ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

Original Research Article

Prevalence of pathogens and their antimicrobial susceptibility in catheter associated urinary tract infection

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How to cite this article: Mahim Koshariya, M.C. Songra, Rohit Namdeo, Arpan Chaudhary, Sumit Agarwal, A. Rai. Prevalence of pathogens and their antimicrobial susceptibility in catheter associated urinary tract infection. IAIM, 2015; 2(4): 96-113.

Available online at www.iaimjournal.com

Received on: 29-03-2015 **Accepted on:** 08-04-2015

Abstract

Hospital-acquired urinary tract infection (UTI) is the most common infection acquired in hospitals. Up to 25% of hospitalised patients undergo urinary catheterisation, a similar proportion of patients cared for in residential homes will have long term indwelling catheters. Although often necessary intervention, indwelling urinary catheters are a leading cause of nosocomial infections and have been associated with both morbidity and mortality. The urinary tract accounts for more than 40% of total number of nosocomial infections. Most nosocomial infections associated with urinary tract follow instrumentations, usually with the catheter. Results of several studies demonstrated that this antibiotic drug prophylaxis has increased the rate of isolation of resistant organisms. To ensure appropriate therapy, current knowledge of organisms that cause UTI and the antibiotic susceptibility is mandatory. The aim of present study was to assess the bacterial profile for catheter associated UTI and the antimicrobial sensitive to most commonly used antibiotics, used in the therapeutic or prophylactic settings before the results of the urine culture are available. In our study, the incidence of infection in catheterized patients was found to be 27% which was low but comparable to studies done in India and Western studies. E. coli was the most common cause of catheter associated infection and highest sensitivity was found to Amikacin.

Key words

Urinary tract infection, CAUTI, Indwelling urinary catheters, E. coli, Amikacin.

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Introduction

Hospital-acquired urinary tract infection (UTI) is the most common infection acquired in hospitals. Up to 25% of hospitalised patients undergo urinary catheterisation, a similar proportion of patients cared for in residential homes will have long term indwelling catheters. Although often necessary intervention, indwelling urinary catheters are a leading cause of nosocomial infections and have been associated with both morbidity and mortality.

The urinary tract accounts for more than 40% of total number of nosocomial infections. Most nosocomial infections associated with urinary tract follow instrumentations, usually with the catheter. The duration of catheterisation is directly related to the development of bacteriuria. The overall incidence of nosocomial urinary tract infection among these patients is 35 to 10% (average 5%) per day. Bacteremias are attributed to the urinary tract.

Patients who develop a nosocomial infection have their hospital stay extended by approximately 3 days and nearly 3 times more likely to die during hospitalisation than patients without such infections. The case fatality rate from UTI related nosocomial bacteraemia is approximately 13% severely ill patients at highest risk.

Empirical antibiotic treatment is usually started when a symptomatic catheter associated UTI is suspected and the result of urine culture is not yet available. Once the catheter has been removed some patients with asymptomatic catheter associated UTI continue to have bacteriuria or become symptomatic .To prevent or reduce this type of catheter related morbidity ,many clinicians have a policy of administering a short course of prophylactic antibiotics on catheter withdrawal for all or selected groups of patients. Results of several studies demonstrated that this antibiotic drug prophylaxis has increased the rate of isolation of resistant organisms. To ensure appropriate therapy, current knowledge of organisms that cause UTI and the antibiotic susceptibility is mandatory.

The aim of present study was to assess the bacterial profile for catheter associated UTI and the antimicrobial sensitive to most commonly used antibiotics ,used in the therapeutic or prophylactic settings before the results of the urine culture are available.

Aim and objectives

- To find out infection rate (UTI) in catheterised patients.
- To find out prevalence of pathogens in patients with catheter associated UTI.
- To find out the antibiotic sensitivity pattern of organisms isolated.
- To find out antimicrobial agents having sensitivity to majority of pathogens and decide empirical therapy for catheter associated UTI accordingly.

Material and methods

The study was carried out in 154 patients admitted to surgical ward of Hamidia hospital, Bhopal from January, 2004 to December, 2004. Detailed clinical examination of patients was carried out to assess the nature and degree of disease condition and to elicit any history of previous instrumentation or UTI.

Catheterization and specimen collection

All the catheterization was done under strict aseptic conditions, because of inherent risk of introducing an infection into the urinary tract. Catheter was usually introduced by no touch technique. In males the penis was cleaned by betadine solutions and draped the fore skin of penis should always be retracted and

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

accumulated smegma duly cleaned. 2% xylocaine jelly was introduced into urethra by applying nozzle into the external urethral meatus. The meatus was closed by pinching the glans. It allowed the anaesthetic to act for a minute or two and then the catheter was introduced into urethra by right hand. The left hand holds shaft of penis erect. In the absence of stricture a catheter can usually be passed in very easily. Once the tip of catheter reached the bladder, urine started flowing out. The catheter was further pushed and bulb was inflated.

In females the patients laid in supine position, the knees were bent then separated with feet together. The genitalia was cleaned by betadine solution and draped. Two folds of labia were released with one hand while meatus was cleaned and only released after catheter was inserted. 2% xylocaine jelly was pushed into urethra. After waiting for one or two minutes, the catheter was lubricated and introduced into urethra by right hand, while the left hand retracts the fold of labia.

The specimen of urine that flows out at the time of catheterisation was collected in sterile test tube. Collected spacemen was sent to the microbiological laboratory without delay, in routine hours. In emergency hours, the specimen stored in refrigeration at 40 ˚C and sent to laboratory next day.

If this first sample comes out to be sterile, then patient was included in our study group and another catheter urinary specimen was collected using aseptic precautions. Catheter was clamped for 30 minutes after which the clamp was released gradually and the specimen of urine that flows out was collected in a sterile test tube and sent to laboratory immediately.

All the catheter specimens of urine were processed at the laboratory of Department of Microbiology, Gandhi Medical College, Bhopal Semi quantitative urine culture were assessed using standard loop method. An inoculating loop of standard dimensions was used to take up small, approximately fixed and known volume of mixed uncentrifuged urine and was spread over a plate of MacConkeys media and Cystine lactose electrolyte deficient medium and incubated overnight at 37 ˚C.

The following day, different colonies were studied from growth media by their shape, size, color (due to pigment production) consistency. All these media with colonies of growths were subculture according to necessity for isolation of different organisms. The suspected organisms were examined in a smear of colony on the basis of their morphology after gram staining of the gram positive cocci, staphylococci and streptococci were differentiated from their arrangement under microscope.

The gram negative bacilli were identified by their colony character on MacConkeys medium, gram staining, motility and various biochemical reactions like fermentation glucose, lactulose, sucrose and mannitol, indole production H_2S production and hydrolyse of urea as per **Table – 1**.

Antibiotics sensitivity tests

Antibiotic sensitivity tests were carried out on the isolated organisms using the technique of single disc antibiotics sensitivity by Kirby, et al. [1, 2, 3] and the criterion and interpretation of results were according to Pal and Ghosh Ray method [4].

Results

Age incidence in present study was as per **Table – 2** and **Graph – 1**. Sex incidence was as per **Graph – 2**. Overall incidence of infection in urinary tract in catheterized patients was as per

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Table – 3 and **Graph - 3**. Incidence of UTI associated with urinary catheters in the study group was 27%. The frequency of bacterial pathogen in the catheterized urine specimens was as per **Table – 4** and **Graph - 4**. In the study group, E. coli was the most common urinary pathogen isolated, followed by Pseudomonas and coagulase positive staphylococci. Antibiotic sensitivity pattern of E. coli was as per **Table – 5** and **Graph – 5**. In our group, E. coli was found to have highest sensitivity to Amikacin and Nitrofurantoin. Antibiotic sensitivity pattern of Staphylococcus was as per **Table – 6** and **Graph – 6**. In our group, Staphylococcus was found to have highest sensitivity to Amikacin and Nitrofurantoin. Sensitivity pattern of Proteus was as per **Table – 7** and **Graph – 7**. In our study, Proteus was highly sensitive to Amikacin and Nitrofurantoin. Sensitivity pattern of Pseudomonas was as per **Table – 8** and **Graph – 8**. In our study, Pseudomonas was found to have highest sensitivity to Amikacin and Cefoperazone with Sulbactam. Sensitivity pattern of Klebsiella was as per **Table – 9** and **Graph – 9**. In our study, Klebsiella was found to have highest sensitivity to Nitrofurantoin. Pattern of total CAUTI's sensitivity to antibiotics was as per **Table – 10** and **Graph - 10**. In overall, bacterial sensitivity was highest to Amikacin, followed by Nitrofurantoin, Ceftazidime and Ofloxacin.

Discussion

The incidence of urinary tract infection in catheter specimens of urine (CSUs) in our study was 27.0%. Wazait HD, et al. [5] in his study over a period of 5 years (1996-2001) in a UK institution found an overall incidence of 38.75% in 8341 CSUs. In a study done at Department of Microbiology, GMC Hospital, Chandigarh, by Gupta V, et al. [6] over 602 CSUs showed incidence of 36.3%. These studies were carried out in a very large scale with proper laboratory and statistical back up and strict surveillance practices. These studies were carried out without taking duration of catheterization in consideration whereas; in our study CSUs were collected 48 hours after catheterization. The overall incidence of UTI among patients was increase by 3% to 10% (average 5% per day). Thus our data was in accordance with above studies. The frequency of bacterial pathogens in CAUTI's in various studies was as per **Table - 11**.

The frequency of pathogens in our study was comparable to that of Neal R. Chamber Lain [7]. Wazait HD, et al. [5] concluded that frequency of E. coli has decreased with time, while the incidence of polymicrobial infection and prevalence of gram positive cocci have increased.

In a study of urinary isolates from Delhi, E. coli was found to be the commonest organism followed by pseudomonas, S aureus, Klebsiella and Proteus. A study done in children showed that nosocomial UTI is more due to organisms like pseudomonas, acinetobacter and gram positive cocci while E. coli infection showed a decrease in incidence. Comparison of antibiotic sensitivity pattern of E. coli was as per **Table – 12**.

In a study by Daza R., et al. [8] Spain the susceptibility studies showed 37% E. coli strains resistant to Amoxycillin + Clavulanate 33% to Cotrimoxazole and 22% to Ciprofloxacin. Seven strains of E. coli produced ESBL. Thirteen per cent strains were resistant of Cefuroxime but only 1% to Fosfomycin N. In the study done by Mazzaull T., et al., Canada Ampicillin has the lowest activity against catheter-acquired E. coli isolates, with resistance rates ranging from 23% to 41% Trimethoprim-sulphamethoxazole (TMP-SMX) resistance rates range from 8.4% to 19.2%, while the resistance to the Fluoroquinolone

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

ciprofloxacin has remained at 0% to 1.8% since its introduction over 10 years ago.

Goldstein FW, et al. [9], France reported the antibiotic susceptibility rates for Escherichia coli were amoxicillin (58.7%), amoxicillin clavulanic acid (6.3%), ticarcillin (61.4%), cephalothin (66.8%), cefuroxime (77.6%), cefixime (83.6%), cefotaxime (99.8%), ceftazidime (99%), nalidixic acid (91.9%), norfloxacin (96.6%), ofloxacin (96.3%), ciprofloxacin (98.3%), cotrimoxazole (78.2%), fosfomycin (99.1%) and gentamicin.

The ECO.SENS project of Sweden [10] reported that Pseudomonas were more resistant to the broad spectrum beta-lactams (Ampicillin 45.9%, co-amoxiclav 21.3% and cefadroxil 24.6%), nitrofurantoin (40.2%) and fosfomycin (15.6%). Comparison of antibiotic sensitivity pattern of pseudomonas was as per **Table – 13**. Comparison of antibiotic sensitivity pattern of Klebsiella was as per **Table – 14**. Comparison of antibiotic sensitivity pattern of Proteus was as per **Table – 15**. Comparison of antibiotic sensitivity pattern of Staphylococcus was as per **Table - 16**. Comparison of pattern of total CAUTI's sensitivity of antibiotics was as per **Table – 17**.

In our study group, antimicrobial resistance to commonly used antibiotics like ampicillin, trimethoprim and gentamicin was high. Amikacin was found to have highest sensitivity (66.6%) followed by Nitrofurantoin (40.5%), Ceftazidime (33.3%), Ofloxacin (26.2%), Ciprofloxacin (23.8%) and Cefoperazone + Sulbactam (26.2%).

Wazait HD, et al. [5] concluded that there has been a change in the antimicrobial resistance, profile of various organisms. E. coli resistance to co-amoxiclav and ciprofloxacin has increased, and enterococcal resistance to ciprofloxacin has doubled. The resistance of total CAUTIs to ciprofloxacin and cephalexin has increased, but to co-amoxiclav and Nitrofurantoin remained unchanged over time. As a result of all these changes, CAUTIs in 2001 were more frequently sensitivity to coamoxiclav, with a sensitivity rate of 77.5% followed by ciprofloxacin (72.8%) and Nitrofurantoin (71.2%).

Gupta V, et al. [6] concluded that E. coli was 70-80% resistant to cotrimaxozole and aminopenicillin. However first generation cephalosporins, Nintrofurantoin and Norfloxacin were effective but in cases where UTI was associated with agents other than E.coli, amikacin and third generation cephalosporins were found to be effective.

Acharya VN, et al. concluded in his longitudinal study that there has been a gradual and definite increase of microbial resistance to many routinely used which less than 25% isolates are sensitive The superpower antibiotics like sisomicin, netilmicin, cefotaxime introduced into the Indian market after 1985 too have been affected by this problem of resistance The third generation cephalosporins (ceftazidime) and Aminoglycosides (Amikacin) are the only antibacterials with low resistance (5.2% to 18%) noted up to 1986 This en masse resistance seems to be largely plasmid mediated by Lactamase producing bacteria [11, 12, 13, 14].

Conclusion

Catheter associated UTI is the most prevalent form of nosocomial infection and is the second most common cause of nosocomial bacteraemia following intravascular catheters. Prophylactic antibiotic therapy is usually started when symptomatic UTI is suspected in catheterized patients, while the results of urine culture are still awaited. Studies have shown that this prophylactic antibiotic therapy has increased the rate of isolation of resistant organisms.

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In our study the incidence of infection in catheterized patients was found to be 27% which was low but comparable to studies done in India and Western studies. The prevalence of E. coli was 53.3%, which was high comparatively to other studies. The prevalence of pseudomonas (13.3%), staphylococci (13.3%), proteus (8.8%), klebsiella(6.7%) was in accordance with other studies. The prevalence of enterococci (2.2%) and candida (2.2%) was comparatively low.

In our study highest sensitivity was found to amikacin (66.6%) followed by nitrofurantoin (40.5%), ceftazidime(33.3%) and ofloxacin (26.2%). Resistance to commonly used antibiotic like ampicillin, gentamicin, ciprofloxacin, trimethoprim was high. Currently the most appropriate antibiotic for empirical management of CAUTI is amikacin, followed by nitrofurantoin ofloxacin.

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Source of support: Nil Conflict of interest: None declared.

Table – 1: Biochemical test to differentiate various gram negative bacilli [1].

organism	Motility	Latulose	Glucose	H_2S	Sucrose	Manitol	Urea	Indole	Colony on macconkeys mediun
E. coli	+	AG	AG	-	AG/-VE	AG	+	+	Pink, Discrete
Klebsiella	-	AG	AG	-	AG	AG	+/-	-	Pink mucoid
Pseudomonas aeroginosa	+	_	A	-	-	-	+/-	-	Transparent, colorless colony
Proteus	+	-	A or AG	+	A orAG	A or AG or –ve	++		Do
Alkalogens and fecalis	+	-	-	-	-	-	-	-	Do

A= Acid only, AG = acid gas, urea += Urea hydrolyses, Indole + = Indole is produced

Table – 2: Age incidence.

Sr. No.	Age group (in years)	No. of patients	Percentage of total study group (%)
1.	10-19	6	3.9
2.	20-29	32	20.6
3.	30-39	23	14.8
4.	40-49	26	16.4
5.	50-59	26	17.4
6.	60-69	26	17.4
7.	70-79	10	6.45
8.	$\geq$ 80	6	3.8

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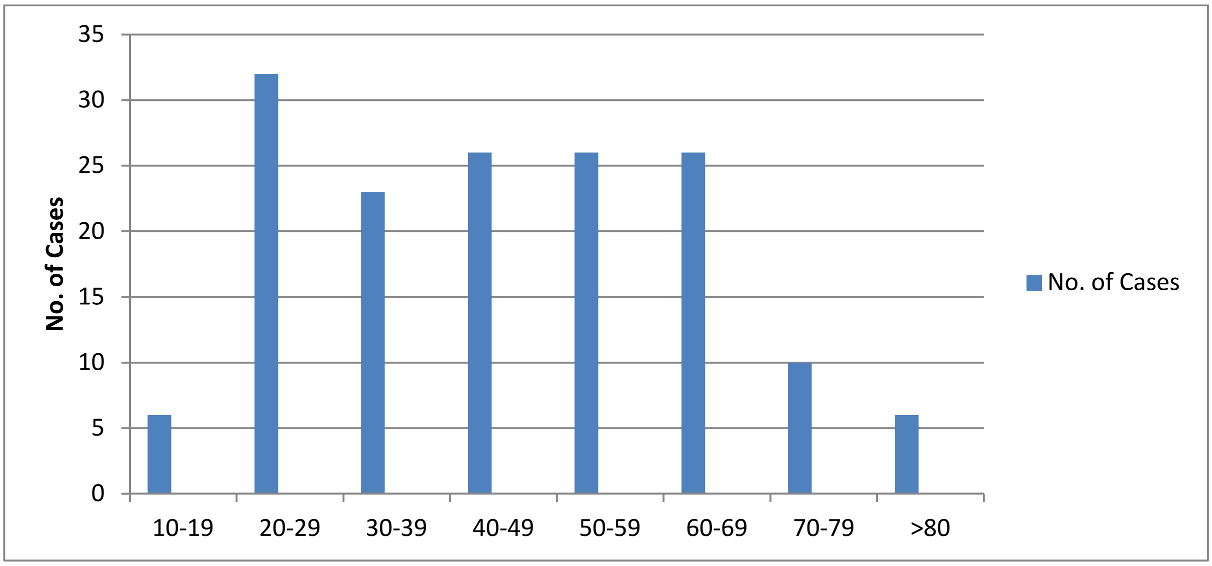
Graph – 1: Age incidence.



Graph – 2: Sex incidence.

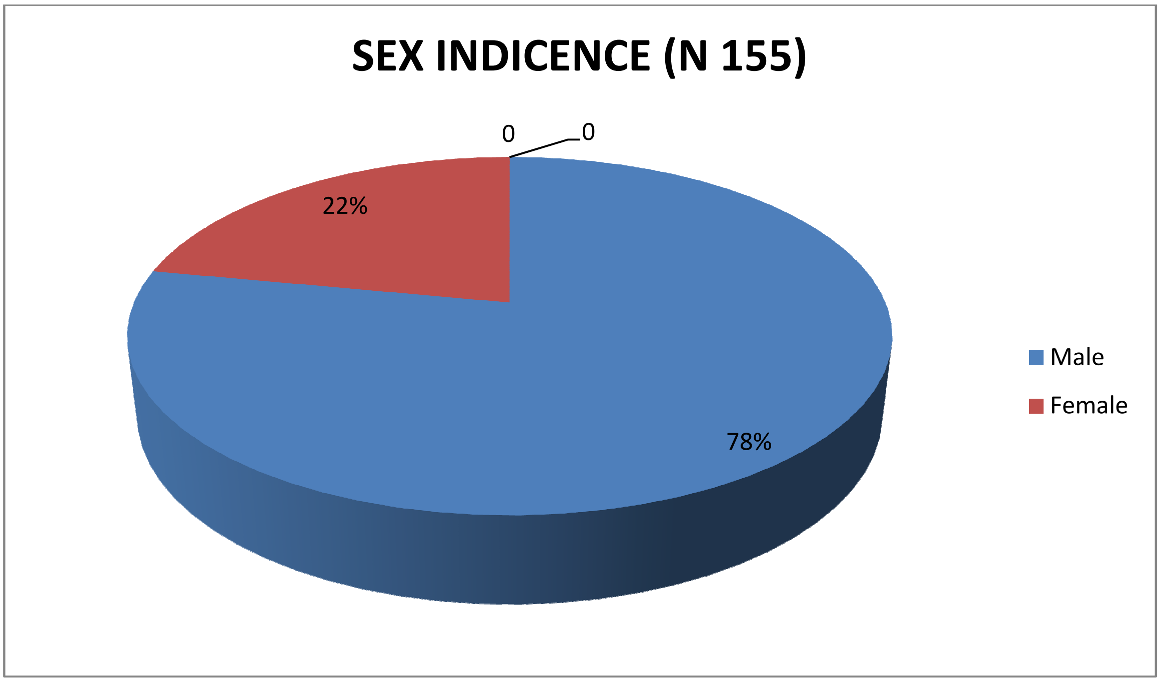


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Table – 3: Overall incidence of infection in urinary tract in catheterized patients.

Total no. of patients in study group	155
Total no. of patients in study group with evidence of infection (positive urine culture report)	42
Incidence of UTI in study group	27%

Graph – 3: Overall incidence of infection in urinary tract in catheterized patients.

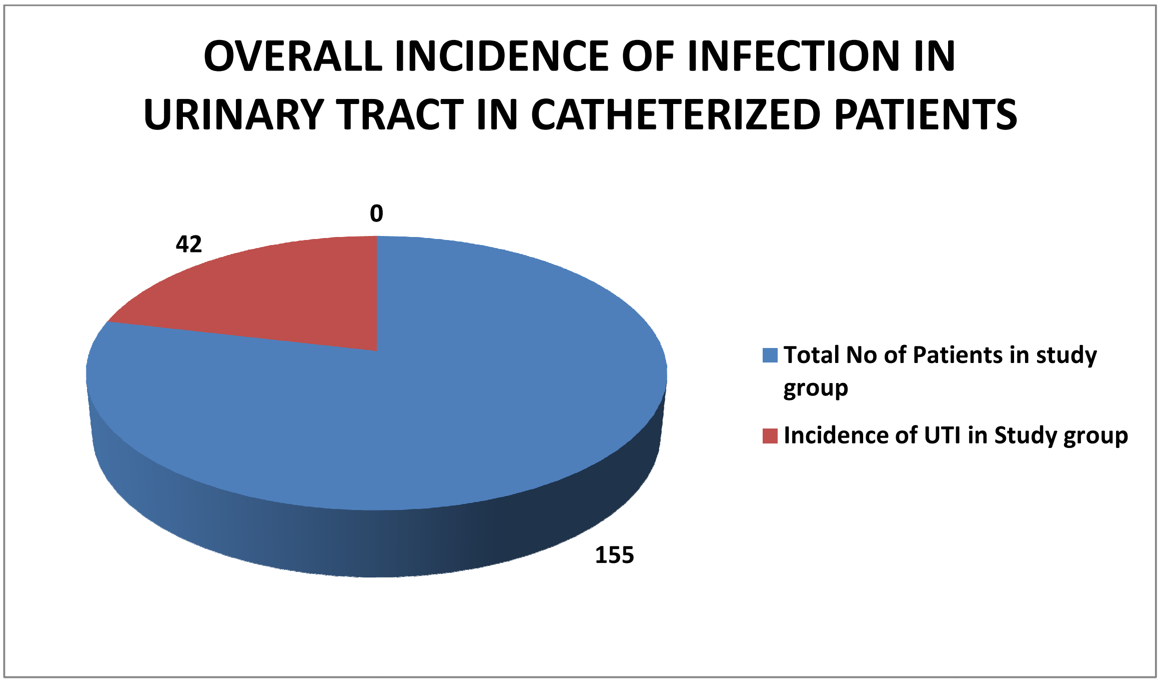

Table – 4: The frequency of bacterial pathogen in the catheterized urine specimens.

Sr. No.	Pathogen	No. of pathogen Isolated	Percentage of total Isolated (45%*)
1.	E. Coli	24	53.3
2.	Pseudomonas	6	13.3
3.	Proteus	4	8.8
4.	Klebsiella	3	6.7
5.	Staphylococci	6	13.3
6.	Enterococci	1	2.2
7.	Candida	1	2.2

* Mixed Growth was seen in 3 patients.

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Graph – 4: The frequency of bacterial pathogen's in the catheterized urine specimens.

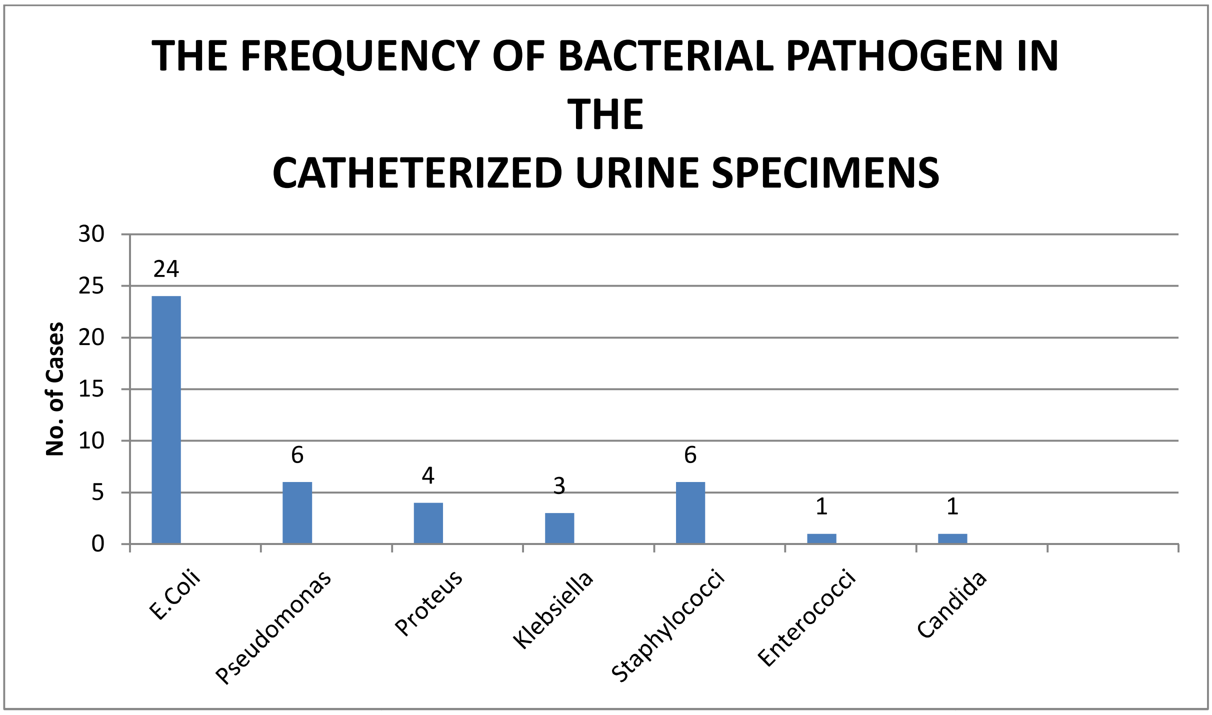

Table – 5: Antibiotic sensitivity pattern of E. coli. (No. of pathogen = 24)

Antibiotics	HS	IS	Total	Sensitivity (%)
Ampicillin	0	1	1	4.1
Trimethoprim	1	1	2	8.3
Garamycin	1	2	3	12.5
Pefloxacin	-	3	3	12.5
Amikacin	12	4	16	66.6
Norfloxaciin	3	3	6	25
Ofloxacin	2	3	6	25
Ciprofloxacin	4	2	6	25
Nitrofurantoin	6	6	12	50
Nalidixic Acid	1	2	3	12.5
Cephalexin	-	1	4	16.6
Cefuroxime	-	3	3	12.5
Cefotaxime	2	3	5	20.8
Ceftazidime	7	2	9	37.5
Cefoperozone + Sulbactam	6	-	6	25
Cefdinir	1	3	4	16.6
Cefixime	-	2	2	8.3
Ceftriaxone	-	1	1	4.1

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Graph – 5: Antibiotic sensitivity pattern of E. coli. (No. of pathogen = 24)

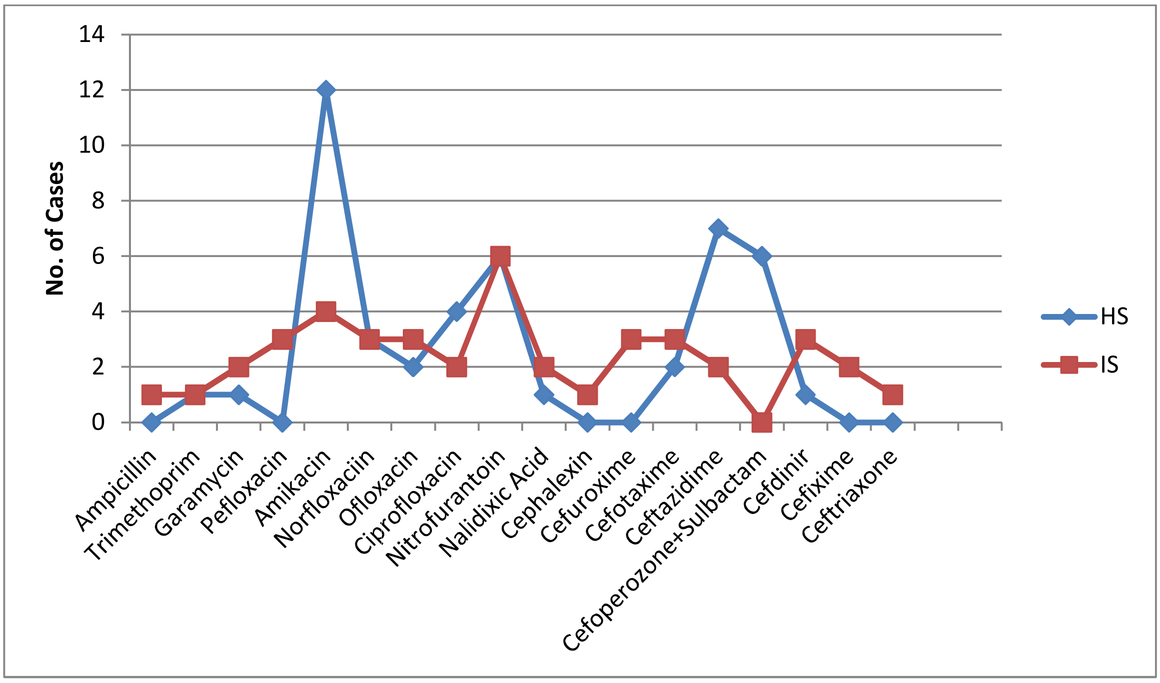

Table – 6: Antibiotic sensitivity pattern of Staphylococcus. (No. of pathogen = 26)

Antibiotics	HS	IS	Total	Sensitivity (%)
Ampicillin	-	-	-	-
Trimethoprim	-	-	-	-
Garamycin	1	-	1	16
Pefloxacin	-	-	-	-
Amikacin	4	-	4	66.66
Norfloxaciin	1	-	1	16.6
Ofloxacin	-	3	3	50
Ciprofloxacin	1	-	1	15.6
Nitrofurantoin	1	-	1	16.6
Nalidixic Acid	-	-	-	-
Cephalexin	-	-	-	-
Cefuroxime	-	-	-	-
Cefotaxime	-	-	-	-
Ceftazidime	-	2	2	33.2
Cefoperozone + Sulbactam	-	-	-	-
Cefdinir	-	-	-	-
Cefixime	-	-	-	-
Ceftriaxone	-	-	-	-

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Graph – 6: Antibiotic sensitivity pattern of Staphylococcus. (No. of pathogen = 26)

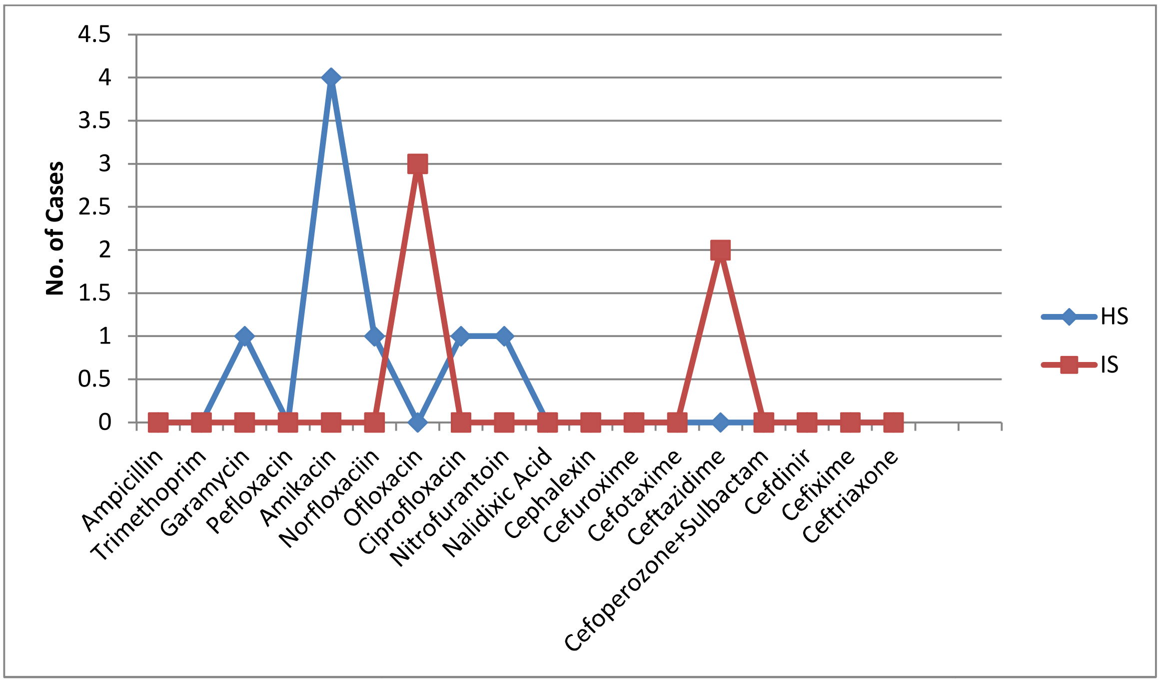

Table – 7: Sensitivity pattern of Proteus. (No. of pathogen = 24)

Antibiotics	HS	IS	Total	Sensitivity (%)
Ampicillin	-	-	-	-
Trimethoprim	-	-	-	-
Garamycin	-	-	-	-
Pefloxacin	-	-	-	-
Amikacin	4	-	4	100
Norfloxaciin	-	-	-	-
Ofloxacin	-	-	-	-
Ciprofloxacin	-	1	1	25
Nitrofurantoin	2	1	3	75
Nalidixic Acid	-	-	-	-
Cephalexin	-	-	-	-
Cefuroxime	1	-	1	25
Cefotaxime	-	-	-	-
Ceftazidime	-	-	-	-
Cefoperozone + Sulbactam	1	-	1	25
Cefdinir	1	-	1	25
Cefixime	-	-	-	-
Ceftriaxone	-	-	-	-

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Graph – 7: Sensitivity pattern of Proteus. (No. of pathogen = 24)

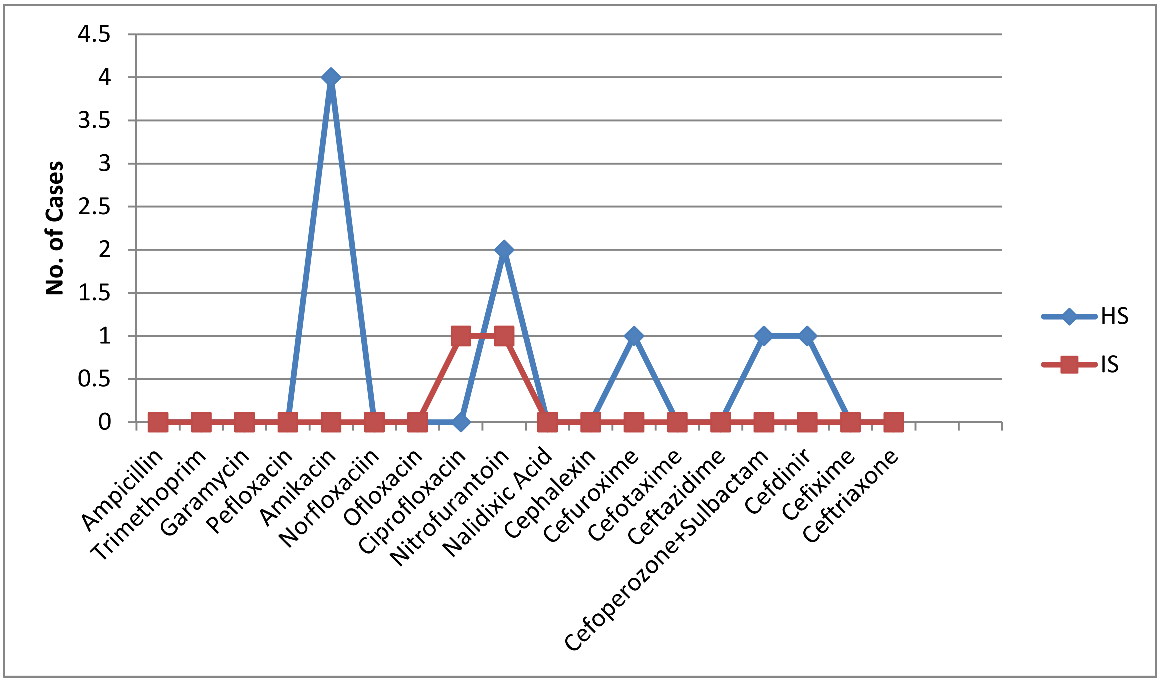

Table – 8: Sensitivity pattern of Pseudomonas. (No. of pathogen = 6)

Antibiotics	**HS**	**IS**	**Total**	**Sensitivity (%)**
Ampicillin	-	-	-	-
Trimethoprim	-	-	-	-
Garamycin	-	1	1	16.6
Pefloxacin	-	-	-	-
Amikacin	2	1	3	50
Norfloxaciin	1	-	1	16.6
Ofloxacin	1	1	2	33.2
Ciprofloxacin	2	-	2	33.2
Nitrofurantoin	-	-	-	-
Nalidixic Acid	-	-	-	-
Cephalexin	1	-	1	16.6
Cefuroxime	1	-	1	16.6
Cefotaxime	-	1	1	16.6
Ceftazidime	1	-	1	16.6
Cefoperozone + Sulbactam	3	-	3	50
Cefdinir	1	-	1	16.6
Cefixime	-	-	-	-
Ceftriaxone	1	-	1	16.6

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Graph – 8: Sensitivity pattern of Pseudomonas. (No. of pathogen = 6)

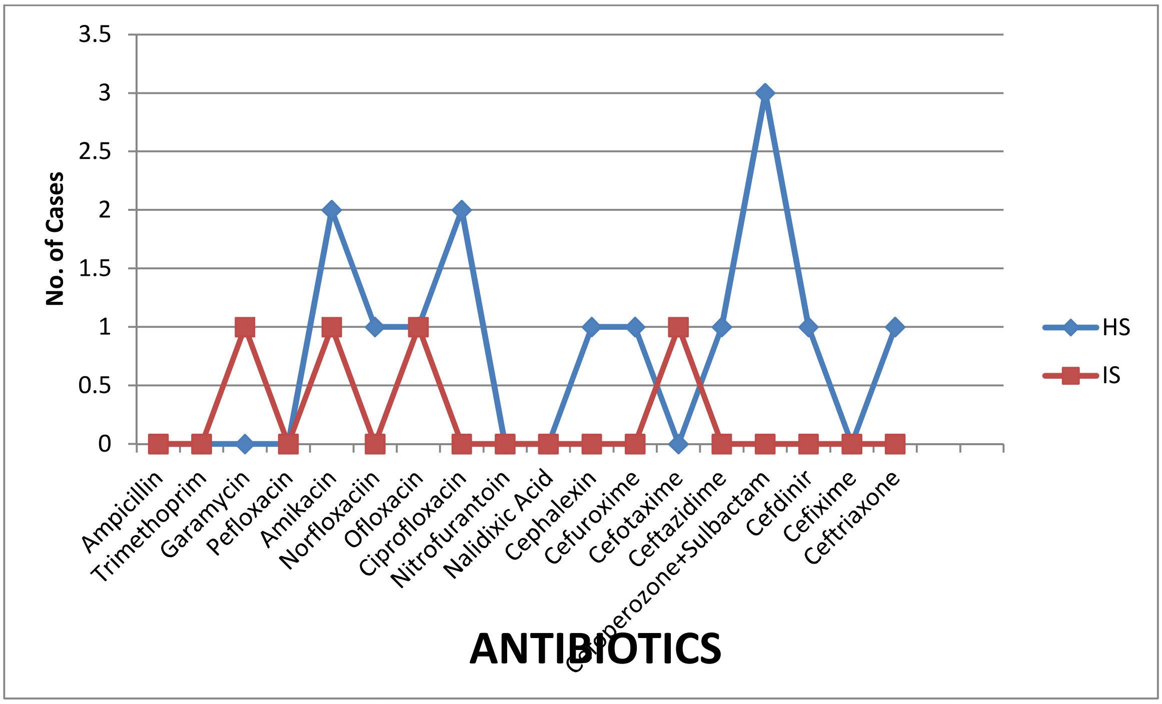

Table – 9: Sensitivity pattern of Klebsiella. (No. of Pathogen = 3)

Antibiotics	HS	IS	Total	Sensitivity (%)
Ampicillin	-	1	1	33.3
Trimethoprim	-	1	1	33.3
Garamycin	-	1	1	33.3
Pefloxacin	-	-	-	-
Amikacin	1	-	1	33.3
Norfloxaciin	-	1	1	33.3
Ofloxacin	-	-	-	-
Ciprofloxacin	1	-	1	33.3
Nitrofurantoin	2	-	2	66.6
Nalidixic Acid	-	1	1	33.3
Cephalexin	-	1	1	33.3
Cefuroxime	-	1	1	33.3
Cefotaxime	1	-	1	33.3
Ceftazidime	1	-	1	33.3
Cefoperozone + Sulbactam	1	-	1	33.3
Cefdinir	1	-	1	33.3
Cefixime	1	-	1	33.3
Ceftriaxone	-	1	1	33.3

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ISSN: 2394-0034 (O)

Graph – 9: Sensitivity pattern of Klebsiella. (No. of Pathogen = 3)

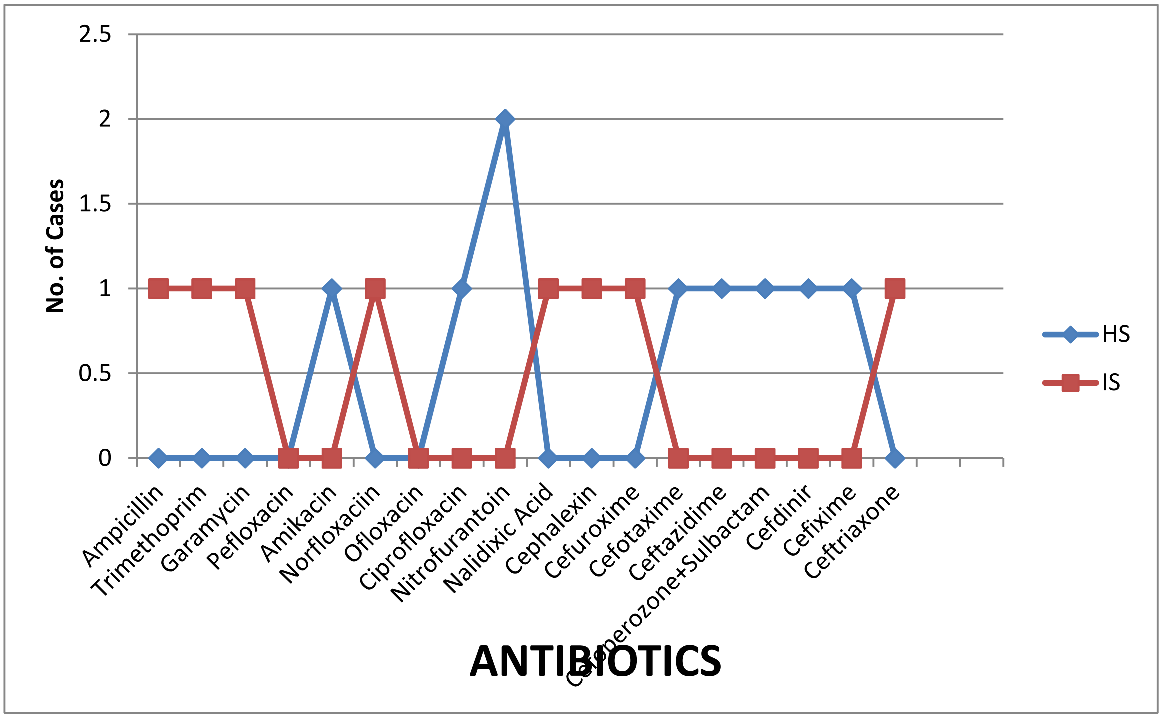

Table – 10: Pattern of total CAUTI's sensitivity to antibiotics.

Antibiotics	Total No. of Pathogens Sensitivity (HS+IS)	Sensitivity
Ampicillin	2 (0+2)	4.7
Trimethoprim	3 (1+2)	7.1
Garamycin	6 (3+3)	14.3
Pefloxacin	4(1+3)	9.5
Amikacin	28 (22+6)	66.66
Norfloxaciin	9 (5+4)	21.4
Ofloxacin	11 (3+8)	26.2
Ciprofloxacin	10 (7+3)	23.8
Nitrofurantoin	17 (11+6)	40.5
Nalidixic Acid	4 (1+3)	9.5
Cephalexin	3 (1+2)	7.1
Cefuroxime	7 (3+4)	16.6
Cefotaxime	7 (3+4)	163.6
Ceftazidime	14 (10+4)	33.3
Cefoperozone + Sulbactam	11 (11+0)	26.2
Cefdinir	7 (4+3)	16.6
Cefixime	2 (0+2)	4.7
Ceftriaxone	3 (1+2)	7.1

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ISSN: 2394-0034 (O)

Graph – 10: Pattern of total CAUTI's sensitivity to antibiotics.

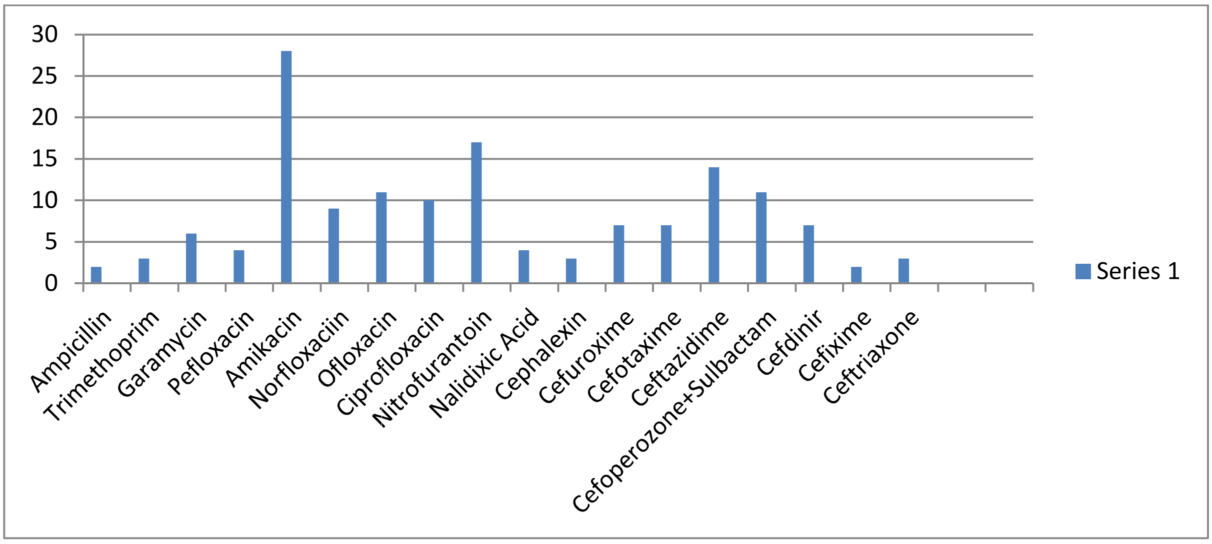

Table – 11: The frequency of bacterial pathogens in CAUTI's in various studies.

Various study	E. coli	Enterocoocci	Proteus	Klebsiela	Pseudomonas	Staphyylocus	Candida
Wazait H.D., et al. (1996-2001) [5]	30.9%	17.2%	15.6%	12.4%	11.2%	9.5%	NA
Neal R. Chamberlain (2004) [7]	18.57%	7-16%	4-8%	6-15%	1-11%	4-17%	2-26%
Gupta V, et al. [6]	4.5%	6.4%	2.7%	24.8%	10.0%	-	NA
Turkish Nosocomial UTI Study Group [8]	32.4%	8.5%	-	17.0%	11.7%	-	
Present Study	53.3%	2.2%	8.8%	6.7%	13.3%	13.3%	2.2%

 ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

Table – 12: Comparison of antibiotic sensitivity pattern of E. coli.

Antibiotic	Wazait HD, et al. (2002) [5]	Gupta V, et al. (2002) [6]	Present Study
Aminopenicillin	43.7%	10%	4.1%
Ciprofloxacin	91.0%	48%	25%
Cotrimaxozole	-	-	-
Trimethoprim	66%	-	8.3%
Co- Amoxiclav	81.9%	-	-
Gentamicin	92.9%	73.%	12.5%
Cephalexein	-	60%	12.6%
Amikacin	-	91%	66.6%
Nalidixic Acid	-	90%	20.8%
Natrofurantoin	-	29%	12.5%
Cefotaxime/ Ceftazidime	94.6%	85%	50.0%

Table – 13: Comparison of antibiotic sensitivity pattern of Pseudomonas.

Antibiotic	Wazait HD, et al. (2002) [5]	Gupta V, et al (2002) [6]	Present Study
Ciprofloxacin	95.6%	64%	33.2%
Gentamicin	97.8%	34%	16.6%
Cephalexein	-	-	16.6%
Amikacin	-	68%	50%
Cefotaxime/ Ceftazidime	98.9%	72%	16.6%

Table – 14: Comparison of antibiotic sensitivity pattern of Klebsiella.

Antibiotic	Wazait HD, et al. (2002) [5]	Gupta V, et al. (2002) [6]	Present Study
Aminopenicillin	4.1%	10%	33.33%
Ciprofloxacin	96%	67%	33.33%
Cotrimaxozole	-	11%	-
Trimethoprim	68.7%	-	33.33%
Co-Amoxiclav	71.8%	-	-
Gentamicin	-	28%	33.33%
Cephalexein	68.7%	42%	33.33%
Amikacin	-	87%	33.33%
Nalidixic Acid	-	27%	33.33%
Nitrofurantoin	62.7%	57%	66.6%
Cefotaxime/ Ceftazidime	-	8.6%	33.33%

ISSN: 2394-0026 (P)
ISSN: 2394-0034 (O)

Table – 15: Comparison of antibiotic sensitivity pattern of Proteus.

Antibiotic	Wazait HD, et al. (2002) [5]	Gupta V, et al. (2002) [6]	Present Study
Aminopenicillin	60.6%	20%	-
Ciprofloxacin	95.8%	70%	25%
Cotrimaxozole	-	12%	-
Trimethoprim	54.2%	-	-
Co-Amoxiclav	78.9%	-	-
Gentamicin	-	50%	-
Cephalexein	72%	65%	-
Amikacin	-	90%	100%
Nalidixic Acid	-	65%	-
Nitrofurantoin	-	20%	75%
Cefotaxime/ Ceftazidime	-	90%	-

Table – 16: Comparison of antibiotic sensitivity pattern of Staphylococcus.

Antibiotic	Wazait HD, et al. (2002) [5]	Present Study
Aminopenicillin	5.9%	-
Ciprofloxacin	-	16.6%
Trimethoprim	69.2%	-
Co-Amoxiclav	33.9%	-
Gentamicin	-	16.6%
Amikacin	-	66.6%
Nitrofurantoin	98.6%	16.6%
Cefotaxime/ Ceftazidime	-	33.2%

Table – 17: Comparison of pattern of total CAUTI's sensitivity of antibiotics.

Antibiotic	Wazait HD, et al. (2002) [5]	Present Study
Co-Amoxiclav	77.5%	-
Ciprofloxacin	77.8%	23.8%
Nitrofurantoin	71.2%	40.5%
Trimethoprim	62.5%	7.1%
Cephalexin	59.8%	7.1%
Aminopenicillin	50.9%	4.7%