A STUDY OF RISK FACTORS FOR CATHETER ASSOCIATED URINARY TRACT INFECTION

Dissertation submitted in partial fulfillment
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AUGUST-2014

CERTIFICATE

This is to certify that this dissertation entitled **"A STUDY OF RISK FACTORS FOR CATHETER ASSOCIATED URINARY TRACT INFECTION"** submitted by **Dr. RAO KARTHIK B** appearing for **M.Ch UROLOGY** degree examination in August 2014 is an original bonafide record of work done by him during the academic period of August 2011 to July 2014 under my guidance and supervision in partial fulfillment of requirement of the Tamil Nadu Dr. M.G.R. Medical University, Chennai. I forward this to the Tamil Nadu Dr. M.G.R. Medical University, Chennai, Tamil Nadu, India.

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DECLARATION

I, Dr. RAO KARTHIK B solemnly declare that this dissertation **"A STUDY OF RISK FACTORS FOR CATHETER ASSOCIATED URINARY TRACT INFECTION"** was done by me in the Department of Urology, Government Kilpauk Medical College and Government Royapettah Hospital, Chennai, under the guidance and supervision of **Prof. MUTHULATHA N,** Professor of Urology, Kilpauk Medical College, Chennai-10.

This dissertation is submitted to the Tamil Nadu Dr. M.G.R. Medical University, Chennai-600032 in partial fulfillment of the University requirements for the award of the degree of M.Ch., Urology.

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Abbreviations

NSHN	National Health Care Safety Network
CAUTI	Catheter Associated Urinary tract Infection
CDC	Centre for Disease Control
CMS	Centre for Medicare and Medi Aid Services
Ml	milliliter
Ch	Charriere
Fr	French
HAI	Hospital Acquired Infections
UTI	Urinary Tract Infection
CFU	Colony Forming Units
WBC	White Blood Cells
ICU	Intensive Care Unit
E.Coli	Escherichia Coli
Hb	Hemoglobin
SPSS	Service product for Statistical Solution
MEDCALC	Medical Calculator
ROC	Receiver Operating Characteristic
OR	Odds Ratio

INTRODUCTION

Introduction

The indwelling urinary catheter plays an important part of many medical practices. The National Health Care Safety Network (NSHN) defined an indwelling catheter as any tube that is inserted into the urinary bladder through the urethra and does not include supra pubic catheters and nephrostomy tubes.[1]

Catheter associated urinary tract infection (CAUTI) is the most common nosocomial infection worldwide accounting for nearly 30-40% of all institutionally acquired infections.[2-5] 80% of all urinary tract infections are associated with an indwelling catheter. It is defined by the Center for Disease Control (CDC) as any urinary tract infection in a patient who had an indwelling catheter in place at the time of or within 48 hours prior to onset of infection.[1] There has not been any minimum period defined for the catheter to be in place for the urinary tract infection to be categorized as CAUTI.

CAUTI can range from asymptomatic bacteremic urinary tract infection to symptomatic urinary tract infection. CAUTI is associated with major morbidity and can lead to genitourinary complications such as pyelonephritis, cystitis, prostatitis, epididymo-orchitis and other systemic complications such as vertebral osteomyelitis, septic arthritis, endocarditis, endophthalmitis and meningitis. 3% of all patients with catheter will develop bacteremia. Complications associated with CAUTI lead to prolonged hospital stay, and increased cost, morbidity and

mortality. The morbidity and mortality due to CAUTI according to Centre for Disease Control is increased by 2.8 fold and the length of hospitalization is increased by 1-3 days. The importance of CAUTI with regards to cost is best shown by the CMS (Medicare) data in the United States that estimated the annual cost due to CAUTI was between $340 to $450 Million.[6, 7, 8, 9]

Asymptomatic bacteriuria often precipitates antimicrobial therapy and CAUTI forms one among the largest etiologies of drug resistant nosocomial infection. Incidence of sterile urine converting to bacteriuria occurs at a rate of 3-10% per day. Although definitive indications for use of catheter have been identified, it is often over used in most hospitals.

The role of indwelling catheter in urinary tract infections was first reported by Kass in 1957 [10] and most studies were done in the 1970's and 1980's to understand the pathogenesis of CAUTI. But in this modern era with improved health care, innovative technologies and early discharge of patients CAUTI still forms the bulk of nosocomial infections.

Understanding the risk factors for catheter associated urinary tract infection is essential for implementing prevention strategies in daily care of our patients. This study aims to evaluate the patient and catheter related factors contributing to the urinary tract infection to help in decreasing the burden of hospital acquired infections.

AIM OF THE STUDY

Aim of the study

To study the incidence of catheter associated urinary tract infection in our medical college hospital.

To study the various risk factors predisposing to catheter associated urinary tract infection.

To document the microbiological profile of catheter associated urinary tract infections.

REVIEW OF LITERATURE

Review of literature

Catheters have been used from time immemorial. The word catheter is a Greek word meaning “to let or send down”. Catheters were used as early as 3000 B.C to relieve acute urinary retention.[11] Materials used to form hollow tubes ranged from straw used by Syrians, rolled up palm leaves, hollow tops of onions used by Chinese and various metal tubes such as gold, silver, copper, brass and lead used by Hindus and Greeks. Silver became popular as a base for catheters as it could be moulded into various shapes and was proposed to also have anti septic effect.

This property of silver for catheters was first used by Sir Benjamin Franklin in 1752 for his older brother who suffered from kidney stones and needed to insert a bulky metal catheter into his bladder. With his local silversmith he designed a catheter with side holes bored into the tube to allow for drainage.[11]

Straight catheters initially developed were difficult to introduce and hence curved tip catheters were developed. Coude’ with single bend and double Coude’ catheters with two bends at the tip were then developed in the 18th and 19th century for male catheterization.[12,13] Catheters made from rubber were then developed but the initial catheters were weak at body temperature and left a lot of debris in the bladder. The discovery of rubber vulcanization by Goodyear in the year 1844 revolutionized the rubber industry by improving the firmness and durability of rubber catheters. This discovery allowed for mass production of rubber catheters. The earlier catheters

were winged tips called Malecots or with flexible shoulders called Pezzer that had the property of self retaining in the bladder.

Latex rubber catheters became available since the 1930s and the break through invention came from Dr Fredrik E B Foley, a Urologist from Minneapolis, who developed the latex balloon catheter. Advantage of this catheter was that the catheter could be retained within the bladder without having to suture or bandage the catheter to the external genitalia. The modern day catheter is named after this pioneer in urology though he lost the patent to the industrial firm C R Bard.

The external diameter of the catheter was described using Charriere's French scale and the term "French" was coined. Joseph Frederic Benoit Charriere was a maker of surgical instruments and in some French speaking countries the term Charriere (Ch) is still used.

Concept of asepsis was first described by Joseph Lister in 1867. The incidence of infections reduced markedly using these aseptic principles and catheterization was deemed safe and acceptable. Dr Jack Lapides[14] introduced the term clean intermittent catheterization in 1971 and he proposed that apart from bacteria, chronic residual stagnant urine and over distention of bladder were also responsible for urinary tract infections. Though initially scorned by urologist world over, CIC has become the method of choice to treat chronic retention of urine as in neurogenic bladders.

The most common type of catheter used is the self retaining balloon Foley catheter. Other types of catheters in use include the DePezzer or mushroom catheter that are used for supra pubic catheterization. Catheters with triple lumen are used following surgeries on the prostate and bladder where continuous bladder irrigation is required. Fenestrated catheters allow drainage of the urethral secretions and reduce urethral inflammation, thereby decreasing the rates of strictures. The Tiemann coude catheter is used for continuous or intermittent use, has a curved tip with more than one opening for drainage and helps to negotiate the posterior urethra in patients with a large prostate. Whistle tipped catheter have larger openings above and lateral to the balloon and facilitate greater drainage. The Roberts catheter has openings proximal and distal to the balloon that facilitate the emptying of any residual urine in the bladder.[13, 15, 16, 17]

Urinary tract catheterization is one of the most frequently performed procedures in hospitals today and indications for catheterization may vary from acute retention of urine to simple monitoring of output in critically ill patients. Indications may be for diagnostic or therapeutic purposes. Diagnostic indications include obtaining sample of urine for evaluation, bladder distention prior to transvaginal or abdominal ultrasound of the pelvis, as part of cystogram or cystourethrogram and in critically ill patients for monitoring the urine output. Therapeutic indications

include acute or chronic retention of urine, postoperatively following surgery or anaesthesia and instillation of chemotherapeutic agents.[18]

Hospital acquired infection is defined by the CDC[1] as a localized or systemic condition resulting from an adverse reaction to the presence of an infectious agent or toxin that occurs in a health care setting and was not present or incubating at the time of admission. Urinary tract infections account for 30% of all HAIs. 80% of the UTIs in this setting are estimated to be catheter associated. CAUTI also is second most common cause of hospital acquired blood stream infection. Nosocomial bacteruria and candiduria occur in upto 25% of patients catheterized for more than 7 days. Although most CAUTIs are asymptomatic and rarely extend hospital stay, they often lead to unnecessary antimicrobial drug therapy and thereby form the majority of nosocomial antibiotic resistant strains of organisms.

Pathogenesis of CAUTI:

Lifecycle of a catheter begins with catheter placement, continues when the catheter is kept in place, and ceases when the catheter is removed. It resumes if another catheter is re-inserted. Each stage of this cycle provides an opportunity for microorganisms to infect the urinary tract.[19] Most organisms causing endemic CAUTI are derived from the patient's own flora from the colon or perineum or from healthcare professionals handling during catheterization. Organisms can gain access through two routes. Direct inoculation at the time of catheter insertion leads to early extra-luminal contamination. Late contamination can occur from organisms that ascend from the perineum by capillary action in the pericatheter region through the thin mucous film. Intraluminal contamination occurs from organisms gaining access to the lumen of the catheter by breach in the system of closed drainage or by contamination of the urine collected in the collecting bag.[20,21,22]

The catheter provides a survival advantage to the bacteria. Bacteria adherent to the catheter are not washed away by the normal urine flow, are more resistant to phagocytosis, are multi drug resistant. Catheter provides a direct communication between the heavily colonized perineum and the bladder. The stagnated urine in the bladder or in the catheter also helps in promoting growth of the bacteria. In the absence of antimicrobial therapy, bacteruria develops within 24 to 48 hours.

A study of the pathogenesis of CAUTI by Tambyah PA et al.[20] concluded that CAUTIs occur in 66% of the patients by the extraluminal route and in 34% by the intraluminal route. The mechanism of CAUTI was based on a prospective study on 1497 patients who were recently catheterized. 235 patients had a urinary tract infection. Gram negative organisms were the most common cause of CAUTI through both mechanisms. The study result also revealed candiduria to be more common via extraluminal route than intraluminal route (69% vs 31%).

Most infected urinary catheters are enclosed by a thick biofilm layer that contain the organisms within the matrix of host proteins. Biofilms are communities of bacteria covered in a matrix of polysaccharides that facilitate adhesion. The biofilm can form extraluminally, intraluminally or by a combination of both mechanisms. The infection usually advances in a retrograde fashion. But various studies have not clearly shown the role of biofilm contributing to the CAUTI. Urinary catheters cause damage to the protective uroepithelial mucosa leading to the exposure of new binding sites for bacterial adhesions and also disrupt normal host mechanical defenses. The foreign body within the urinary tract helps the organisms to colonize with fewer virulence factors and establish infection when compared to pathogens to infect a fully functional urinary tract. Catheter obstruction can lead to sepsis and even mortality.

Diagnosis of CAUTI:

Catheter associated urinary tract infection manifests as either symptomatic urinary tract infection or asymptomatic bacteremic bacteruria. The Center for Disease Control has developed a classification system for diagnosis of CAUTI based on fixed criteria.

Symptomatic CAUTI is defined by the presence of catheter at the time of specimen collection or the catheter should have been removed within 48 hrs prior to specimen collection with atleast one of the signs and symptoms such as fever (>38° Centigrade), suprapubic pain or costovertebral angle pain or tenderness with a positive urine culture of $>10^5$ colony forming units/ml with no more than 2 species of microorganisms. If urine culture reveals colony count between $>10^3$ and $\leq 10^5$ CFU then a positive dipstick test for leukocyte esterase and / or Nitrate, pyuria (urine specimen with ≥10 white blood cells [WBC] /mm^3 of unspun urine or ≥3 WBC/high power field of spun urine) and presence of bacteria on gram stain of unspun urine is also diagnostic of CAUTI.

In asymptomatic bacteremic urinary tract infections patient has no signs or symptoms of UTI, but has a positive urine culture with $>10^5$ colony forming units of no more than 2 micro organisms with a positive blood culture showing atleast one matching uropathogen. The CDC in 2009 updated the definitions for UTI and

removed isolated asymptomatic bacteriuria without symptoms or positive urine analysis from the surveillance criteria of urinary tract infections.

Urinary catheter tip culture sensitivity is not accepted as diagnosis of catheter associated urinary tract infections. Similarly urine cultures from bag specimens are not reliable. Specimen from indwelling catheters should be obtained after disinfecting the sampling port. Urine specimens should be cultured as soon as possible preferably within 1 to 2 hours. If urinary specimens cannot be inoculated within 30 minutes, the sample should be refrigerated or transported in appropriate solutions. Specimens that have been refrigerated should be inoculated within 24 hours.

Other key term defined by the CDC is location of attribution. This is the location (such as ward, casualty, ICU and so on) where the patient was assigned on the date of the UTI event and is further defined as the date when the first clinical evidence appeared or the date the specimen used to meet the criterion was collected, whichever came first. The date on which the specimen was collected is known as the event date.

Risk factors for CAUTI:

Various studies have attempted to study the risk factors associated with CAUTI. The risk factors are classified as catheter related, patient related factors and environment or personnel related factors.

Catheter related factors include duration of catheterization, lack of urimeter drainage, colonization of drainage bag, reason for catheterization and breaks in closed system. Patient related factors include age, gender, critically ill, presence of Diabetes, renal failure and periurethral colonization. Environment or personnel related factors include department in which patient is hospitalized, day of insertion of catheter in hospital, catheterization outside the operation theatre, lack of antibiotics and improper care.

Tambyah PA et al.[20] published a comprehensive review of catheter associated urinary tract infections with respect to pathogenesis, risk factors, clinical and laboratory features and contribution to hospital costs, morbidity and mortality.

1,497 newly catheterized patients hospitalized at the University of Wisconsin Hospitals and Clinics were prospectively studied. Majority of infections (2/3rd) were caused by organisms by extraluminal mechanism. Most common organism were Staphylococci, Enterococci and yeasts that are commonly present in the perineum as commensals. For intra-luminal route, Gram-negative bacteriae (Enterobacter, Pseudomonas, Acinetobacter) were the most common organisms

grown. Prolonged catheterization and female gender were the most important risk factors. Other risk factors identified were catheterization outside the operating theatre, diabetes, concurrent infections, malnutrition and renal failure.

The factors influencing bacteriuria following urethral catheterization were studied by Garibaldi RA et al.[23] as early as in 1974. 405 patients were included in the study. 23% acquired bacteriuria and risk was significantly greater in females, elderly or critically ill. The protective effect of antimicrobials was limited only to the first 4 days of catheterization.

A comprehensive study of risk factors for CAUTI was done by Maki DG et al.[21] and published in 2000. The various risk factors reported in this study included prolonged duration of catheterization, female sex, catheter insertion outside the operating room, other active sites of infection, diabetes, anemia, malnutrition, presence of ureteral stents, indication for catheterization being urine output monitoring and violation in the closed system of drainage. The study concluded that duration of catheterization is the single most important risk factor for CAUTI.

Platt R et al.[24] conducted a prospective study between June 1979 to April 1981at New England Hospital, Boston, Massachusetts. 134 of 1,458 patients developed a urinary tract infection due to indwelling catheters. The indication for catherization was also found to be a risk factor for CAUTI apart from the above mentioned risk factors.

Boybeyi O et al.[25] studied the risk factors for CAUTI in paediatric patients undergoing surgery. 112 patients were included in this study. All patients had serial urine cultures done. Patients with positive urine cultures were catheterized for longer duration. The duration of preoperative antibiotic usage had a significant association with increased risk of CAUTI (P = 0.003). The rate of infection in patients catheterized outside the operating room was significantly higher (P = 0.030).

This study concluded that increased duration of catheterization, preoperative antibiotic usage and inappropriate conditions during catheterization were the most important risk factors for development of CAUTI.

Temiz E et al.[26] conducted a study in Turkey on factors associated with CAUTI and effects of other simultaneously existing nosocomial infections in an intensive care unit setting. They studied 204 patients out of which 85 developed a nosocomial infection. 22 patients developed CAUTI alone whereas 38 developed CAUTI with an additional nosocomial infection. The other infection was acquired either concomitantly or prior to the onset of CAUTI. This study revealed that in the presence of concomitant nosocomial infection at other sites, immune suppression, history of previous antibiotic usage were independent factors associated with risk of CAUTI. When nosocomial infections at other sites were excluded female gender and duration of catheterization were the significant risk factors.

A review article was published by Parida S, Mishra SK[27] on urinary tract infections in the critical care unit. They conducted a medline search for factors influencing urinary tract infections and their management. Prolonged catheterization, female gender, diabetes, raised renal parameters, presence of stent were all independent risk factors for CAUTI.

Tsuchidaa T et al.[28] studied the relationship between catheter care and the risk of CAUTI in Japanese general hospitals. They included 555 adult patients who were catheterized for more than 3 days in five general hospitals in Japan. The data collected included catheter insertion method, catheter management and signs and symptoms of urinary tract infections. The mean duration of catheterization was 25 days and the incidence of CAUTI ranged from 0.6 to 7.2 cases per 1000 device days. 94% of the patients diagnosed with CAUTI had fecal incontinence and hence only this group was analyzed. They concluded that the use of closed system of catheter drainage and cleansing of the perineal area daily reduced the incidence of CAUTIs by 50%.

Wald HL et al.[29] in 2008, as part of National Surgical Infection prevention project published an analysis of indwelling catheter use in the post operative period. 35904 medicare patients undergoing major surgery were included in the study. 86% of patients had perioperative indwelling urinary catheters and 50% were catheterized for more than 2 days in the postoperative period. Duration of postoperative

catheterization longer than 2 days was associated with an increased risk of nosocomial urinary tract infection.

Bhatia N et al.[30] published an article on urinary catheterization in medical wards. They studied the indications for catheterization in medical wards, the rate of inappropriate catheterization and their risk factors, CAUTI and colonization of bacteria on Foleys catheter. This hospital based prospective study included 125 patients admitted in medical wards. 28.8% of patients in this study were inappropriately catheterized and the most frequent indication for inappropriate catheterization was urinary incontinence without significant skin break down. 22.4% patients developed CAUTI and the risk factors for acquiring CAUTI were age >60 years, impaired mental status and duration of catheterization >3 days.

Adukauskiene et al.[31] studied the etiology, risk factors and outcome of urinary tract infections in 82 patients admitted to an ICU. All patients in this study with a positive urinary culture had a catheter in place. Risk of development of urinary tract infection estimated in this study was 21.7% for each day of catheterization. But in contrast to many other studies this study did not find a significant correlation between age, sex and duration of catheterization alone on the occurrence of urinary tract infection.

Lee JH et al.[32] undertook a retrospective study to investigate the factors associated with nosocomial catheter associated urinary tract infections in intensive care units

over 2 years at a single centre in South Korea. 1315 patients were included in the study between January 2009 to December 2010. CAUTI was defined as isolated bacterial growth of $>10^5$ CFU within 48 hours after transfer to the ICU if the catheter was placed before the transfer or 48 hours after insertion if the catheter was inserted in the ICU. Only patients with negative initial culture results before catheterization were included in the study. Using the above criteria 241 patients had a positive urine culture and 61 patients were diagnosed with CAUTI. Diabetic patients were found to have a relative risk of 4.55 for developing CAUTI and also had 1.1 fold increased duration of indwelling catheters. E.coli was the most common organism cultured in 38.7% patients.

Mohammedzadeh M and Behnaz F[33] studied the incidence and risk factors for CAUTI in Iran. The variables studied were sex, age, antimicrobial usage, duration of catheterization and hospital stay. The incidence of CAUTI in this study was 21.8%. Duration of catheterization had a relative risk of 1.2 whereas antimicrobial usage was found to be protective.

Domingo KB, Mendoza MT and Torres TT[34] conducted a prospective study in 1998 to determine the incidence of CAUTI, risk factors associated and the pathogens isolated with their resistance patterns. Serial urine cultures were done until development of catheter related urinary tract symptoms, catheter removal or discharge. The incidence of CAUTI in this study was 51.4%. Majority (91%)

acquired infection within seven days of catheterization. Most common organism grown was Escherichia coli. Three risk factors were found to be significantly associated with CAUTI that included duration of catheterization, female gender and diabetes. They concluded that since duration of catheterization was the only alterable risk factor, importance must be laid on reducing the catheter duration to a minimum period.

Jeong et al.[35] compared the catheter associated urinary tract infection rates following the use of four different perineal care agents (skin cleansing foam, soap-and-water, 10% povidone-iodine and normal saline) among patients in an intensive care setting. 97 patients were included in the study. Patients were randomized to receive any one of the four different types of perineal care. They concluded that the type of perineal care did not influence the incidence of CAUTIs.

Jaggi N and Sissodia P[36] conducted a programme of multimodal supervision to reduce CAUTI at a tertiary hospital between January 2009 to December 2009. They initially analyzed CAUTI rates for the first 6 months and then instituted a supervision program from the month of July. The program included training with respect to standard protocols for sample collection, urinary catheter care check list and hand hygiene practices. The average rate of CAUTI decreased by almost 47% after the program. The average duration of catheterization reduced from 23 days to 21 days. The adherence to strict catheter care check list and hand hygiene

compliance was increased by 44% and 56% respectively. Factors such as bladder irrigation and perineal cleansing were not found to significantly affect CAUTI rates.

Similar study was conducted by Rosenthal VD, Guzman S and Safdar N[37] in Argentina. Simple factors such as prevention of compression of the tubing by the leg and proper hand washing by nurses and health care professionals improved the CAUTI rates that decreased significantly from 21.3 to 12.39 per 1000 catheter-days. They concluded that implementing education and performance feedback regarding trivial but essential points such as catheter care measures and compliance with hand washing prior to catheterization could significantly reduce CAUTI rates.

Huth et al.[38] in 1992 conducted a clinical trial of junction seals to prevent urinary catheter associated urinary tract infection. The study included patients attending a community hospital. They were randomized into two groups within 24 hours of insertion of catheter to receive a tape seal applied to the catheter-drainage tube junction or no tape seal. The catheter urine cultures and violations in catheter care were monitored until patient discharge or catheter removal. 13.7% of 903 patients in the junction seal group acquired bacteriuria compared with 14.9% of 837 patients in the control group. Multivariate analysis was done and only female gender and lack of systemic antibiotic use correlated significantly with

development of bacteriuria. The junction treatment randomization showed no significant differences between the treatment groups.

Danchaivijitr S et al.[39] published a study in 2005 reporting the incidence, risk factors and cost factor analysis of catheter associated urinary tract infections in patients with indwelling catheters for more than a week. 101 patients were included in this study. Incidence of CAUTI was 73.3% and higher incidence was seen in the first two weeks of catheterization. None of the patients had secondary bacteremia. High incidence of resistant organisms were found in this study. Significant risk factors were prolonged catheterization and change of catheter.

This study is being done to describe the complication of urethral catheterization in terms of the incidence of CAUTI, the microbiological profile and to determine the significance of various risk factors involved.

MATERIAL AND METHODS

Material and Methods

Type of study: Prospective study

Period of study: September 2012 to February 2014

Inclusion criteria:

A total of 210 patients subjected to Foleys catheterisation in the hospital (or within 24 hours of presentation to the hospital) for an appropriate indication were included in the study.

Exclusion criteria:

The following patients were excluded from the study.

- Pregnant women
- Patients with known allergy to latex or silicone
- Patients with urethral catheter in place for >24 hours at admission
- Subjects whose initial urine culture at onset of catheterization was already positive
- Patients with suprapubic catheters

The study was approved by the institutional ethical committee.

On entry into the study, demographic and clinical data including age, gender, underlying systemic diseases including diabetes mellitus and cancer, immunosuppressive therapy, recent surgery and the indication for catheterization was recorded. Urine culture was done at the time of catheterization, 48 hours after catheterization and when the patient had symptoms of fever, supra pubic pain, loin pain or change in colour of urine. Samples were also sent on the day of catheter removal in all patients. The duration of catheterization was recorded as the date when symptoms appeared or when the urine specimen was sent for culture sensitivity, whichever was earlier. Haemoglobin and renal function tests were sent on the day of admission.

Approximately 3ml of urine was aspirated from the sampling port of the catheter after sterilizing the port with 10% povidone iodine. Each sample was immediately sent to the microbiology laboratory for inoculation into agar plates. Quantitative analysis for the growth and type of organisms were monitored at 24 and 48 hours. Antibiotic susceptibility testing was done using the Kirby-Bauer disk diffusion technique.

OBSERVATION AND RESULTS

Observation and Results

Statistical analysis: Data were analyzed using the statistical analysis package SPSS version 20 for Windows and MEDCALC software. Two analyses were undertaken: univariate analyses of the association of each variable with CAUTI and multivariable logistic regression to predict CAUTI outcome. In the univariate analysis, Chi-square test and Fisher's Exact Test was used for categorical variables and Student's t-test or Mann-Whitney test was used for continuous variables. All testing was two-sided. Univariate relative risk ratios and multivariable analyses were done by assigning the continuous variables into discrete variables, based on their being above or below a set value. The Multivariable logistic analyses was done in a stepwise manner. One variable was entered at a time into the classification equation. The predictor variable with the highest association with CAUTI was first entered. Variables with a statistically significant contribution to CAUTI were then entered into the final model.

Table 1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Creatinine	210	.6000	4.2000	1.402381	.6017073
Dur of Cath	210	2.00	12.00	4.85	2.346
Hemoglobin	210	6.8000	13.6000	10.277143	1.3406602
Age	210	17	88	51.61	16.213

Table 2: Age Group Distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<20	4	1.9	1.9	1.9
	21-30	20	9.5	9.5	11.4
	31-40	39	18.6	18.6	30.0
	41-50	36	17.1	17.1	47.1
	51-60	37	17.6	17.6	64.8
	>60	74	35.2	35.2	100.0
	Total	210	100.0	100.0	

Chart 1: Age group Distribution

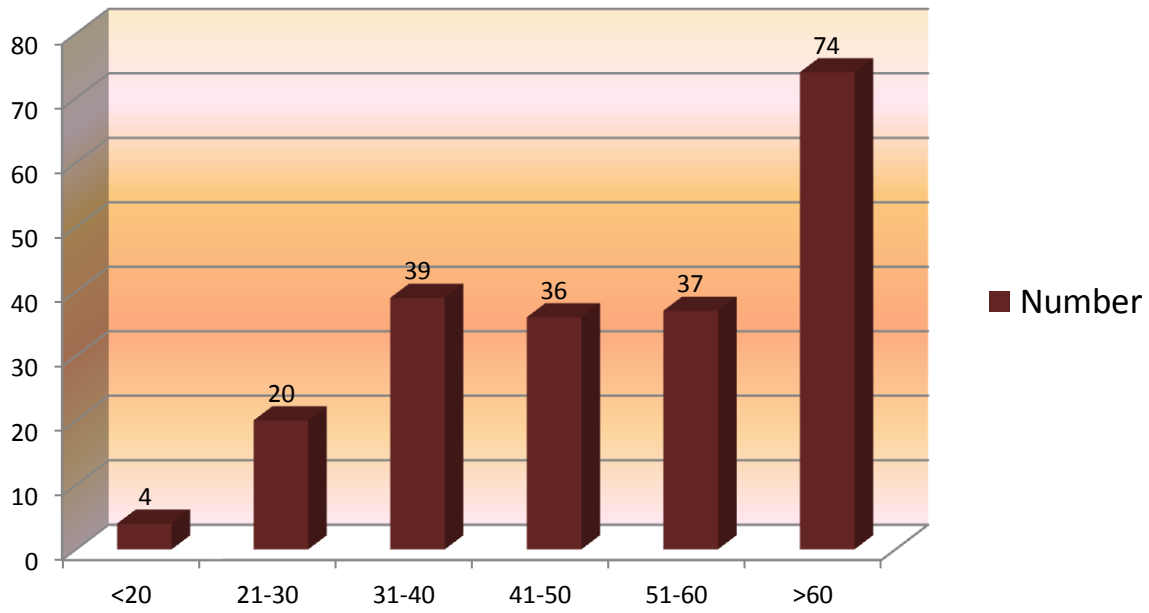


Table 3: Sex Distribution

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	F	69	32.9	32.9	32.9
	M	141	67.1	67.1	100.0
	Total	210	100.0	100.0	

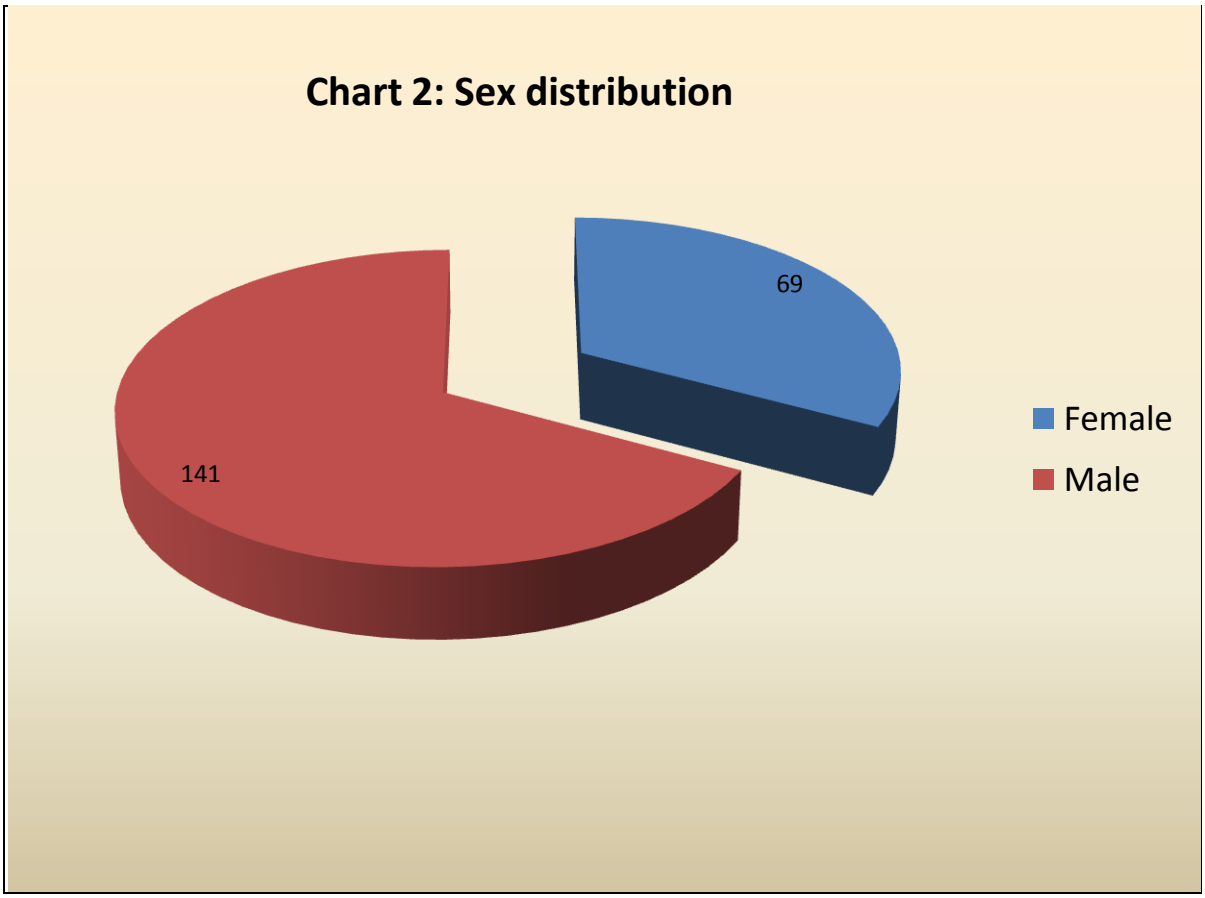


Table 4: Catheter Size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	16	77	36.7	36.7	36.7
	18	126	60.0	60.0	96.7
	22	7	3.3	3.3	100.0
	Total	210	100.0	100.0	

Chart 3: Catheter Size

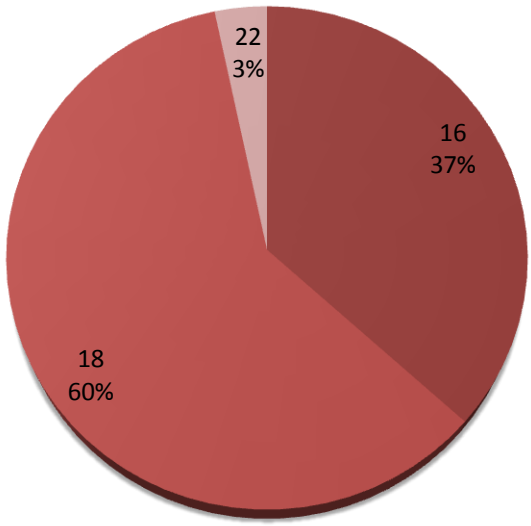


Table 5: Duration of catheterization

	Frequency	Percent	Valid Percent	Cumulative Percent
2	21	10.0	10.0	10.0
3	52	24.8	24.8	34.8
4	57	27.1	27.1	61.9
5	13	6.2	6.2	68.1
6	15	7.1	7.1	75.2
7	10	4.8	4.8	80.0
8	24	11.4	11.4	91.4
9	10	4.8	4.8	96.2
10	4	1.9	1.9	98.1
11	2	1.0	1.0	99.0
12	2	1.0	1.0	100.0
Total	210	100.0	100.0	

Table 6: Frequency distribution of Creatinine

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<=1.5	163	77.6	77.6	77.6
	>1.5	47	22.4	22.4	100.0
	Total	210	100.0	100.0	

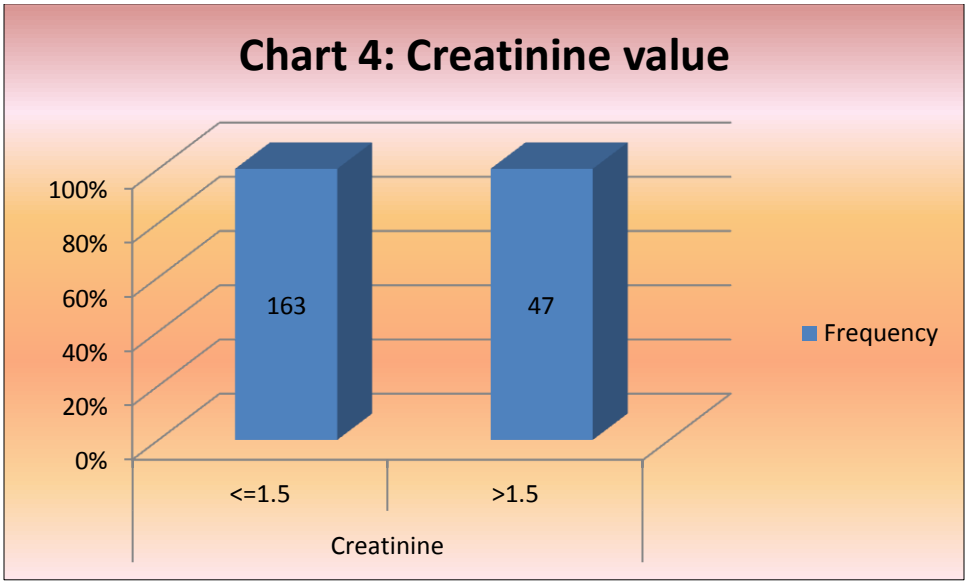


Table 7: Age group*CAUTI cross tabulation

			CAUTI		Total
			Absent	Present	
Age Group	<20	Count	3	1	4
		% within Age Group	75.0%	25.0%	100.0%
		% within CAUTI	2.5%	1.1%	1.9%
		% of Total	1.4%	0.5%	1.9%
	21-30	Count	17	3	20
		% within Age Group	85.0%	15.0%	100.0%
		% within CAUTI	14.2%	3.3%	9.5%
		% of Total	8.1%	1.4%	9.5%
	31-40	Count	33	6	39
		% within Age Group	84.6%	15.4%	100.0%
		% within CAUTI	27.5%	6.7%	18.6%
		% of Total	15.7%	2.9%	18.6%
	41-50	Count	28	8	36
		% within Age Group	77.8%	22.2%	100.0%
		% within CAUTI	23.3%	8.9%	17.1%
		% of Total	13.3%	3.8%	17.1%
	51-60	Count	15	22	37
		% within Age Group	40.5%	59.5%	100.0%
		% within CAUTI	12.5%	24.4%	17.6%
		% of Total	7.1%	10.5%	17.6%
	>60	Count	24	50	74
		% within Age Group	32.4%	67.6%	100.0%
		% within CAUTI	20.0%	55.6%	35.2%
		% of Total	11.4%	23.8%	35.2%
Total		Count	120	90	210

Chi-square test p value 0.000

Table 8: Sex * CAUTI

Crosstab

			CAUTI		
			Absent	Present	Total
Sex	F	Count	37	32	69
		% within CAUTI	30.8%	35.6%	32.9%
		% of Total	17.6%	15.2%	32.9%
	M	Count	83	58	141
		% within CAUTI	69.2%	64.4%	67.1%
		% of Total	39.5%	27.6%	67.1%
	Total	Count	120	90	210
		% within CAUTI	100.0%	100.0%	100.0%
		% of Total	57.1%	42.9%	100.0%

Chi-Square test p value 0.471

Chart 5: Sex*CAUTI

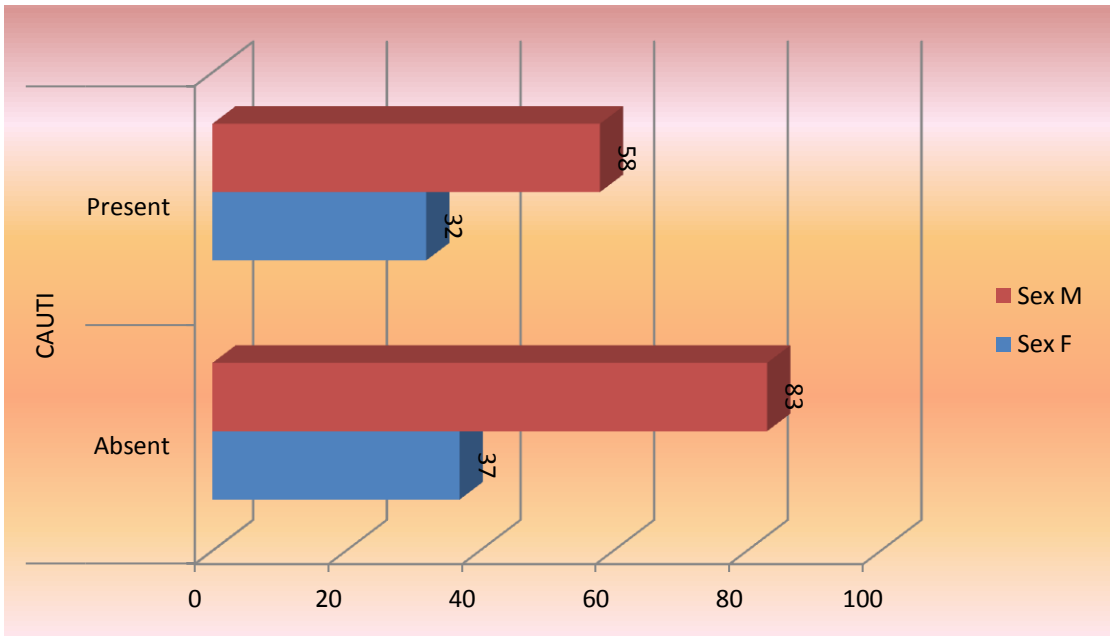


Table 9: Urinary retention * CAUTI

Crosstab

			CAUTI		
			Absent	Present	Total
Urinary retention	Absent	Count	99	47	146
		% within CAUTI	82.5%	52.2%	69.5%
		% of Total	47.1%	22.4%	69.5%
	Present	Count	21	43	64
		% within CAUTI	17.5%	47.8%	30.5%
		% of Total	10.0%	20.5%	30.5%
	Total	Count	120	90	210
		% within CAUTI	100.0%	100.0%	100.0%
		% of Total	57.1%	42.9%	100.0%

Chi-Square p value 0.000

Chart 6: Urinary retention*CAUTI

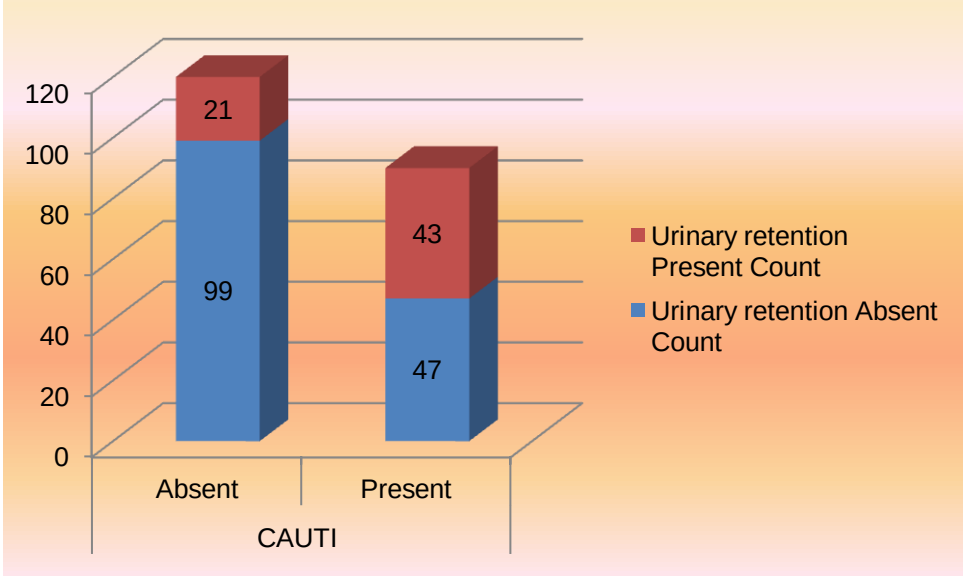


Table 10: Incontinence * CAUTI

Crosstab					
			CAUTI		
			Absent	Present	Total
Incontinence	Absent	Count	116	73	189
		% within CAUTI	96.7%	81.1%	90.0%
		% of Total	55.2%	34.8%	90.0%
	Present	Count	4	17	21
		% within CAUTI	3.3%	18.9%	10.0%
		% of Total	1.9%	8.1%	10.0%
	Total	Count	120	90	210

Chi-Square P value 0.000

Table 11: Diabetes * CAUTI

Crosstab					
			CAUTI		
			Absent	Present	Total
Diabetes	Absent	Count	103	32	135
		% within CAUTI	85.8%	35.6%	64.3%
		% of Total	49.0%	15.2%	64.3%
	Present	Count	17	58	75
		% within CAUTI	14.2%	64.4%	35.7%
		% of Total	8.1%	27.6%	35.7%
	Total	Count	120	90	210

Chi-Square p value 0.000

Table 12: Place of catheterization * CAUTI

Crosstab					
			CAUTI		
			Absent	Present	Total
Place of catheterization	Casualty	Count	3	26	29
		% within CAUTI	2.5%	28.9%	13.8%
		% of Total	1.4%	12.4%	13.8%
	OT	Count	95	19	114
		% within CAUTI	79.2%	21.1%	54.3%
		% of Total	45.2%	9.0%	54.3%
	Ward	Count	22	45	67
		% within CAUTI	18.3%	50.0%	31.9%
		% of Total	10.5%	21.4%	31.9%
	Total	Count	120	90	210

Chi-Square p value 0.000

Table 13: Drainage system * CAUTI

Crosstab

			CAUTI		
			Absent	Present	Total
Drainage system	Closed	Count	100	21	121
		% within CAUTI	83.3%	23.3%	57.6%
		% of Total	47.6%	10.0%	57.6%
	Open	Count	20	69	89
		% within CAUTI	16.7%	76.7%	42.4%
		% of Total	9.5%	32.9%	42.4%
	Total	Count	120	90	210
		% within CAUTI	100.0%	100.0%	100.0%
		% of Total	57.1%	42.9%	100.0%

Chi-Square P value 0.000

Table 14: Duration of Catheterization*CAUTI

			CAUTI		Total
			Absent	Present	
DURCAT	<=6 days	Count	115	41	156
		% within CAUTI	95.8%	45.6%	74.3%
		% of Total	54.8%	19.5%	74.3%
	>6 days	Count	5	49	54
		% within CAUTI	4.2%	54.4%	25.7%
		% of Total	2.4%	23.3%	25.7%
Total		Count	120	90	210
		% within CAUTI	100.0%	100.0%	100.0%
		% of Total	57.1%	42.9%	100.0%

Chi-Square p value 0.000

Table 15: Catheter Size * CAUTI

		CAUTI		Total
		Absent	Present	
Catheter Size	16	44	33	77
	18	63	63	126
	22	2	5	7
Total		109	101	210

Chi-Square p value 0.279

Table 16: Hemoglobin * CAUTI

Crosstab

			CAUTI		Total
			Absent	Present	
Hb	>=10	Count	95	41	136
		% within CAUTI	79.2%	45.6%	64.8%
		% of Total	45.2%	19.5%	64.8%
	<10	Count	25	49	74
		% within CAUTI	20.8%	54.4%	35.2%
		% of Total	11.9%	23.3%	35.2%
Total		Count	120	90	210
		% within CAUTI	100.0%	100.0%	100.0%
		% of Total	57.1%	42.9%	100.0%

Chi-Square p value 0.000

Table 17: Creatinine * CAUTI

Crosstab

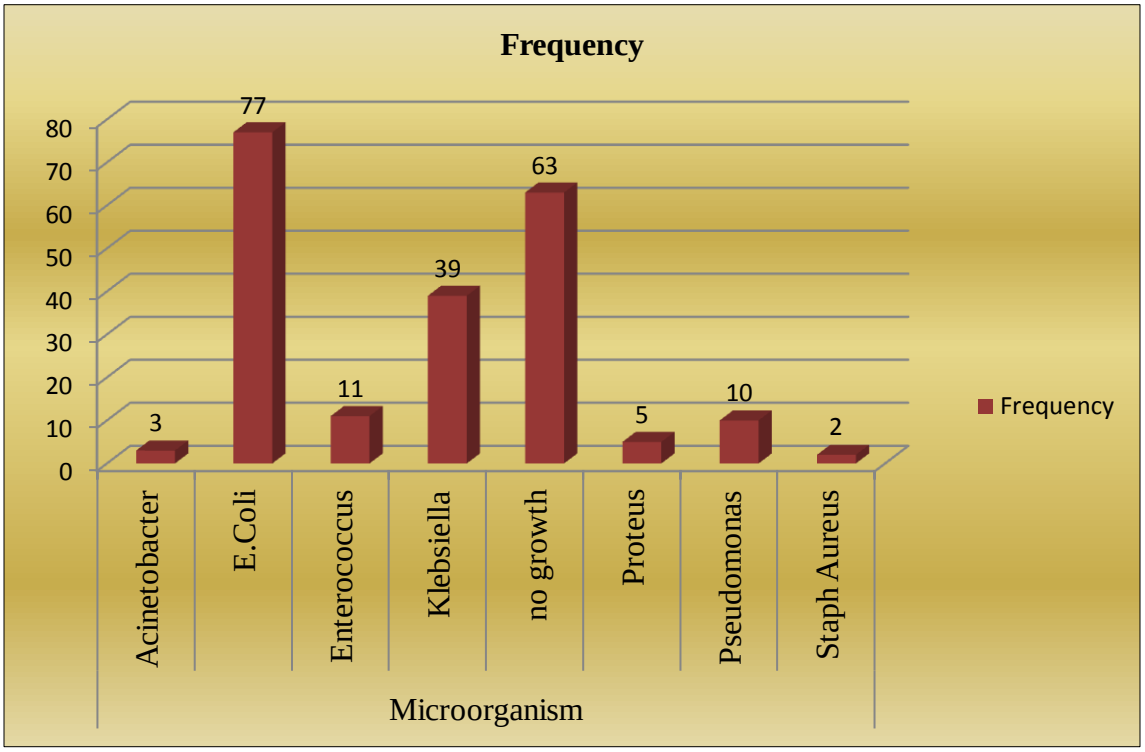
			CAUTI		Total
			Absent	Present	
Creatinine	<=1.5	Count	114	49	163
		% within CAUTI	95.0%	54.4%	77.6%
		% of Total	54.3%	23.3%	77.6%
	>1.5	Count	6	41	47
		% within CAUTI	5.0%	45.6%	22.4%
		% of Total	2.9%	19.5%	22.4%
Total		Count	120	90	210
		% within CAUTI	100.0%	100.0%	100.0%
		% of Total	57.1%	42.9%	100.0%

Chi-Square p value 0.000

Table 18: Micro organism profile

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Acinetobacter	3	1.4	1.4	1.4
	E.Coli	77	36.7	36.7	38.1
	Enterococcus	11	5.2	5.2	43.3
	Klebsiella	39	18.6	18.6	61.9
	no growth	63	30.0	30.0	91.9
	Proteus	5	2.4	2.4	94.3
	Pseudomonas	10	4.8	4.8	99.0
	Staph Aureus	2	1.0	1.0	100.0
	Total	210	100.0	100.0	

Chart 7: Microorganism profile



Logistic regression

Coefficients and Standard Errors

Variable	Coefficient	Std. Error	P
Age	-0.067851	0.024892	0.0064
Catheter_Size	0.52484	0.21960	0.0168
Diabetes	1.63283	0.60146	0.0066
Drainage_system	2.31897	0.52399	<0.0001
Duration_of_catheterisation	0.94343	0.18882	<0.0001
Place_of_catheterisation=1	1.36890	0.78026	0.0794
Sex=2	1.88000	0.65038	0.0038
Constant	-15.7110		

Odds Ratios and 95% Confidence Intervals

Variable	Odds ratio	95% CI
Age	0.9344	0.8899 to 0.9811
Catheter_Size	1.6902	1.0990 to 2.5993
Diabetes	5.1183	1.5746 to 16.6379
Drainage_system	10.1652	3.6398 to 28.3889
Duration_of_catheterisation	2.5688	1.7742 to 3.7193
Place_of_catheterisation=1	3.9310	0.8518 to 18.1415
Sex=2	6.5535	1.8317 to 23.4470

ROC curve analysis

Area under the ROC curve (AUC)

Area under the ROC curve (AUC)	0.946944
Standard Error[a]	0.0147
95% Confidence interval[b]	0.907371 to 0.973082
z statistic	30.468
Significance level P (Area=0.5)	<0.0001

[a] DeLong et al., 1988
[b] Binomial exact
Chart 8: ROC curve

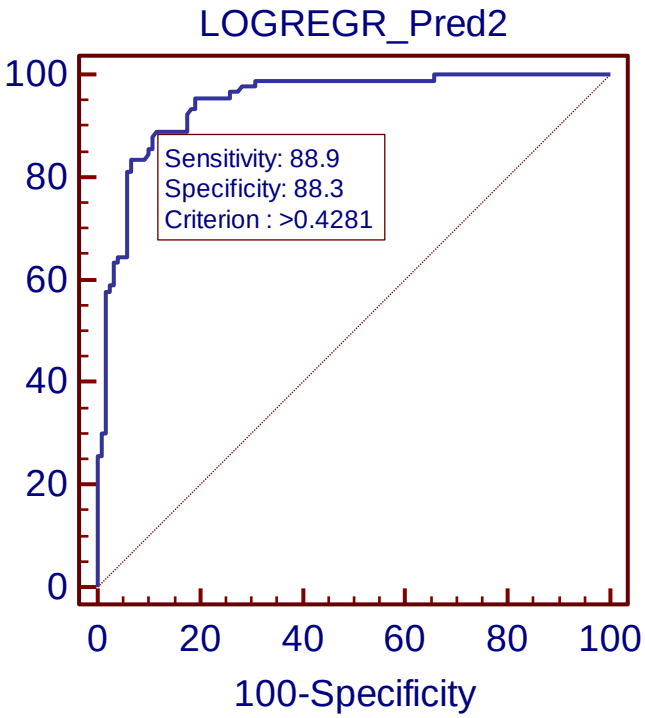


Table 19: Summary of logistic regression analysis:

Variables	P value	Odds ratio	Std error	95% C.I
Age	0.0064	0.9344	0.024892	0.8899 to 0.9811
Catheter_Size	0.0168	1.6902	0.21960	1.0990 to 2.5993
Diabetes	0.0066	5.1183	0.60146	1.5746 to 16.6379
Drainage_system	<0.0001	10.1652	0.52399	3.6398 to 28.3889
Duration_of_catheterisation	<0.0001	2.5688	0.18882	1.7742 to 3.7193
Place_of_catheterisation=1	0.0794	3.9310	0.78026	0.8518 to 18.1415
Sex=2	0.0038	6.5535	0.65038	1.8317 to 23.4470

ANALYSIS

Analysis

210 patients were included in the study.

Patients in this study were catheterized for a minimum period of 2 days to a maximum of 12 days and the mean duration of catheterization was 4.85 days (Table 1).

The age of the patients varied from a minimum of 17 years to maximum of 88 years (mean 51.61 years) (Table 2).

Among 210 patients, 141 were males and 69 were female patients (Table 3).

Three various sizes of catheters were used namely 16 Fr, 18 Fr and 22 Fr (Table 4).

Most common indication for catheterization in this study was postoperative. 64 patients were catheterized for retention of urine, 21 patients for incontinence and 13 patients were catheterized for monitoring of urine output.

Most common organism grown in culture was Escherichia coli (36.7%) followed by Klebsiella (18.6%) and pseudomonas. All the positive cultures were unimicrobial (Table 18).

Results of univariate analysis done using SPSS software version 20 revealed the following.

Sex of the patient was not significantly associated with risk of catheter associated urinary tract infection in this study (p value 0.471) when studied as an independent risk factor (Table 8).

47.8% of 64 patients presenting with retention of urine developed urinary tract infection following catheterization which was significant as an independent variable (p value 0.000) (Table 9).

21 patients were catheterized for incontinence and showed a significant correlation for development of CAUTI (p value 0.000) (Table 10).

Diabetes was associated with a significantly increased risk of CAUTI (p value 0.000) (Table 11).

96 patients were catheterized outside the operation theatre which included patients catheterized in ward and casualty. Place of catheterization was a significant risk factor with maximum risk of CAUTI seen in patients catheterized outside the operation theatre (p value 0.000) (Table 12).

89 patients had a breach in the closed system of drainage which was associated with significantly increased risk (p value 0.000) of CAUTI than in patients in with a closed drainage system (Table 13).

54 patients in this study had a duration of catheterization of 7 or more days. Duration of catheterization more than 6 days had a significantly higher risk of CAUTI than in patients with duration of catheterization less than 6 days (p value 0.000) (Table 14).

Various catheter sizes were used with 18 Fr catheter being used most commonly in 126 patients. Catheter size was not found to have a significant correlation with increased risk of CAUTI (p value 0.279) (Table 15).

74 patients in this study had a hemoglobin of less than 10 gm/dl. Patients with hemoglobin less than 10 had a significantly higher risk of CAUTI (p value 0.000) (Table 16).

Raised renal parameters with serum creatinine more than 1.5 was seen in 47 of the 210 patients studied. Patients with raised renal parameters had a significant correlation to development of CAUTI (p value 0.000) (Table 17).

Model for multivariate analysis was done using logistic regression analysis to create an ROC curve (Chart 8).

The most significant factors in this model were Age, catheter size, diabetes, duration of catheterization, a breach in the closed system of catheter drainage and sex. Drainage system and duration of catheterization were the most important factors (p value <0.001) (Table 19). The model derived has a sensitivity of 88.9% and a specificity of 88.3% in correctly predicting the risk of catheter associated urinary tract infection in patients when all the various risk factors are used.

DISCUSSION

Discussion

Indwelling urinary catheters are a routine in most urological patients. As with any medical innovation the benefits of the catheters must be weighed against its potential adverse effects. The most common adverse effect being catheter associated urinary tract infection.

Studies by four different groups[20, 24, 40, 42] have identified certain risk factors that were significantly associated with CAUTI. Factors that were found to be associated with an increased risk in one or more of the studies included prolonged duration of catheterization, female gender, renal insufficiency, diabetes, advancing age and catheter care violations.

The incidence of CAUTI in our study was 42.9% and is comparable to studies done by Domingo et al. and Danchaivijitr S et al. who reported a CAUTI incidence of 51.4% and 73.3% respectively. Majority of the patients were catheterized in the operation theatre following surgery (54.3%), rest were catheterized in the ward (31.9%) and Casualty (13.8%). The criteria for CAUTI was taken as bacteriuria in the presence of symptoms (symptomatic UTI) [as] per the CDC criteria. CAUTI rates from other studies are variable as different criteria were used to define CAUTI.

Microbiological profile in our study revealed Escherichia coli and other entero pathogens to be the most common pathogens. This has also been reported in various other studies.[2,3,4] This study did not study the organisms infecting the

urinary tract from extra luminal mechanisms wherein gram positive cocci like Staphylococcus aureus and Enterococcus were more common.

Seven factors were independently predictive of an increased risk of catheter associated urinary tract infection. Age, duration of catheterization, diabetes, catheterization place, drainage type, anemia and raised renal parameters were found to be significant risk factors. Other factors such as sex of the patient (p value 0.471) and catheter size (p value 0.279) were not found to be significant factors.

The first study done to evaluate risk factors for CAUTI done by Garibaldi et al.[23] in 1974 revealed that catheter care violations like break in the drainage system was not associated with an increased risk . In the contrary other studies done by Maki DG et al.[21] and Platt et al.[24] concluded that catheter care violations formed an important risk factor for catheter associated urinary tract infections. This was also confirmed in this study.

Seven factors were included in multivariate analysis as shown in the logistic regression table. Most significant risk factors for CAUTI were duration of catheterization and drainage system (p value <0.0001). Female gender (OR 6.55) and Diabetes (OR 5.11) were associated with a significantly increased risk. Shorter urethra in females and its proximity to the perineum are factors determining an increased risk in females.

Diabetics were consistently found to be associated with increased risk of CAUTI in all studies including this study. The possible explanation is that diabetics have an increased colonization of organisms in their perineum and urine in diabetics also supports the growth of microorganisms. Altered host immunity in diabetics may also play a role though yet to be investigated.

Duration of catheterization was found to be a very significant risk factor with an odds ratio of 2.56. Most comprehensive study of risk factors for catheter associated urinary tract infection done by Maki DG and Tambyah PA [21] also revealed that longer duration of catheterization is associated with increased chance (OR 5.2) of ascending infections either intra or extraluminal. Catheter size and age were less significant factors in the logistic regression model with an odds ratio of 1.69 and 0.93 respectively.

The place of catheterization plays an important role as catheterization outside the sterile confines of the operating room was found to be associated with a 2-5 times increased risk from various prospective studies. Place of catheterization outside the operating room had an increased of CAUTI (OR 3.93) in this study but did not show a statistical significance (p value 0.079).

This study though not a very large study has shown comparable results with other similar studies as shown in the table.

Variable	Platt[24]	Shapiro[40]	Johnson[41]	Tambyah[20]	Riley[42]	This study
Duration of catheterization	+	+	-	+	+	+
Female Gender	+	-	+	+	+	+
Diabetes	+	NR	NR	+	NR	+
Place of catheterization outside Operating room	NR	+	NR	-	NR	-
Age	-	-	-	-	+	+
Catheter care violation	NR	+	-	+	-	+

CONCLUSION

Conclusion

The urinary tract with an indwelling catheter is highly susceptible to infection. Most patients acquire CAUTI within seven days of catheterization. With more and more inappropriate use of antibiotics there is an increased risk of developing infections with resistant organisms. Prevention of CAUTI rather than cure should be the goal in all patients catheterized for an appropriate indication. An understanding of the risk factors that play a significant role in development of CAUTI helps in reducing the additional burden on the health care system especially in a developing country like ours. Simple measures as shown in this study like shortening the duration of catheterization, strict control of diabetes and sterile precautions in insertion and maintenance of indwelling catheters can help prevent CAUTI. Female gender is a host factor that is not alterable and hence catheterization in females should be done only when absolutely indicated and not as a convenience for nurses or the health care professional. The CDC definitions of CAUTI[43] should be uniformly followed so as to have a comparable outcome for further studies.

Various guidelines and studies done to prevent catheter associated urinary tract infections need to be reviewed.[43, 44, 45] Research on role of antibiotic prophylaxis, instillation of antibiotics and other agents in the drainage bag, use of different perineal care agents requires further study. The overall goal should be to identify,

educate and implement best practice measures for prevention or reducing the incidence of catheter associated urinary tract infections.

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ANNEXURE

ANNEXURE: 1

INSTITUTIONAL ETHICAL COMMITTEE
GOVT.KILPAUK MEDICAL COLLEGE,
CHENNAI-10
Ref.No.8139/ME-1/Ethics/2012 Dt:06.09.2012.
CERTIFICATE OF APPROVAL

The Institutional Ethical Committee of Govt. Kilpauk Medical College, Chennai reviewed and discussed the application for approval "A Study of risk factors for catheter associated urinary tract infection"- For Dissertation purpose submitted by Dr.Rao Karthik.B, M.Ch Genito Urinary Surgery, PG Student, KMC, Chennai-10.

The Proposal is APPROVED.

The Institutional Ethical Committee expects to be informed about the progress of the study any Adverse Drug Reaction Occurring in the Course of the study any change in the protocol and patient information /informed consent and asks to be provided a copy of the final report.

GOVT. KILPAUK MEDICAL COLLEGE
14 SEP 2012
Kilpauk, Chennai-10.

CHAIRMAN,
Ethical Committee
Govt.Kilpauk Medical College,Chennai

ANNEXURE: 2

PROFORMA

Name: KMC/GRH Date:

Age: Sex: IP No:

Complaints:

Reason for catheterization: Output monitoring

Urinary retention

Incontinence

Postoperative

Past H/O DM HT

TB COPD

CANCER

General Examination

Pallor Icterus Lymphadenopathy Edema

Systemic Examination: CVS:

P/A:

R.S:

DATE AND PLACE OF CATHETERISATION:

TYPE OF CATHETER USED:

SIZE OF CATHETER:

DRAINAGE SYSTEM: CLOSED/OPEN

DURATION OF CATHETERIZATION:

Post Catheterization symptoms:

Fever

Irritative LUTS

Supra pubic pain

Loin pain

Urinary turbidity

Investigations

Urine - Albumin

Sugar

Deposits

HEMOGLOBIN:

UREA

CREATININE

CAUTI:

URINE C/S

Organism Grown:

Antibiotic sensitivity:

ANNEXURE 3																							
S.No	Name	Age	Sex	Hosp No	OM	UR	INC	PO	Dia	HTN	TB	MAL	POC	SIZE	DS	Fev	LUTS	SP	LP	UT	DUR	CAUTI	HB	CREA	ORG
1	Sahira	43	F	1337	-	-	-	+	-	-	-	-	OT	18	Open	+	-	-	-	+	4	Symptomatic	9.6	1.1	Klebsiella
2	Begumjan	70	F	8827	-	-	+	-	+	+	-	-	Ward	18	Open	+	-	+	-	+	2	Symptomatic	8	1.4	E.Coli
3	Chandramathy	62	F	1368	-	+	-	-	+	+	-	-	Ward	16	Open	-	-	-	-	-	4	Asymptomatic	9.2	1.5	Klebsiella
4	John amma	60	F	5827	+	-	-	-	+	+	-	-	Ward	16	Open	-	-	-	-	-	2	Asymptomatic	7.4	2.6	Proteus
5	Kanniyamma	55	F	9437	-	-	-	+	-	-	-	-	OT	16	Open	-	-	-	-	-	2	Asymptomatic	9.4	1.2	Proteus
6	Balammal	65	F	9406	+	-	-	-	+	-	-	-	Ward	18	Open	+	-	-	-	-	4	Symptomatic	9.2	2	E.Coli
7	Sundari	82	F	9435	-	-	+	-	+	-	-	-	Ward	16	Closed	-	-	-	-	-	4	Asymptomatic	8.4	1.6	Klebsiella
8	Vasantha	42	F	1018	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	4	Asymptomatic	11	1.1	Klebsiella
9	Kadar Bibi	60	F	9780	-	-	+	-	+	+	-	-	Ward	16	Open	-	-	-	-	-	2	Asymptomatic	8.6	1.2	E.Coli
10	Kamala	70	F	2032	+	-	-	-	+	+	-	-	Ward	18	Open	-	-	+	-	+	4	Symptomatic	8	2.8	Pseudomonas
11	Haseena	42	F	2038	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	4	Asymptomatic	10.2	1	Klebsiella
12	Manimekalai	56	F	1015	-	-	-	+	-	+	-	-	OT	16	Closed	-	-	-	-	-	4	Asymptomatic	9.6	1.2	Pseudomonas
13	Sarada	45	F	2050	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	9.4	1.1	E.Coli
14	Maheshwari	45	F	2026	-	-	-	+	+	-	-	-	OT	18	Open	-	-	-	-	-	3	Asymptomatic	9	1.6	Klebsiella
15	Malathi	53	F	2059	-	-	-	+	+	+	-	-	OT	18	Open	+	-	-	-	-	5	Symptomatic	10.4	1.4	E.Coli
16	Sampoornam	70	F	10210	+	-	-	-	+	-	-	-	Ward	16	Open	+	-	+	-	+	8	Symptomatic	9	2.8	E.Coli
17	Suvajunissa	48	F	2657	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	10	1.1	E.Coli
18	Manjari	63	F	2122	+	-	-	-	+	-	-	-	Ward	16	Open	+	-	+	-	-	4	Symptomatic	6.8	3.4	E.Coli
19	Sumathi	41	F	6091	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	11	1.3	Pseudomonas
20	Ranganayaki	36	F	2545	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	2	Asymptomatic	9.8	1.2	E.Coli
21	Amuda	46	F	10875	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	+	3	Symptomatic	11	1	Klebsiella
22	Annapushpam	58	F	8247	-	-	-	+	-	-	-	-	OT	16	Open	-	-	-	-	-	3	Asymptomatic	10	1.2	Klebsiella
23	Jeevalakshmi	60	F	1177	-	-	+	-	+	+	-	-	Ward	18	Open	-	-	-	-	+	9	Symptomatic	8.6	1.8	Klebsiella
24	rajalakshmi	55	F	1300	-	-	-	+	+	-	-	-	OT	16	Closed	+	-	-	-	-	4	Symptomatic	10.1	1.4	E.Coli
25	Anjalai	60	F	8591	-	+	-	-	+	+	-	-	Ward	16	Open	+	-	-	-	+	6	Symptomatic	7.4	1.9	E.Coli
26	Mallika	45	F	9421	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	11.1	1.2	E.Coli
27	Selvi	45	F	2272	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	10.4	1.2	E.Coli
28	saraswathi	55	F	9899	+	-	-	-	+	+	-	-	Ward	16	Closed	-	-	-	-	+	10	Symptomatic	8	3.6	Klebsiella
29	Malar	48	F	2228	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	2	Asymptomatic	10.1	1.3	E.Coli
30	Anusuya	45	F	2185	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	10.2	1.1	E.Coli
31	Raseeda	60	F	2761	-	-	-	+	+	+	-	-	OT	18	Closed	+	-	-	-	-	4	Symptomatic	10.2	1.4	E.Coli
32	Poongavanam	70	F	1072	-	-	+	-	+	+	-	-	Ward	18	Open	-	-	+	-	+	9	Symptomatic	6.8	4.2	E.Coli
33	Rani	41	F	2534	-	-	-	+	-	-	-	-	OT	18	Open	-	-	-	-	-	2	Asymptomatic	10	1.2	Enterococcus
34	Thangarani	39	F	2836	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	9.8	1.1	no growth
35	Vasanthi	50	F	2843	-	-	-	+	+	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	10.4	1.1	E.Coli
36	Preethi	17	F	1331740	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	11.2	0.6	no growth

37	Mary	60	F	2862	+	-	-	-	+	+	-	-	Ward	16	Open	-	-	-	-	+	12	Symptomatic	9	3.5	E.Coli
38	Raniammal	70	F	1334334	-	-	+	-	+	+	-	-	Ward	16	Closed	-	-	+	-	+	8	Symptomatic	7.6	1.4	E.Coli
39	Dhanalakshmi	52	F	1378298	-	-	-	+	-	-	-	-	OT	18	Open	+	-	-	-	-	4	Symptomatic	9.2	1.1	E.Coli
40	Sabitha	19	F	133129	-	-	-	+	-	-	-	-	OT	16	Closed	+	-	-	-	-	7	Symptomatic	10.2	1.1	Klebsiella
41	Hemavathy	56	F	1948	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	4	Asymptomatic	10.1	1.3	no growth
42	Anbarasi	51	F	1335984	-	-	-	+	+	-	-	-	OT	18	Open	-	-	-	-	-	3	Asymptomatic	9	1.2	Enterococcus
43	Lakshmi	40	F	1320158	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	+	-	-	4	Symptomatic	11	1.1	no growth
44	Parvathy	57	F	1196	-	-	+	-	+	+	-	-	Ward	18	Open	+	-	+	-	-	9	Symptomatic	10	1.4	E.Coli
45	Anandi	30	F	2941	-	-	+	-	-	-	-	-	OT	16	Open	+	+	-	-	-	4	Symptomatic	9.4	1.1	E.Coli
46	Unnamalai	65	F	2945	-	+	-	-	+	-	-	-	Ward	18	Closed	+	-	-	-	-	6	Symptomatic	10	1.4	Proteus
47	Sivagami	25	F	2729	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	10.4	0.9	no growth
48	rajeshwari	40	F	1154	-	-	-	+	-	-	-	-	OT	18	Closed	+	-	-	-	-	4	Symptomatic	9.6	1.2	Klebsiella
49	Raheela	45	F	1032	-	+	-	-	+	-	-	-	Ward	16	Open	+	-	-	-	+	6	Symptomatic	8.7	1.4	Staph Aureus
50	Hamsaveni	45	F	2986	-	-	-	+	-	-	-	-	OT	18	Open	+	-	-	-	-	5	Symptomatic	11.4	1.1	Acinetobacter
51	Sangeeta	23	F	1333412	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	+	-	-	3	Symptomatic	10.2	1.2	Klebsiella
52	Zeenath	28	F	1333103	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	4	Asymptomatic	10.4	1.1	no growth
53	Gomathy	30	F	1333426	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	4	Asymptomatic	9.6	0.7	no growth
54	Sivagami	30	F	2989	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	4	Asymptomatic	10.4	1.1	no growth
55	Selvarani	25	F	1334564	-	-	-	+	-	-	-	-	OT	18	Closed	+	-	-	-	-	3	Symptomatic	11.4	1.2	no growth
56	Bagyalakshmi	64	F	4458	+	-	-	-	+	-	-	-	Ward	16	Open	+	-	-	-	-	6	Symptomatic	6.8	3.5	E.Coli
57	Saraswathi	55	F	3008	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	9.4	1.1	no growth
58	Muniyamma	43	F	3032	-	-	+	-	+	-	-	-	Ward	18	Open	-	-	-	-	-	4	Asymptomatic	9.4	1.8	E.Coli
59	Kanagavalli	75	F	3622	-	-	+	-	+	+	-	-	Ward	16	Open	+	-	-	-	-	8	Symptomatic	8.9	1.9	Enterococcus
60	Indra	28	F	2987	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	9.8	0.9	no growth
61	Valarmathi	35	F	1988	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	4	Asymptomatic	11.2	1.1	no growth
62	Vidya	34	F	3065	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	9.7	1.1	no growth
63	Angammal	35	F	111860	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	9.8	1.1	no growth
64	Selvi	41	F	111986	-	-	+	-	-	-	-	+	Ward	18	Open	+	-	-	+	-	9	Symptomatic	8.4	1.9	Enterococcus
65	Devi	28	F	110720	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	4	Asymptomatic	9.4	1.2	no growth
66	Latha	31	F	111321	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	2	Asymptomatic	11	0.9	no growth
67	Geetha	55	F	114532	+	-	-	-	+	+	-	-	Ward	16	Open	-	-	+	+	-	6	Symptomatic	8	3.5	E.Coli
68	Jyothi	37	F	114322	-	-	-	+	-	-	-	-	OT	18	Closed	+	-	-	-	-	3	Symptomatic	10.1	1	E.Coli
69	Hamsa	45	F	275	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	2	Asymptomatic	8.9	1.3	no growth
70	Damodar	40	M	8247	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	2	Asymptomatic	12.1	1.3	E.Coli
71	Nirmal Kumar	35	M	1341	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	2	Asymptomatic	11.8	1.2	E.Coli
72	Syed Mubeen	66	M	1340		+	-	-	+	+	-	-	Casualty	18	Open	+	-	+	-	-	5	Symptomatic	10	1.6	E.Coli
73	Arjun	26	M	1335	-	+	-	-	-	-	-	-	Ward	16	Closed	-	-	-	-	-	4	Asymptomatic	12.5	1	E.Coli
74	Gopinath	66	M	1385	-	+	-	-	-	+	-	-	Casualty	16	Open	+	-	-	-	-	6	Symptomatic	10.2	1.8	E.Coli

75	Krishnan	60	M	9139	-	+	-	-	-	-	-	-	Casualty	18	Closed	+	-	-	-	-	7	Symptomatic	10.1	1.3	E.Coli
76	Subramani	87	M	9203	-	+	-	-	+	+	-	-	Casualty	18	Open	+	-	-	-	-	4	Symptomatic	8.7	1.8	Proteus
77	Anto	67	M	2541	-	+	-	-	+	+	-	-	Ward	18	Closed	-	-	-	-	-	4	Asymptomatic	10.4	1.6	E.Coli
78	Kothandaraman	83	M	9475	-	+	-	-	-	+	-	-	Ward	18	Closed	-	-	-	-	-	10	Asymptomatic	8	1.4	Pseudomonas
79	Navaneethan	45	M	1402	-	-	-	+	+	-	-	-	OT	18	Closed	-	-	-	-	-	4	Asymptomatic	10.2	1.2	E.Coli
80	Mahmood khan	45	M	9461	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	4	Asymptomatic	10.8	1.4	E.Coli
81	Paneerselvam	88	M	14028	-	+	-	-	+	-	-	-	Ward	18	Open	+	-	+	-	+	6	Symptomatic	10	1.5	E.Coli
82	Arumugam	56	M	9627	-	+	-	-	-	+	-	-	Casualty	18	Open	-	-	-	-	-	4	Asymptomatic	11.8	1.4	Klebsiella
83	Kumarasamy	75	M	9922	-	+	-	-	+	-	-	-	Ward	18	Closed	-	-	-	-	-	4	Asymptomatic	10.2	1.2	E.Coli
84	Krishnamurthy	46	M	1716	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	4	Asymptomatic	11	1.1	E.Coli
85	Prasad	55	M	6228	-	-	+	-	+	-	-	-	Ward	18	Open	-	-	+	+	-	3	Symptomatic	9.6	1.8	Pseudomonas
86	Chandran	60	M	2012	-	+	-	-	+	+	-	-	Ward	18	Closed	-	-	-	-	-	4	Asymptomatic	10.2	1.4	E.Coli
87	Venkatesan	68	M	10377	-	+	-	-	-	+	-	-	Casualty	18	Open	-	-	+	-	+	6	Symptomatic	10.1	1.3	Klebsiella
88	Chelladurai	65	M	10371	-	+	-	-	+	+	-	-	Ward	18	Closed	-	-	-	-	+	7	Symptomatic	11	1.2	E.Coli
89	balan	39	M	2051	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	10.8	0.9	Pseudomonas
90	vanasami	87	M	10388	-	-	+	-	+	-	-	-	Ward	18	Open	+	-	-	-	-	9	Symptomatic	9.2	1.6	E.Coli
91	Suresh	28	M	1472	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	2	Asymptomatic	12	0.8	Klebsiella
92	Kannan	40	M	2777	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	2	Asymptomatic	12	1.2	Klebsiella
93	Govindan	60	M	1084	-	+	-	-	-	+	-	-	Ward	18	Open	+	-	+	-	+	7	Symptomatic	9.6	1.5	E.Coli
94	Chelladurai	70	M	10077	-	+	-	-	+	+	-	-	Casualty	18	Open	-	-	-	-	+	5	Symptomatic	10.4	1.8	E.Coli
95	Durairaj	60	M	1892	-	+	-	-	-	-	-	-	Ward	18	Closed	-	-	+	-	+	8	Symptomatic	9.4	1.7	E.Coli
96	Pandi	50	M	1416	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	11.4	1.2	Klebsiella
97	Nariah	65	M	10534	-	+	-	-	-	+	-	-	Casualty	18	Open	-	-	+	-	-	6	Symptomatic	9.6	1.6	Klebsiella
98	Vinayakam	68	M	10035	-	-	-	+	-	+	-	-	OT	22	Open	+	+	-	-	-	5	Symptomatic	10	1.4	Klebsiella
99	Durairaj	56	M	2124	-	+	-	-	-	-	-	-	Casualty	18	Open	+	-	-	-	-	4	Symptomatic	10.4	1.3	Pseudomonas
100	Perumal	62	M	2132	-	+	-	+	+	-	-	-	OT	22	Open	-	+	+	-	-	10	Symptomatic	11.2	1.4	E.Coli
101	Solai	65	M	2128	-	+	-	-	-	-	-	-	Ward	18	Closed	-	-	-	-	-	4	Asymptomatic	10	1.3	Klebsiella
102	Balan	60	M	4249	-	-	+	-	+	+	-	-	Ward	18	Open	-	-	+	-	+	8	Symptomatic	9.6	1.4	E.Coli
103	Kumar	51	M	11064	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	12.6	1.1	Klebsiella
104	mani	70	M	10590	-	+	-	-	-	+	-	-	Ward	18	Closed	-	-	-	-	-	9	Asymptomatic	10.8	1.1	Klebsiella
105	Murugesan	36	M	11194	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	2	Asymptomatic	12.8	1.1	Klebsiella
106	Srinivasan	75	M	4214	-	+	-	-	+	+	-	+	Ward	16	Open	-	-	-	-	+	11	Symptomatic	9.8	1.6	E.Coli
107	Babu	37	M	11137	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	13	1.1	Pseudomonas
108	Thangappa	70	M	3156	-	+	-	-	-	-	-	-	Ward	18	Open	-	-	+	-	+	11	Symptomatic	9.8	1.4	Klebsiella
109	Eshwaran	60	M	10845	-	+	-	-	+	-	-	-	Casualty	16	Open	+	-	-	-	-	7	Symptomatic	11.2	1.2	Klebsiella
110	Balaji	65	M	2370	-	-	+	-	-	-	-	+	Ward	18	Closed	-	-	-	-	-	12	Asymptomatic	10	1.6	Klebsiella
111	Jayakannan	27	M	2293	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	12.8	0.8	Klebsiella
112	Jayakumar	60	M	2377	-	+	-	-	-	+	-	-	Ward	18	Open	-	-	-	-	-	5	Asymptomatic	10.3	1.2	E.Coli

113	Abdullah	62	M	2373	-	+	-	-	+	-	-	-	Casualty	16	Closed	+	-	-	-	-	8	Symptomatic	10	1.1	Klebsiella
114	Nasooran	55	M	2345	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	11	0.9	E.Coli
115	Mani	65	M	2813	-	+	-	-	-	+	-	-	Ward	18	Open	-	-	-	-	+	8	Symptomatic	9.2	1.3	E.Coli
116	Surendar	26	M	2820	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	12.6	0.9	E.Coli
117	Natrajan	61	M	2809	-	+	-	-	+	-	-	-	Casualty	16	Open	-	-	+	-	+	8	Symptomatic	9.6	1.8	Klebsiella
118	Johnson	54	M	2823	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	4	Asymptomatic	10.8	1.2	no growth
119	Pandiyaraj	63	M	2012	-	-	+	-	+	+	-	-	Ward	18	Open	-	-	-	-	+	10	Symptomatic	9.4	1.6	E.Coli
120	Chandra raja	45	M	2822	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	4	Asymptomatic	11.2	1.4	Enterococcus
121	ragu	32	M	2806	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	10.5	1.1	Staph Aureus
122	Natraj	72	M	1331368	+	-	-	-	+	+	-	-	Ward	18	Open	+	-	-	-	+	8	Symptomatic	8	2.4	Enterococcus
123	Mohan	19	M	1331603	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	12.8	0.7	no growth
124	Krishnamurthy	60	M	1330715	-	+	-	-	+	-	-	-	Casualty	16	Open	+	-	-	-	+	5	Symptomatic	10.4	1.3	E.Coli
125	Thangaraj	62	M	2359	-	+	-	-	-	+	-	-	Ward	18	Closed	-	-	-	-	-	4	Asymptomatic	10.4	1.2	no growth
126	Dilip Kumar	70	M	2038	-	-	-	+	+	-	-	-	OT	18	Open	-	-	-	-	-	5	Asymptomatic	11.1	1.3	E.Coli
127	Thirumalaidasan	32	M	1934	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	13.2	0.9	no growth
128	Kondiya	40	M	2841	-	+	-	-	-	-	-	-	Casualty	16	Open	+	-	+	-	-	4	Symptomatic	11	1.2	E.Coli
129	Ekambaram	63	M	2893	-	+	-	-	-	-	-	-	Casualty	18	Open	+	-	-	-	-	6	Symptomatic	9.6	1.4	Enterococcus
130	Periyasamy	65	M	1332192	-	+	-	-	+	+	-	-	Ward	18	Open	+	-	-	-	-	8	Symptomatic	8.4	1.3	Klebsiella
131	Devaraj	42	M	2745	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	4	Asymptomatic	12	1.1	no growth
132	ganesan	76	M	2890	-	+	-	-	-	-	-	+	Ward	18	Open	-	-	+	-	-	6	Symptomatic	10.1	1.4	E.Coli
133	Babu	54	M	2893	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	4	Asymptomatic	12.6	1.1	no growth
134	balaraman	74	M	2904	-	+	-	-	+	-	-	-	Ward	18	Open	+	-	-	-	-	7	Symptomatic	8.9	1.2	E.Coli
135	Velu	29	M	2914	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	2	Asymptomatic	12	1.1	no growth
136	Baskar	39	M	1332892	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	11.4	1.2	no growth
137	Vetrivel	23	M	1332595	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	4	Asymptomatic	10.2	0.9	no growth
138	Kandasamy	60	M	1332891	-	+	-	-	+	-	-	-	Casualty	16	Closed	+	-	-	-	-	8	Symptomatic	9.4	1.6	E.Coli
139	Murugesan	70	M	1320	-	+	-	-	-	+	-	-	Ward	18	Closed	-	-	-	-	-	7	Asymptomatic	9.4	1.3	E.Coli
140	Vijayan	42	M	2838	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	4	Asymptomatic	12.1	1.3	no growth
141	Pachiyappan	71	M	2940	-	+	-	-	+	-	-	-	Casualty	18	Closed	-	-	-	-	-	6	Asymptomatic	9.2	1.2	Proteus
142	Pandian	48	M	1237	-	-	-	+	-	-	-	-	OT	16	Open	-	-	-	-	-	4	Asymptomatic	10.2	1.3	Enterococcus
143	Arumugam	65	M	2938	-	+	-	-	-	-	-	-	Ward	18	Closed	-	-	-	-	-	5	Asymptomatic	9.7	1.3	no growth
144	Ramachandran	38	M	1333061	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	2	Asymptomatic	12.4	1.1	no growth
145	Karunamurthy	33	M	22206	-	+	-	-	-	-	-	-	Casualty	16	Open	+	-	-	-	+	6	Symptomatic	11	0.9	Pseudomonas
146	gangadaran	19	M	1993	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	2	Asymptomatic	11.2	0.8	no growth
147	Pandiyaraj	29	M	2822	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	10.3	0.9	no growth
148	Shankar	33	M	2272	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	11	1.2	no growth
149	Sourirajan	65	M	635	-	+	-	-	+	+	-	-	Ward	18	Open	-	-	-	-	+	8	Symptomatic	9.6	1.5	E.Coli
150	Arasu	28	M	1318309	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	2	Asymptomatic	11.2	1.1	no growth

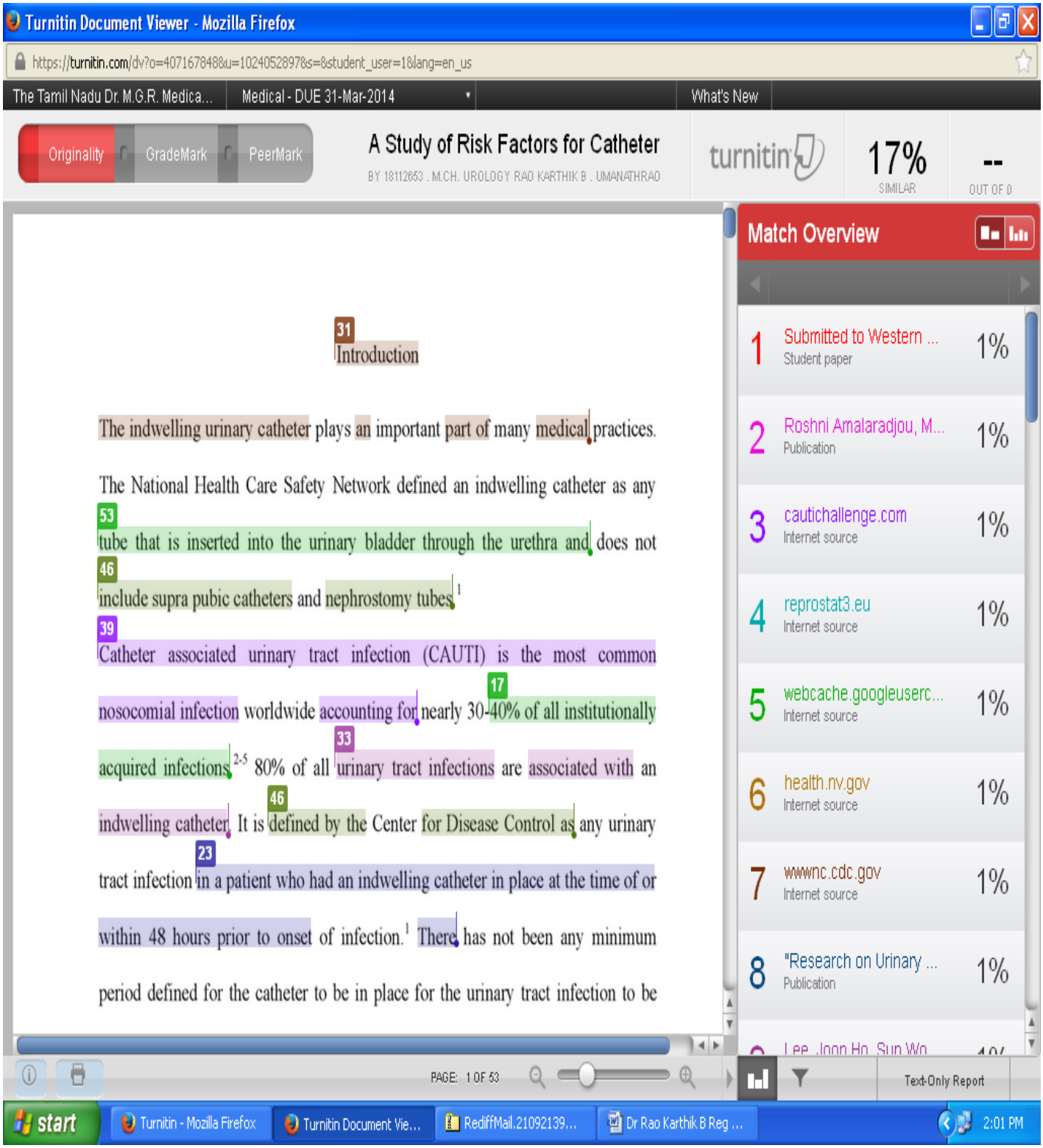
151	Abdul	31	M	2827	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	10.8	0.9	no growth
152	chakravarthy	63	M	1503	-	+	-	-	+	-	-	-	Casualty	16	Open	+	-	-	-	-	9	Symptomatic	9.6	1.4	E.Coli
153	Rajamanickam	63	M	1600	+	-	-	-	+	+	-	-	Ward	18	Open	+	-	+	-	-	8	Symptomatic	6.8	4.2	Klebsiella
154	Anandan	32	M	2976	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	12	1.1	no growth
155	Thirunavakarasu	60	M	2526	-	+	-	-	+	+	-	-	Casualty	16	Open	+	-	+	-	-	9	Symptomatic	10	1.8	E.Coli
156	Nethran	36	M	2970	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	12.1	0.7	no growth
157	Parameshwaran	70	M	1333508	-	+	-	-	+	-	-	-	Ward	18	Open	+	-	-	-	-	8	Symptomatic	9.8	1.6	Pseudomonas
158	Subramani	70	M	2997	-	+	-	-	+	+	-	-	Ward	18	Open	+	-	-	-	-	8	Symptomatic	8.6	1.8	Enterococcus
159	Jayapal	50	M	8732	-	-	-	+	-	+	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	12	1.4	E.Coli
160	Balaji	25	M	3004	-	+	-	-	-	-	-	-	Ward	16	Closed	-	-	-	-	-	4	Asymptomatic	9.7	0.8	no growth
161	Krishnan	73	M	2475	-	+	-	-	+	-	-	-	Casualty	18	Open	+	-	+	-	-	8	Symptomatic	10.4	1.6	Enterococcus
162	Paneerselvam	62	M	3003	-	-	+	-	+	+	-	-	Ward	18	Open	+	-	-	-	+	9	Symptomatic	9.4	1.9	E.Coli
163	Perumal	73	M	2966	-	+	-	-	-	+	-	-	Casualty	18	Closed	-	-	-	-	+	5	Asymptomatic	10.3	1.2	Enterococcus
164	Kumar	27	M	3031	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	4	Asymptomatic	12	0.8	no growth
165	Antonydas	70	M	2942	-	+	-	-	-	-	-	-	Ward	18	Open	-	-	-	-	-	5	Asymptomatic	10.2	1.4	Klebsiella
166	Jayaraman	65	M	4018	-	-	-	+	-	+	-	-	OT	18	Closed	-	-	-	-	-	4	Asymptomatic	10.2	1.4	no growth
167	saravanan	40	M	2830	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	12.4	1.2	no growth
168	Murugesan	56	M	1334873	-	+	-	-	+	-	-	-	Casualty	18	Closed	-	-	-	-	+	6	Symptomatic	11	1.4	E.Coli
169	Senthil Kumar	53	M	3037	-	-	-	+	-	-	-	-	Ward	16	Open	-	-	-	-	+	8	Symptomatic	10	1.2	E.Coli
170	Dandapani	53	M	7380	-	-	-	+	+	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	11.3	1.1	Acinetobacter
171	Kumaran	33	M	3056	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	10.4	1.3	no growth
172	Sourirajan	65	M	6351	-	+	-	-	+	+	-	-	Casualty	16	Open	+	-	+	-	-	7	Symptomatic	10	1.6	E.Coli
173	Antony	76	M	2942	-	+	-	-	-	-	-	-	Ward	18	Closed	-	-	-	-	-	4	Asymptomatic	11.2	1.4	no growth
174	Raja Manickam	75	M	3055	-	+	-	-	+	-	-	-	Ward	18	Open	+	-	-	-	+	8	Symptomatic	9.4	1.5	E.Coli
175	Kannan	33	M	1335488	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	12.6	1	no growth
176	Krishnan	45	M	3049	-	-	-	+	+	+	-	-	OT	18	Closed	-	-	+	-	-	4	Symptomatic	10.5	1.6	Klebsiella
177	Thiyagararajan	35	M	1334571	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	11.8	0.9	no growth
178	Thangavel	32	M	3065	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	10.1	1.4	no growth
179	Vijayan	45	M	2838	+	-	-	-	+	+	-	-	Ward	16	Open	+	-	+	-	+	9	Symptomatic	7.4	3.8	Acinetobacter
180	Balakumaran	73	M	1087	-	+	-	-	-	+	-	-	Casualty	18	Open	+	-	-	-	+	8	Symptomatic	10.4	2	Klebsiella
181	Gopal	59	M	3073	-	+	-	-	+	-	-	-	Casualty	18	Closed	-	-	-	-	+	6	Symptomatic	10.3	1.6	E.Coli
182	Venkatesan	50	M	2108	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	4	Asymptomatic	12.6	1.1	no growth
183	Karupiah	63	M	112586	-	+	-	-	-	-	-	-	OT	22	Open	-	-	-	-	-	4	Asymptomatic	10.4	1.3	E.Coli
184	Suresh kumar	30	M	112521	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	11.3	1.1	no growth
185	Thameem Ansar	34	M	112551	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	10.8	1.4	no growth
186	Joseph	60	M	112284	-	-	+	-	+	+	-	-	Casualty	16	Open	+	-	-	-	-	7	Symptomatic	9.6	1.8	Klebsiella
187	Kothandan	68	M	112288	-	-	+	-	-	+	-	+	Ward	18	Closed	-	-	+	-	+	8	Symptomatic	10.4	1.2	E.Coli
188	Narayanan	41	M	111549	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	2	Asymptomatic	12.4	1	no growth

189	Janakiraman	77	M	111552	-	+	-	-	+	-	-	-	Ward	18	Closed	-	-	-	-	-	5	Asymptomatic	10.1	1.4	no growth
190	Susai Michael	48	M	110836	-	-	-	+	-	+	-	-	OT	18	Open	-	-	-	-	-	3	Asymptomatic	11.2	1.1	E.Coli
191	Srinivasan	78	M	109033	-	-	-	+	-	-	-	-	OT	22	Open	-	-	-	-	-	4	Asymptomatic	9.6	1.5	no growth
192	Senthil Kumar	32	M	111033	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	2	Asymptomatic	13.6	0.8	no growth
193	Vasudevan	32	M	456	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	2	Asymptomatic	11.4	1.1	no growth
194	Easurajan	63	M	110591	-	+	-	-	-	+	-	-	Casualty	18	Open	+	-	-		+	7	Symptomatic	10.1	1.6	Klebsiella
195	Thangavel	70	M	114062	-	-	+	-	+	-	-	+	Ward	18	Open	-	-	+	-	+	8	Symptomatic	10.8	1.4	E.Coli
196	Vamanan	38	M	114288	-	-	-	+	-	-	-	-	OT	18	Closed	-	-	-	-	-	3	Asymptomatic	12	0.9	no growth
197	Muruga Pillai	70	M	114063	-	-	-	+	-	-	-	-	OT	22	Open	-	-	-	-	-	4	Asymptomatic	11.4	1.2	no growth
198	Murugan	42	M	113715	-	-	-	+	-	-	-	-	OT	18	Open	-	-	-	-	-	4	Asymptomatic	12	0.8	no growth
199	Balachandran	40	M	113549	-	-	-	+	-	-	-	-	OT	18	Open	-	-	-	-	-	4	Asymptomatic	13.2	1.1	no growth
200	Ruban	36	M	113331	-	-	-	+	-	-	-	+	OT	22	Open	+	-	-	-	-	3	Symptomatic	8.9	1.4	Klebsiella
201	Ramiah	76	M	112584	-	+	-	-	+	+	-	-	Casualty	16	Open	-	-	+	-	+	8	Symptomatic	10.1	1.7	E.Coli
202	Kaliah perumal	75	M	112332	-	-	-	+	-	+	-	-	OT	18	Closed	-	-	-	-	-	4	Asymptomatic	10	1.3	no growth
203	Vasan	35	M	113652	-	-	-	+	-	+	-	-	OT	18	Closed	-	-	-	-	-	4	Asymptomatic	13.4	0.8	no growth
204	manickam	65	M	725	-	+	-	-	+	-	-	-	Ward	18	Closed	-	-	-	-	-	5	Asymptomatic	10.1	1.4	no growth
205	Karthikeyan	66	M	1266	-	-	+	-	+	-	-	-	Ward	18	Open	+	-	-	-	+	8	Symptomatic	9.5	1.2	Klebsiella
206	Basha	42	M	891	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	11.3	1.1	no growth
207	Baktavatchalam	40	M	1207	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	3	Asymptomatic	10.8	1.2	no growth
208	Shankar	45	M	1165	+	-	-	-	+	+	-	-	Ward	18	Open	+	-	-	-	+	8	Symptomatic	6.8	4.1	E.Coli
209	Abdul Azeez	63	M	427	-	-	-	+	-	+	-	-	OT	22	Open	-	+	-	-	-	4	Symptomatic	11.4	1.4	E.Coli
210	Babu	39	M	13551	-	-	-	+	-	-	-	-	OT	16	Closed	-	-	-	-	-	4	Asymptomatic	12.1	1.1	no growth

Key to master chart

OM:	Output Monitoring	Fev:	Fever
UR:	Urinary Retention	LUTS:	Lower urinary tract symptoms
INC:	Incontinence	SP:	Suprapubic pain
PO:	Post operative	LP:	Loin Pain
Dia:	Diabetes	UT:	Urinary turbidity
HTN	Hypertension	DUR:	Duration of Catheterization
TB:	Tuberculosis	HB:	Hemoglobin
MAL:	Malignancy	CREA:	Creatinine
POC:	Place of catheterization	ORG:	Organism
DS:	Drainage system		

Annexure 4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Introduction
The indwelling urinary catheter plays an important part of many medical practices.
The National Health Care Safety Network defined an indwelling catheter as any tube that is inserted into the urinary bladder through the urethra and does not include supra pubic catheters and nephrostomy tubes.[1]
Catheter associated urinary tract infection (CAUTI) is the most common nosocomial infection worldwide accounting for nearly 30-40% of all institutionally acquired infections.[2-5] 80% of all urinary tract infections are associated with an indwelling catheter. It is defined by the Center for Disease Control as any urinary tract infection in a patient who had an indwelling catheter in place at the time of or within 48 hours prior to onset of infection.[1] There has not been any minimum period defined for the catheter to be in place for the urinary tract infection to be
Match Overview
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