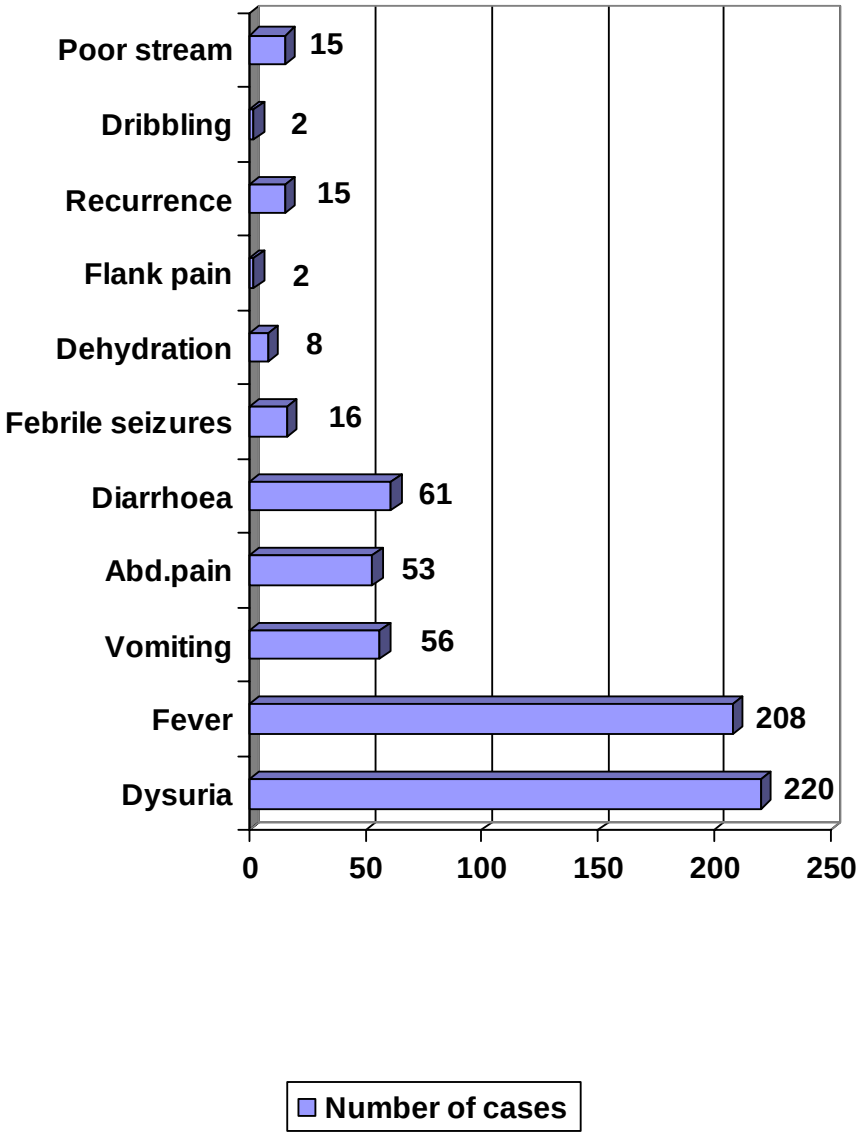


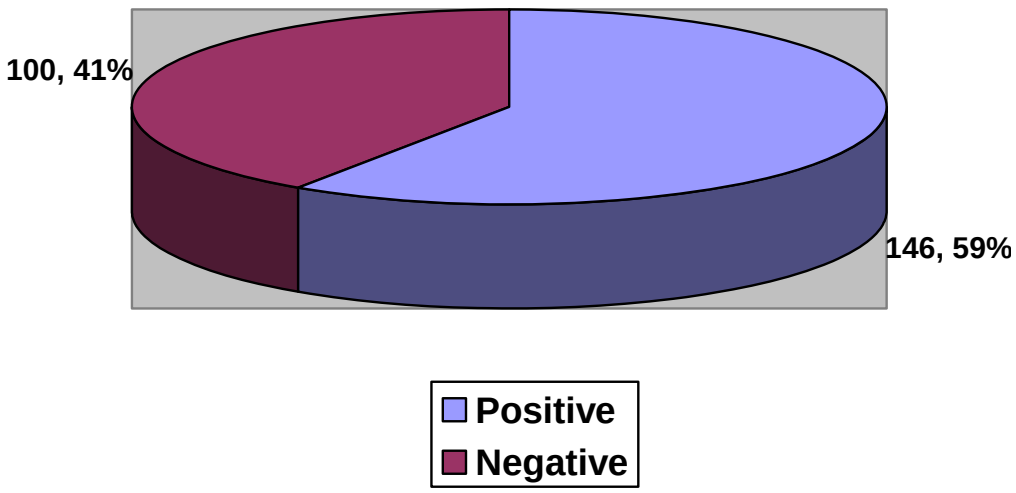
SEX DISTRIBUTION



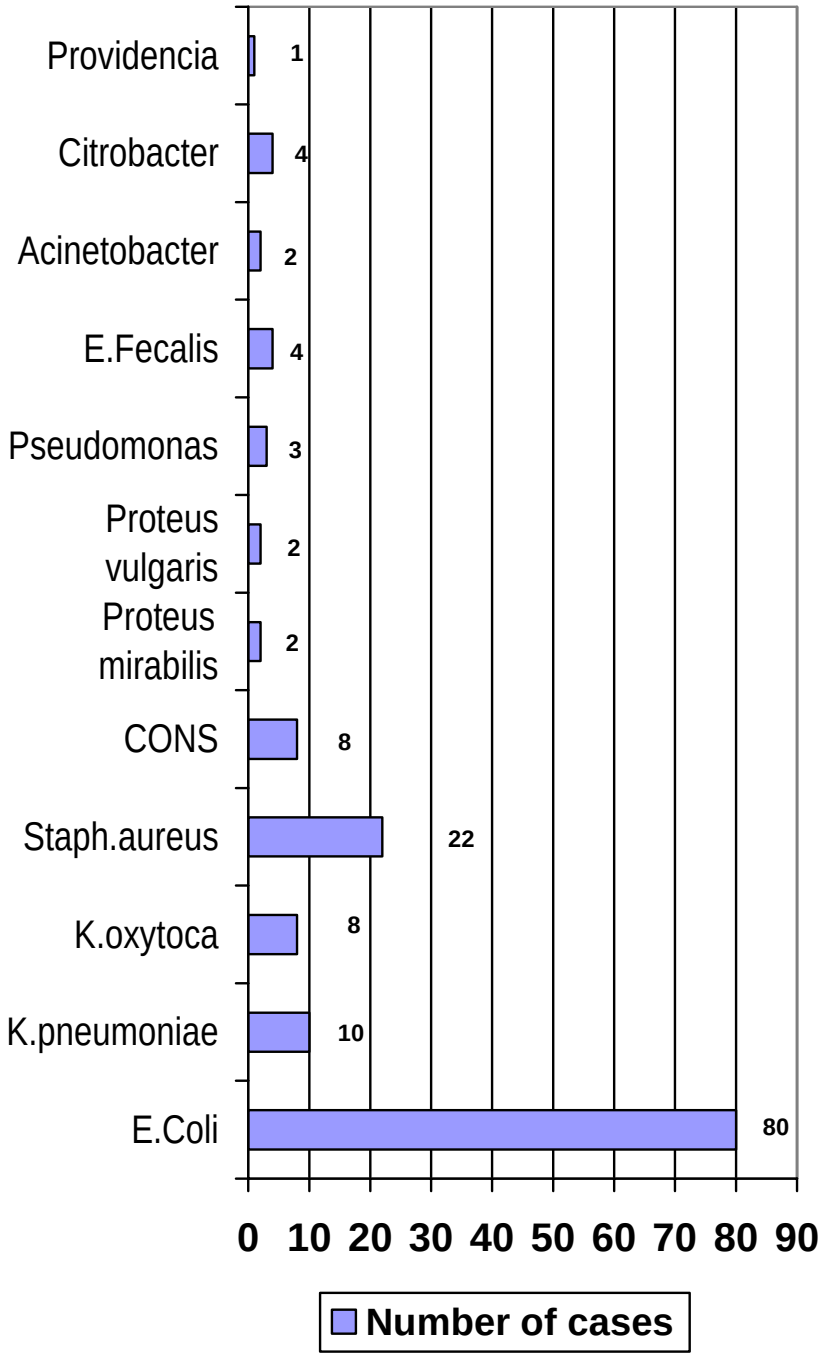
CLINICAL PROFILE



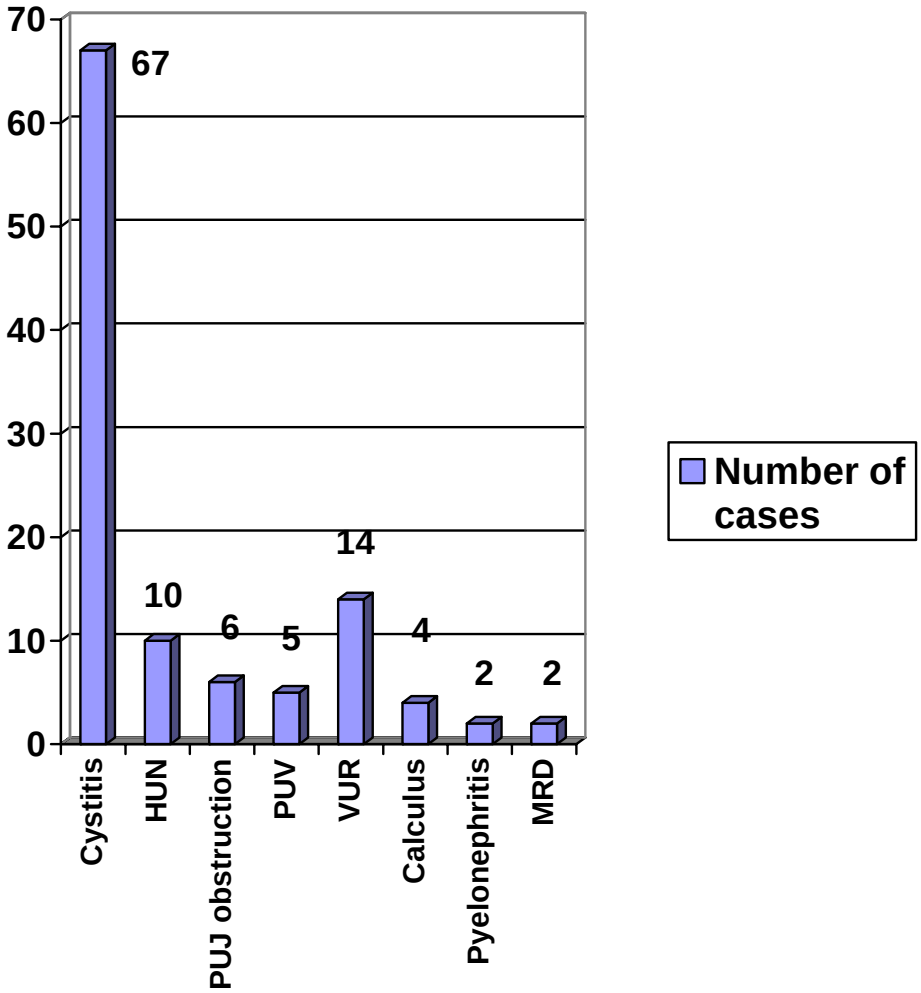
SIGNIFICANT BACTERIURIA



BACTERIOLOGICAL GROWTH PROFILE



RADIOLOGICAL PROFILE



NORMAL MCU

VESICOURETERIC REFLUX