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A Clinical and Microbiological Study of Urinary Tract Infection in Patients Following Instrumentation

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The present study was carried out on both outpatients and inpatients attending the Department of Urology, Vijayanagar Institute of Medical Sciences, Bellary. The study consisted of 110 cases based on clinical diagnosis and type of instrumentation performed on patients. Urine samples were collected from all the patients by mid stream sample or aseptically aspirated catheter sample and were processed in the Department of Microbiology, VIMS, Bellary for both bacteria and fungi. In the present study urinary tract infection (UTI) following instrumentation was more common among men than women. In men the highest incidence was seen in 61 to 70 years group about 14% and in women 21 to 30 years group about 17.9%. In the present study cystoscopy accounted most common instrumentation procedure carried out in 36.3% of cases followed by catheterization in 30.9% of cases. Other instrumentation procedures commonly carried were urethral dilatation (22.7%), transurethral resection of prostate (5.4%) and endostricturotomy (4.5%). The highest incidence of infection rate following instrumentation was seen in transurethral resection of prostate about 66.7%. Endostricturotomy and catheterization also carries a equal risk of infection accounting for 60% and 58.8% respectively. Microbiological study of urine samples obtained from 110 patients showed the positive growth in 46.3% cases and no growth was obtained in 53.7% of cases. Among the bacterial isolates gram negative enteric bacteria were the predominant organisms. *Escherichia coli* and *Klebsiella pneumonia* constituted predominant isolates obtained. *Pseudomonas aeruginosa* was the third most common organism isolated in 12% of cases. Gram positive cocci were isolated in 16% of cases. *Coagulase negative staphylococci* was the predominant isolate obtained in 12% followed by *Staphylococcus aureus* in 4% of cases. In case of urinary tract infection without any instrumentation *Escherichia coli* and *Klebsiella pnuimoniae* were the predominant organisms. So in the preset study no significant difference was found between the bacteriology of UTI with or without instrumentation. Antibiotic susceptibility patterns shows amikacin, gentamicin, ciprofloxacin and norfloxacin are antibiotic choice for treating the urinary tract infection following instrumentation.

No fungus was isolated in 110 cases of UTI following instrumentation. 30 cases of UTI without any instrumentation was also included in the study as control group. In the control group there was a female preponderance. The most commonly affected age groups in females was 11 to 20 years about 20%. The most commonly affected age groups among males was 31 to 40 years about 10% . In case of UTI without any instrumentation *E. coli* and *Klebsiella pneumonia* were the predominant organisms. Therefore, it was concluded that no significant difference was found between the bacteriology of UTI with or without instrumentation. No fungus was isolated in 30 cases of UTI without any instrumentation.

Key words: UTI, Instrumentation, *Escherichia coli,* Antibiotics.

The urinary tract is the second most common site susceptible to microbial infection and invasion. Urinary tract infections can occur in all age groups and in both sexes. Most commonly urinary tract infections are due to obstruction in the urinary tract, anatomical abnormalities, stones, surgery and unhygienic practice. It may also be duo to several causes like instrumentation and various procedures performed on the urinary tract. Urinary tract infections appear to be responsible for more than 35% of all hospital acquired infection[2,] among these the great majority of infections are associated with urinary tract instrumentation in the hospital[3]. Most uropathogens originate from the host microbial flora and most commonly from the faecal flora[4] . They can also be exogenous al when introduced during diagnostic or therapeutic instrumentation of the urinary tract. The ascending route by way of the urethra is the most usual route by which microorganisms enter the urinary tract[5]. Urinary tract infection is often diagnosed on clinical grounds and treated on an empirical basis by the clinicians.

In some cases untreated urinary tract infection may lead to severe complication[6]. Treatment in such conditions may not by useful because of drug resistant microorganisms[7]. Advances in antimicrobial therapy have been accompanied by an increased frequency of infection due to microorganisms, which are resistant to commonly used antibiotics[8]. Although such resistant infection occurs most frequently in hospital practices they are also subsequently encountered in the community at large. In this study an attempt has been made to isolate and identify the microorganisms that are commonly implicated in the causation of urinary tract infection following instrumentation. Antibiotic susceptibility pattern of the isolates has also been carried out as an aid to assist the clinician to select the most appropriate antibiotic. A comparison has been made between the microbial flora involved in the causation of urinary tract infection in individuals without any instrumentation and in individuals following instrumentation.

To isolate and identify the urinary pathogens responsible for urinary tract infection following instrumentation. To study the various susceptibility factors and risk groups involved in urinary tract infection. To identify the most common causative agent as determined by frequent isolation in the region of study. To determine the sensitivity and resistant patterns of the isolates to various antimicrobial agents.

Methodolody

Source of data

The study group consists of both outpatients and inpatients of Department of Urology, Vijayanagar Institute of Medical Sciences, Bellary for a period of one year from 1.1.2000 to 31.12.2000.The patients undergoing various lower urinary tract instrumentation procedures namely urethrocystoscopy, Urethral dilatations, transurethral surgeries, catheterization etc., were enrolled in the study. Urine specimens were obtained prior to instrumentation and again 48 hrs after the instrumentation. The isolates were identified on the basis of conventional microbiological procedures.

Method of collection of data

A urine samples were obtained from patients suffering from urinary tract infections after advising the proper method of collection both in men and women i.e., retraction of fore skin of the genitalia in men and separation of labia in women. A urine specimen was taken from the catheter for culture at the time of catheterization and specimens were also collected after 48 hrs of catheterization from the catheter by aseptic needle aspiration and not from the collection drainage bag.[66-69] The urine specimens were subjected to microscopic examination followed by culture within two hours of collection.

Antimicrobial susceptibility test

Antimicrobial susceptibility test by Kirby Bauer disk diffusion method Antimicrobial disks used were Ampicillin (10µg), Doxycycline (30µg), Nalidixic acid (30µg), Nitrofurentoin (300µg), Gentamicin (10µg), Amikacin (30µg), Norfloxacin (10µg), Ciprofloxacin (05µg), Cefotoxime (30µg), (Co-Trimaxozole) Trimethoprim (1.25µg) and Sulfamethoxazole (23.75µg),

Mycological methods

Urine sample were examined for fungi by wet mount and Gram's stain and inoculated on two sets of Sabouraud's dextrose agar and incubated at 22^0 and 37^0. The culture tubes were examined every day for the first week and twice a week for the next three weeks.

RESULTS

A clinical and microbiological study of urinary tract infection following instrumentation was carried out on both outpatients and inpatients of Department of Urology, Vijayanagar Institute of Medical Sciences, Bellary for a period of one year, from 1.1.2000 to 31.12.2000. A total of 110 cases were included in the study. The data was collection regarding age, sex clinical diagnosis and type of instrumentation. Microbiological study of urine samples and antibiotic susceptibility of bacterial isolates was carried out in the Department of Microbiology, Vijayanagar Institute of Medical Sciences, Bellary. 30 cases of urinary tract infection without any type of instrumentation were also included in the study.

Age and sex distribution

Out of 110 cases of urinary tract infection following instrumentation 71 (64.5%) were males and 39 (35.5%) were females. Age distribution shows 6 (5.4%) were under the age group of 11-20 years, 32 (29.1%) were under the age group of 21-30 years, 24 (21.9%) were under the age group of 31-40 years, 19 (17.3%) were under the age group of 41-50 years, 10 (9%) were under the age group of 51-60, 16 (14.6%) were under the age group of 61-70 and only 3 (2.7%) were above 71 years. (Table 1) Out of 71 (64.5%) urine samples of males following instrumentation, 35 (49.3%) cases yields positive growth and 36 (50.7%) cases shows no growth. Out of 35 culture positive cases, 7 (9.8%) belongs to 21-30 years age group, 6 (8.5%) belongs to 31-40 years, 6 (8.5%) belongs to 41-50 years, 5 (7%) cases were under 51-60 years age group, 10 (14%) cases belongs to 61-70 years, and only 1 (1.5%) case belongs to 71 and

Table 1. Age and sex distribution

Age	Male		Female		Total	
(Yrs)	No.	%	No.	%	No.	%
0-10	-	-	-	-	-	-
11-20	3	2.7	3	2.7	6	5.4
21-30	18	16.4	14	12.7	32	29.1
31-40	16	14.6	8	7.3	24	21.9
41-50	8	7.3	11	10	19	17.3
51-60	9	8.2	1	0.9	10	9
61-70	15	13.6	1	0.9	16	14.6
71 and above	2	1.8	1	0.9	3	2.7
TOTAL	71	64.5	39	35.5	110	100

Table 2. Culture positivity among males and females

Age	Male				Female			
(Yrs)	Positive growth		No growth		Positive growth		No growth	
	No.	%	No.	%	No.	%	No.	%
0-10	-	-	-	-	-	-	-	-
11-20	0	0	3	4.2	2	5.2	1	2.5
21-30	7	9.8	11	15.4	7	17.9	7	17.9
31-40	6	8.5	10	14	2	5.2	6	15.6
41-50	6	8.5	2	2.9	4	10.3	7	17.9
51-60	5	7	4	5.7	0	0	1	2.5
61-70	10	14	5	7	0	0	1	2.5
71 and above	1	1.5	1	1.5	1	2.5	0	0
TOTAL	35	49.3	36	50.7	16	41.1	23	58.9

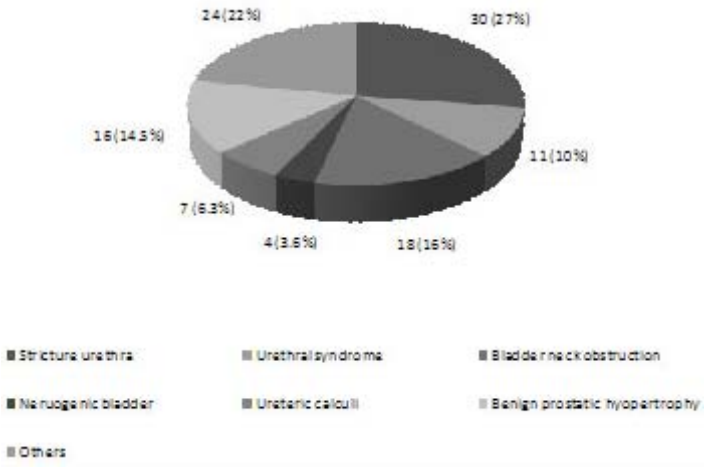

Fig. 1. Showing various types of clinical diagnosis

above age group. Out of 39 (35.5%) urine samples of females following instrumentation, 16 (41.1%) cases shows positive growth and 23 (58.9%) cases shows no growth on culture. Out of 16 (41.1%) positive cases 2 (5.2%) belongs to 11-20 years age group, 7 (17.9%) cases were under 21.-30 years, 2 (5.2%) cases were belongs to 31.-40 years, 4 (10.3%) cases belongs to 41-50 years and 1 (2.5%) case each belongs to 51-60 years, 61-70 and above 71 years age group respectively.

Clinical diagnosis

The therapeutic or diagnostic instrumentation of urinary tract was done on the basis of clinical diagnosis. The clinical diagnosis in the study group of 110 cases were stricture urethra in 30 (27.3%) cases, bladder neck obstruction in 18 (16.3%) cases, benign prostatic hypertrophy in 16 (14.5%) cases, urethral syndrome in 11 (10%) cases, ureteric calculi in 7 (6.3%) cases, neurogenic bladder in 4 (3.6%) cases and other cases like acute retention of urine, burns, post operative cases etc., were 24 (22%). Out of 30 cases of stricture urethra after instrumentation yields positive growth in 11 (36.6%) cases and 19 (6.4%) cases shows no growth. Among 11cases of urethra syndrome after cystoscopy 8 (44.5%) cases shows growth and 10 (55.5%) cases shows no growth. 4 cases of neurogenic bladder after cystoscopy show positive culture in 1 (25%) case and no growth in 3 (75%) cases. Out of 7 cases of ureteric calculi after instrumentation shows positive growth in 3 (42.9%) cases and no growth in 4 (57.1%) cases, 16 cases of benign prostatic hypertrophy after instrumentation yields growth in 10 (62.5%) cases and no growth in 6 (37.5%) cases. 24 other cases undergone instrumentation yields growth in 14 (58.3%) cases and no growth in 10 (41.7%) cases. (Table 3)

Table 3. Clinical diagnosis showing positivity by culture

S. No	Indications for instrumentation	No. tested	Positive growth		No growth	
			No.	%	No.	%
1	Stricture urethra	30	11	36.6	19	63.4
2	Urethral syndrome	11	4	36.3	7	63.7
3	Bladder neck obstruction	18	8	44.5	10	55.5
4	Neruogenic bladder	4	1	25	3	75
5	Ureteric caluli	7	3	42.9	4	57.1
6	Benign Prostatic Hypertrophy	16	10	62.5	6	37.5
7	Others	24	14	58.3	10	41.7
	TOTAL	110	51		59	

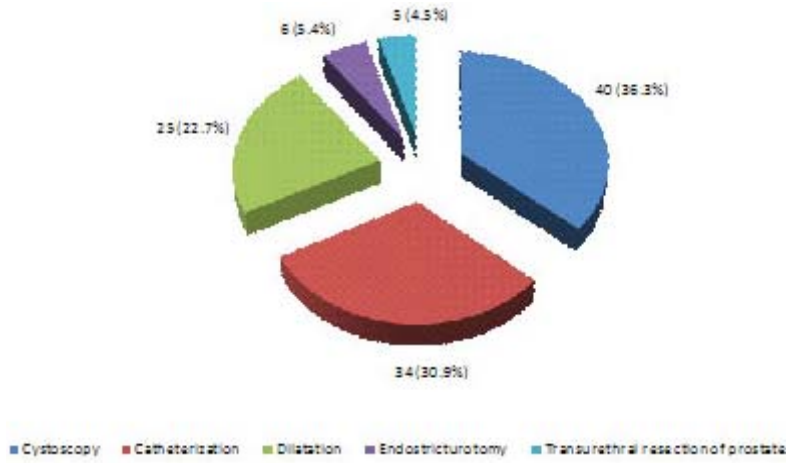

Fig. 2. Showing various procedures conducted on patients

Instrumentation procedure

The diagnostic or therapeutic instrumentation procedures that were commonly performed on the cases were urethral dilatation, urethrocystoscopy, endostricturotomy, transurethral resection of prostate and catheterization. Out of 110 cases, 40 (36.3%) cases underwent cystoscopy, 34 (30.9%) cases underwent catheterization, 25 (22.7%) cases underwent dilatation, 6 (5.4%) cases underwent endostricturotomy and 5 (4.5%) cases underwent transurethral resection of prostate. The culture results of urine samples collected after various instrumentation procedures conducted on patient shows as follows. Out of 110 patients 40 cases underwent cystoscopy shows positive growth in 16 (40%) cases and no growth in 24 (60%) cases. Out of 34 catheterized patients 20 (58.8%) yields positive growth and 14 (41.2%) shows no growth. Among 25 cases of dilatation 8 (32%) cases shows growth and 17 (68%) cases show no growth. Urine samples of 6 cases after transurethral resection of prostate, culture yields growth in 4 (66.7%) cases and 2 (33.3%) shows no growth. Out of 5 cases of endostricturotomy 3 (60%) cases show growth and no growth in 2 (40%) cases. (Table 4)

Table 4. Various procedures conducted on patients showing culture positivity

S. No	Procedure	No.	Positive growth		No growth	
			No.	%	No.	%
1	Cystoscopy	40	16	40	24	60
2	Catheterization	34	20	58.5	14	41.2
3	Dilatation	25	8	32	17	68
4	Transurethral resection of prostate	6	4	66.7	2	33.3
5	Endostricturotomy	5	3	60	2	40
	TOTAL	110	51			242.5

Bacterial isolates

Bacteriological study of urine obtained from the post instrumentation cases yielded growth in 51 (45%) cases. The gram-negative bacilli were recovered from 43 (83%) cases and gram positive cocci from 8 (16%) cases. Among the gram negative bacilli isolated *Escherichia coli* was the predominant isolate accounted for 18 (35%) cases, followed by *Klebsiella pneumonia* in 13 (25%) cases, Pseudomonas aeruginosa in 6 (12%) cases,

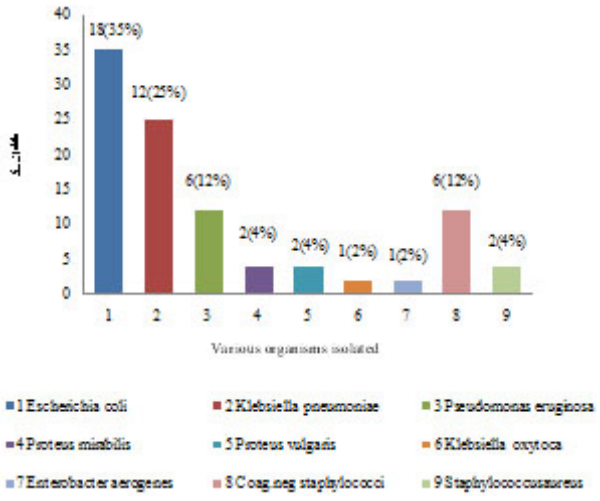

Fig. 3. Showing bacterial isolates from the clinical specimen

Proteus mirabilis in 2 (4%) cases, *Proteus vulgaris* in 2 (4%) cases, *Klebsiella oxytoca* in 1 (2%) case and *Enterobacter aerogenes* in 1 (2%) cases. Among gram positive cocci *Coagulase negative staphylococci* accounted for 6 (12%) cases, *Staphylococcus aureus* in 2 (4%) cases. The antibiotic testing was done for all the bacterial isolates. The antibiotics against which the bacterial isolates were tested include ampicillin, doxycycline, co-trimoxazal, nalidixic acid, nitrofurantoin, gentamicin amikacin, norfloxacin, ciprofloxacin and cefotoxime.

Antibiotic susceptibility pattern of bacterial isolates obtained from 110 cases of uninary tract infection following instrumentation reveals that all bacterial isolates resistant to ampicillin. Doxycycline was effective against only 3 (23%) isolates of *Klebsiella pneumonia*, 1 (50%) isolate of *Proteus vulgaris* and all others were resistant. The bacteria that showed sensitivity pattern against co-trimoxazole were *Escherichia coli* in 2 (11%) isolates and 1 (100%) isolate of *Klebsiella oxytoca.* Other bacterial isolates were resistant to co-trimoxaazole. Nalidixic acid was effective against 4 (30.7%) isolates of *Klebsiella pneumonia*, 1 (50%) isolate of *Proteus mirabilis*, 1 (100%) isolate of *Klebsiella oxytoca* and 1 (5.5%) isolate of *Eschirichia coli.* Nitrofuratoin was effective in 8 (44.4%) isolates of *Eschirichia coli*, 1 (7.6%) isolate of *Klebsiella pneumonia,* 2 (100%) isolates of *Proteus mirabilis*, 1 (50%) isolate of *Proteus vulgaris*, 1 (100%) isolate of *Klebsiella oxytoca* and 1 (100%) isolate of *Enterobacter aerogenes*. All the 13 (100%) isolates of *Klebsiella pneumonia* were sensitive to genetamicin, other isolate like 6 (33.3%) isolates of *Escherichia coli*, 1 (16.6%) isolate of *Pseudomonas aeruginosa*, 1(50%) isolate of *Proteus mirabilis*, 2 (100%) isolate of *Proteus vulgaris* 1 (100%) isolate of *Klebsiella oxytoca* were sensitive to gentamicin. Amikacin was sensitive against almost all bacterial isolates except for 1 (5.5%) isolate of *Escherichia coli.* Norfloxacin was also effective against 9 (50%) isolates of *Escherichia coli*, 10 (76.9%) isolates of *Klebsiella pneumoniae,* 1 (16.6%) isolate of *Pseudomonas aeruginosa.*

All the isolates of *Proteus mirabilis* and *Proteus vulgaris* and *Enterbacter aerogenes* were sensitive to norfloxacin. Ciprofloxacin was effective against 8 (44.4%) isolates of *Escherichia coli*, 11 (84.6%) isolates of *Klebsiella pneumoniae,* 1 (16.6%) isolate of *Pseudomasas aeruginosa* 2 (100%) isolates of *Proteus mirabilis*, 1 (100%) isolate of *Klebsiella oxytoca,* and 2 (100%) isolates of *Staphylococcus aureus.* 9 (50%) isolates of *Escherichia coli* were sensitive to cefotoxime followed by 2 (15.3%) isolates of *Klebsiella pneumonia,* 2 (33.3%) isolate of *Cagulase negative staphylococci* and 2 (100%) isolates of *Staphylococcus aureus.* Other bacteria were resistant to cefotoxime. (Table 5)

Table 5. Antibiogram of bacterial isolates from the clinical specimen

Bacteria	*Escherichia coli*		*Klebsiella pneumoniae*		*Pseudomonas aeruginosa*		*Proteus mirabilis*		*Proteus vulgaris*		*Klebsiella oxytoca*		*Enterobacter aerogenes*		*Coagulase negative* staphylococci		*Staphylococcus aureus*	
Antibiotics	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Ampicillin	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Doxycycline	-	-	3	23	-	-	-	-	1	50	-	-	-	-	-	-	-	-
Co-trimoxazole	2	11	-	-	-	-	-	-	-	-	1	100	-	-	-	-	-	-
Nalidixic acid	1	5.5	4	31	-	-	-	-	1	50	-	-	-	-	-	-	-	-
Nitrofurantoin	8	44.4	1	7.6	-	-	2	100	1	50	1	100	1	100	-	-	-	-
Gentamicin	6	33.3	13	100	1	17	1	50	2	100	1	100	-	-	-	-	1	50
Amikacin	17	94.4	13	100	6	100	2	100	2	100	1	100	1	100	6	100	2	100
Norfloxacin	9	50	10	77	1	17	2	100	2	100	-	-	1	100	-	-	-	-
Ciprofloxacin	8	44.4	11	85	1	17	2	100	2	100	-	-	1	100	-	-	2	100
Cefotoxime	9	50	2	15	-	-	-	-	-	-	1	100	-	-	2	33	2	100

Control group

Out of 30 cases of urinary tract infections without any instrumentation males accounted for 14 (47%) cases and females for 16 (53%) cases. The age distribution shows that 9 (30%) cases were between 11-20 years, 12 (40%) cases were between 21-30 years, and 5 (17%) cases were between 31-40 years, 3 (10%) cases were between 41-50 years and only 1 (3%) case was above 51-60 years of age. (Table 6)

Out of 14 (47%) urine samples from the men 7 (23.3%) shows positive growth and 7 (23.3%) cases shows no growth. Out of 7 (23.3%) culture positive cases 2 (6.6%) each belongs to 11-20 years and 21-30 years group respectively, 3 (10%) cases belongs to 31-40 years age group. Out of 16 (53%) urine samples from the women, 10 (30.3%) yields positive growth and 6 (20%) shows no growth. Among 10 (30.3%) culture positive cases 6 (20%) belongs to 11-20 years, 3 (10%) belongs to 21-30 and 1 (3.3%) case belongs to 31-40 years age group. (Table 7)

The clinical symptoms that were commonly encountered were fever, dysuria, urgency, frequency, burning micturition, suprapubic pain and loin pain etc., out of 30 cases of urinary tract infections without any instrumentation, fever was noted in 23 (77%) cases, burning micturition in 22 (73%) cased, dysuria in 8 (27%) cases, loin pain in 8 (27%) cases, suprapubic pain in 5 (17%) cases, frequency in 3 (10%) cases and urgency in 2 (7%) cases. Bacteriological study of urine obtained from the 30 cases yielded growth in 17 (57%) cases. All the 17 isolates were gram negative bacilli. The predominent organisim isolated was *Escherichia coli* in 10 (58%) cases, followed by *Klebsiella pneumonia* in 3 (18%) cases, *Pseudomonas aeruginosa* in 2 (12%) cases and *Proteus mirabilis* in 2 (12%) cases. (Fig.5) The antibiotic susceptibility testing was done for all the bacterial isolates. The antibiotics that were commonly tested were ampicillin, doxycycline, co-trimoxazole, nalidixic acid, nitrofurantoin, gentamicin, amikacin, norfloxacin, ciprofloxacin and cefotoxime. Ampilicillin was resistant in all cases, only 1 (33%) case of Klebsiella pneumonia was sensitive to doxycycline. Other bacteria were relatively resistant to doxycycline. Co-trimoxazole was effective against 3 (30%) cases of *Escherichia*

coli. All the other bacterial isolates were resistant. Nalidixic acid was effective against 2 (7%) cases of *Escherichia coli* and the bacterial isolates were resistant. 5 (50%) cases of *Escherichia coli* and 1 (50%) case of Proteus mirabilis were sensitive to nitrofurantoin and other bacteria were relatively resistant. Gentamicin was effective against 6 (60%) isolates of *Escherichia coli*, 3 (100%) isolates of *Klebsiella pneumonia* 1 (50%) isolate of *Pseudomonas aeruginosa* and 2 (100%) isolates of *Proteus mirabilis*. Amikacin was 100% effective against all the isolates. 9 (90%) isolates of *Escherichia coli* showed sensitivity pattern to norfloxacin followed by 3 (100%) isolates of

Table 6. Age and sex distribution of contrl group

Age	Male		Female		Total	
(Yrs)	No.	%	No.	%	No.	%
0-10	-	-	-	-	-	-
11-20	3	10	6	20	9	30
21-30	6	20	6	20	12	40
31-40	3	10	2	7	5	17
41-50	2	7	1	3	3	10
51-60	-	-	1	3	1	3
TOTAL	14	47	16	53	30	100

Table 7. Culture positivity among males and females

Age	Male				Female			
(Yrs)	Positive growth		No growth		Positive growth		No growth	
	No.	%	No.	%	No.	%	No.	%
0-10	-	-	-	-	-	-	-	-
11-20	2	6.6	1	3.3	6	20	0	0
21-30	2	6.6	4	13.4	3	10	3	10
31-40	3	10	0	0	1	3.3	1	3.3
41-50	0	0	2	6.6	0	0	1	3.3
51-60	-	-	-	-	0	0	1	3.3
TOTAL	7	23.2	7	23.3	10	33.3	6	19.9

Table 8. Antibiogram of bacterial isolates the control group

Bacteria	*Escherichia coli*		*Klebsiella pneumoniae*		*Pseudomonas aeruginosa*		*Proteus mirabilis*	
Antibiotics	No	%	No	%	No	%	No	%
Ampicillin	-	-	-	-	-	-	-	-
Doxycycline	-	-	1	33	-	-	-	-
Co-trimoxazole	3	30	-	-	-	-	-	-
Nalidixic acid	2	7	-	-	-	-	-	-
Nitrofurantoin	**5**	50	-	-	-	-	1	50
Gentamicin	6	60	3	100	1	50	2	100
Amikacin	10	100	3	100	2	100	2	100
Norfloxacin	9	90	3	100	1	50	2	100
Ciprofloxacin	9	90	3	100	2	100	2	100
Cefotoxime	5	50	-	-	-	-	-	-

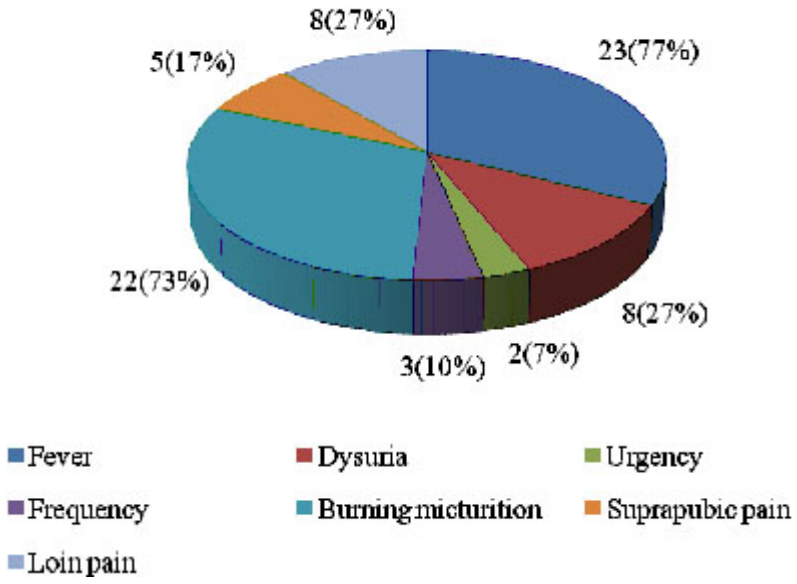

Fig. 4. Showing common clinical symptoms

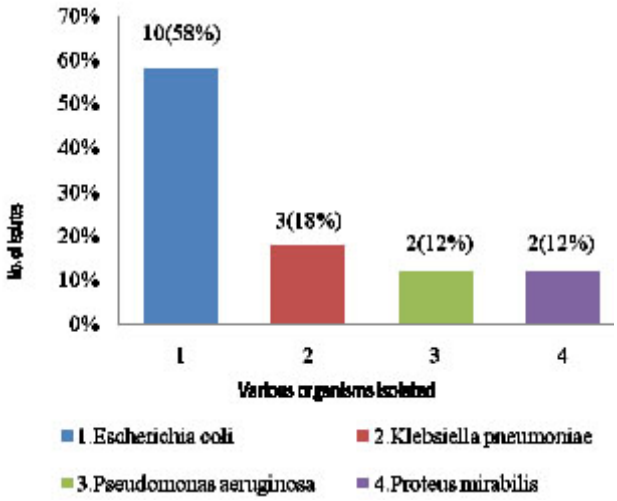

Fig. 5. Showing bacterial isolates in control group

Klebiella pneumonia, 1 (50%) isolate of *Pseudomonas aeruginosa*, 2 (100%) isolates of Proteus mirabilis. Ciprofloxacin was 100% effective against all the isolates except 1 (10% isolate of *Escherichia coli*. Only 5 (50%) isolates of *Escherichia coli* were sensitive to cefotaxime. Other bacterial isolates showed increased resistance to cefotoxime. (Table 8)

DISCUSSION

A total of 110 cases of urinary tract infection following instrumentation were included in the study and data was collected regarding age, sex, clinical diagnosis and type of instrumentation. Microbiological study of urine samples and antibiotic susceptibility of bacterial isolates was

carried out. Infections of the urinary tract frequently occur following instrumentation in all age groups and in both sexes. In the present study, the patients belongs to 18-83 years, the highest number was found in the age group 21-40 years about 51% followed by 51-70 years about 23.6% and only 3 (2.7%) belongs to 71 years and above group. As regards incidence of infection in respect of sex, Gonic *et al.,* reported a higher incidence of infection in males than females[87]. In the present study the incidence of infection has been greater in males about 49.3%. The highest incidence of infection 14% was seen in the age group between 61-70 years in males. The highest incidence in males of this group is possible associated with benign prostatic hypertrophy. The highest incidence of infection 17.9% was seen in the age group between 21-30 years in females.

The therapeutic or diagnostic instrumentation of the urinary tract was done on the basis of clinical diagnosis. The various indications of instrumentation of the present study were 27.3% of stricture urethra, 22% of other condition like acute retention of urine in post operative cases, burns cases etc., where catheterization was needed, 16.3% of bladder neck obstruction, 14.5% of benign prostatic hypertrophy and 10% of urethral syndrome. The highest incidence of infection in respect of instrumentation procedures, Gillespie *et al.,* reported a higher incidence of infections about 83% following transurethral resection of prostate and 73% after catheterization[76] and Mohnty & Jolly documented 48% after catheterization and 26% following transurethral resection of prostate[39]. In the present study also a higher infection rate 66.7% following transurethral resection of prostate was observed. The infection rate of 60% following endostricturotomy and 58.8% following catheterization was also observed in the present study.

This high incidence of infection rate in above said procedures shows the risk of manipulation of the urinary track. The bacterial isolation rate in urinary tract infections following various instrumentation procedures by different authors like Gillespie *et al.,* reports 83% following transurethral resection of prostate and 73% following catheterization,[76] Mohanty & Jolly documented 48% after catheterization and 26% after transurethral resection of prostate.[39] In the present study 66.7% of bacterial isolation rate following transurethral resection of prostate, 60% following endostricturotomy and 58.8% following catheterization accounts for bacterial isolation rate in various instrumentation procedures.

The present study shows isolation of variety of organisms. Studies conducted by Goyal *et al.,* reveals that the bacteria isolated are predominantly gram negative bacilli with 53.03% of culture positivity.[38] Mohanty & Jolly isolated 48% of bacteria in post instrumental patients[39] In the present study 46.3% of cases yielded growth and this study correlates well with the study of the above authors. Among gram negative bacilli *Escherichia coli* was the predominent organism isolated in various studies[35,37,41]. *Klebsiella spp* were also isolated as the major organisms in various studies [25,38]. *Proteus spp* were the major organisms isolated by Mobely[40]. Strand *et al.,* in their study isolated Pseudomonas aeruginosa as the major organism responsible for urinary tract infection following instrumentation.[29] Among gram positive organisms, the isolation rate of *Coagulase negative staphylococci* varied between 3% to 25% evidenced by studies of Liedburg & Lundeburg[37] Tenney & Warren[25] and Garibaldi *et al.,*[41] *Enterococci* was isolated as high as 23% by Garibaldi *et al.,*[41] An isolation rate of 3% of *Staphylococcus aureus* was documented by Tenney and Warren[25] and the isolation rate Group D *Streptococci* as low as 1% by Garibaldi *et al.,*[41]. In most studies of the bacteriology of urinary tract infection following instrumentation *Escherichia coli* has been the most commonly isolated pathogen. The actual frequencies has varied between 14% to 70%. Goyal *et al.,* isolated *Escherichia coli* from 14% of cases[38]. The isolation rate was 30% by Mohanty and Jolly[43]. 50% by Tenney and Warren[25], 52% by Taylor[36], 55% by Liedburg and Lundeberg[37], 58% by Garibaldi *et al.,*[41] and 70% by Cools *et al.,*[35]. In the present study, the isolation rate of *Escherichia coli* accounted in 35% of cases and this correlates with the study of Mohanty & Jolly[43]. *Klebsiella spp* were the next predominant organisms responsible for the causation of urinary tract infection following instrumentation as evidenced by its isolation rates in different studies varying from 9% to 67%. Cools *et al.,*[35], Taylor *et al.,*[36] and

Garibaldi *et al.*,[41] isolated *Klebsiella spp* in 9 to 10% of the cases in their study. The isolation rate of *Klebsiella sps* in other studies were 14% by Mohanty & Jolly[39], 17% by Mobley *et al.*,[40] 42% by Goyal *et al.*,[38] and as high as 67% by Tenney & Wareen[25]. In our study *Klebsiella pneumoniae* was the second predominant isolate accounted in 25% cases along with 2% of *Klebsiella oxytoca.* In our present study, the isolation rate of *Pseudomonas aeruginosa* accounted for 12%.

The isolation rates of *Pseudomonas aeruginosa* varied between 2% to 35.5% in various studies. Mohanty & Jolly[39] and Liedberg & Lundeburg[37] document an isolation rate as low as 2%. The isolation rates in other studies were 3% by Cools *et al.*,35, 5% by Taylor *et al.*,[36] 8.25% by Goyal *et al.*,[38] 11% by Garibaldi *et al.*,[41], 16% by Tenney JH & Warren JW[25] and 35.5% was reported by Strand *et al.*, in their study[29].

Our study correlates with Garibaldi *et al.*,[41] *Proteus sps* were the major pathogens responsible for urinary tract infection following instrumentation in as high as 58% of cases as documented by Mobley *et al.*,[40] and in other studies by Goyal *et al.*,[38] 21% and 26% by Warren[25]. In the present study a slightly low frequency of 4% of *Proteus mirabilis* and 4% of *Proteus Vulgaris* were found. Garibaldi *et al.*, reported a low frequency of isolation of (1%) *Enterobacter aerogenes*[41] in our present study also only 2% of cases yielded *Enterobacter aerogenes*. Studies conducted by different authors isolated significant number of gram positive cocci from the patients with urinary tract infection following instrumentation. The isolation rates of *Coagulase negative staphylococci* was varied between 3% to 25% as evidenced by studies of Liedbug & Lundeberg[37] Tenney & Warren[25] and Garibaldi *et al.*,[41]

In our study *Coagulase negative staphylococci* accounted for 12% of cases. An isolation rate of 3% of *Staphylococcus aureus* was documented by Tenney & Warren[25]. In our study also 4% of cases yielded *Staphylococcus aureus*. Antibiotic sensitivity of the isolated obtained from the 110 cases of urinary tract infection following instrumentation reveals, ampicillin was resistant to all the isolates where as amikacin was sensitive to almost all the organisms isolated. Stacy documents that amikacin was effective in treating urinary tract infection following instrumentation[77]. Doxycycline, co-trimoxazole and nalidixic acid also showed resistant to most of the isolates. Goyal *et al.*, reported a significant resistant pattern of ampicillin and co-trimoxazole. Nitrofurantoin was sensitive to all the isolates of *Proteus mirabilis* (100%), *Klebsiella oxytoca* (100%), *Enterobacter aerogenes* (100%), *Proteus vulgaris* (50%) and *Escherichia coli* (44.4%) Gentamicin was sensitive to all the isolates of *Klebsiella oxytoca,* (100%) *Proteus vulgaris (*100%), *Klebsiella pneumonia* (100%) *Proteus mirabilis* (50%), *Staphylococcus aureus* (50%) *Escherichia coli* (33.3%) and as low as 16.6% of *Pseudomonas aeruginosa.* Norfloxacin was sensitive to 100% isolates of *Proteus mirabilis, Proteus vulgaris, Enterobacter aerogenes*. 76.9% isolates of *Klebsiella pneumonia* 50% of *Escherichia coli* and as low as 16.6% *Pseudomonas aeruginosa* were sensitive to norfloxacin. Ciprofloxacin was sensitive to 100% isolates of *Proteus mirabilis, Proteus vulgaris, Enterobacter aerogenes* and *Staphylococcus aureus.* 84.6% of *Klebsiella pneumonia* and 44.4% of *Escherichia coli* were sensitive to ciprofloxacin. Cefotoxime shows 100% sensitivity to *Klebsiella oxytoca* and *Staphylococcus aureus*. 50% of Escherichia coli, 33.3% of Coagulase *negative staphylococci* and only 15.3% of *Klebsiella pneumonia* were sensitive to cefotoxime.

Fungi are less commonly implicated in the causation of urinary tract infection following instrumentation the prevalence of yeasts in urinary tract infection following instrumentation was between 1 to 19 %. Wareen & Tenney *et al.*,[6] reported a prevalence rate of 1% and Garibaldi *et al.*,[41] reported 19% of yeasts. However, in our study no fungus was isolated from the 110 cases of urinary tract infection following instrumentation.

Control group

A total of 30 cases of urinary tract infection without any instrumentation were included in the study and data was collected regarding age, sex, and clinical features. Microbiological study of urine samples and antibiotic susceptibility of bacterial isolates was carried out and the results are discussed below: In most studies of urinary tract infection, the age range of the patients has been heterogenic. The present study includes 16 female and 14 male patients. The highest number of patients belongs to 21-30 years group about 40% followed by 30% in the 11-20

years group and lowest number of patients about 3% belongs to 51-60 years group. The incidence of infection has been greater in females, Bhaskaran and Murthy[81] reported a higher incidence of infection rate in females about 62.9% followed by Panda *et al.*,[79] about 57% and Sengupta & Baruva[80] about 51.5%. Panda *et al.*, reported a highest number was found in the age group of 21-30 followed by 31-40 years in females and 31-40 in males. In the present study the incidence of infection has been greater in females where the highest number 20% was found in the age group 11-20, 10% in 21-30 years group and 3.3% in 31-40 years group.

The maximum incidence of infection was found between 11-30 years i.e. the child bearing age which predisposes to infection. In the male the highest incidence was found in the age group 31-40 years about 10%. This might be due to urinary obstruction such as stones and stricture urethra. The clinical symptoms that were commonly encountered are fever, dysuria, urgency, frequency, burning micturition, suprapubic pain and loin pain. Fever (77%) and burning micturition (73%) were the predominant features. Frequency and urgency were the least features accounting for only 10% and 7% respectively. Vaishanve & Jhala reported that fever and burning micturition were the predominant features in the urinary tract infection[84]. The bacteria that are implicated in the causation of urinary tract infection are varied and include a variety of organisms.

Commonest organisms isolated from urinary tract infection were gram negative bacilli like *Escherichia coli, Klebsiella pneumonia Klebsiella oxytoca, Proteus mirabilis, Proteus vulgaris* and *Pseudomonas aeruginosa* and gram positive cocci like *Coagulase negative staphylococci, Enterococci, Staphylococcus aureus* and *Group D streptococci.* Among the gram negative bacilli *Escherichia coli* was the predominant organisms isolated in various studies. Balbir *et al.*,[85] isolated 54% Singh *et al.*, isolated 30% of *Escherichia coli*[78]. In our present study 58% of isolates were *Escherichia coli*. *Klebsiella pneumonia* was the next predominant organism responsible for the urinary tract infection as evidenced by its isolation rates in different studies varying from 15% to 24%. Laxmi & Bhatia[86] isolated 15.5% and Balbir *et al.*, documented 16% of *Klebsiella pneumoniae*[85]. Singh *et al.*,78 isolated 22% and Ramakanta *et al.*, isolated 24% of *Klebsiella pneumoniae*[82]. In the present study the isolation rate of 18% of *Klebsiella pneumoniae*., correlates with the above authors. The isolation rate of *Pseudomonas aeruginosa* in urinary tract infection ranges from 9% to 22%. Vaishnav & Jhala[84] isolated as low as 9%, Balbir *et al.*,[85] Ramakanta *et al.*,[82] isolated 12%, Laxmi & Bhatia[86] 13.3% and Singh *et al.*,[78] reported 23% of *Pseudomonas aeruginosa* in their studies.

In the present sturdy the isolation rate of *Pseudomonas aeruginosa* was 12% and this correlates with the study of Ramakanta *et al*. *Proteus sps.* were also responsible for urinary tract infection, the isolation rate ranging from 6.5 to 15%. Laxmi & Bhatia isolated as low as 6.5% of *Proteus sps*[86]. Singh *et al.*,[78] 7.2% Vaishnava & Jhala[84] 11% and Balbir *et al.*, isolated 15% of *Proteus sps.* in their studies[85]. The isolation rate of 12% of *Proteus mirabilis* in our study correlates with the above authors. The antibiotic susceptibility testing was done for all the bacterial isolates. In our study ampicilin was resistant to all the isolates. Doxycycline, co-trimoxazole were also resistant to all the isolates except 1 (33%) isolate are *Klebsiella pneumoniae* and 3 (30% isolates of *Escherichia coli* respectively. Nalidixic acid also resistant to all the isolates except 2 isolates (7%) of *Escherichia coli.* Ramakanta *et al.*, showed 87.1% of *Escherichia coli*, 82.8% of *Klebsiella pneumoniae* and 94.9% of *Proteus mirabilis* were sensitive to nitrofuration[82].

Panda *et al.*, documented 100% of *Pseudomonas aeruginosa* are resistant to nitrofurantoin[79]. In contrast 5 (50%) isolates of *Escherichia coli* and 1 (50%) isolates of *Proteus mirabilis* were sensitive to nitrofurantoin and other bacteria were relatively resistant. Gentamicin was effective against 6 (60%) isolates of *Escherichia coli*, 3 (100%) isolates of *Klebsiella pneumoniae*, 1 (50%) of *Pseudomonas aeruginosa* and 2 (100%) of *Proteus mirabilis* in our study. Amikacin was 100% effective against all the isolates. 9 (90%) isolates of *Pseudomonas aeruginosa* and 2 (100%) of *Proteus mirabilis* were sensitive to norfloxacin. Ciprofloxacin was 100% effective against all the isolates except 1 (10% isolate of *Escherichia coli.* Only 5 (50%) isolates of *Escherichia coli* were sensitive to cefotoxime and all the isolates were

resistant. In our study no fungus was isolated from the 30 cases of urinary tract infection.

CONCLUSION

The findings of the study demonstrated that urinary tract infection following instrumentation was more in men than women. The highest incidence of infection rate following instrumentation was seen in transurethral resection of prostate and endostricturotomy & catheterization also carries equal risk of infection. No significant difference between isolates from urinary tract infection with or without instrumentation. However routine culture and sensitivity of urine sample following instrumentation is advisable for appropriate treatment of infections. Asepsis and proper disinfection of instruments is mandatory to avoid urinary tract infection following instrumentation.

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