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A STUDY OF CATHETER-ASSOCIATED URINARY TRACT INFECTION (CAUTI) IN PATIENTS ADMITTED IN TERTIARY CARE HOSPITAL

General Surgery

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KEYWORDS

INTRODUCTION

The word catheter is derived from greek word Kathiena.[1] Meaning of kathiena is 'to send down' or ' to thrust in to'. For the drainage of urinary bladder urinary catheters used since 3500 years[2,3,4]

Urinary catheterisation is a routine medical procedure can facilitate direct drainage of urinary bladder. Urinary catheterisation can be used as therapeutically or diagnostically[9] .

Most commonly we are using a foley catheter. Urethral catheterisation may cause damage to urethra, bladder, recurrent & chronic urinary tract infection and contribute to development of antibiotic resistance.[11] Different Complications can occur due to urethral catheterisation, the present study intends to study the trauma/injury caused by the urethral catheterisation, to study the CAUTI, and the compliance with urinary catheter care.

CAUTI – Catheter Associated Urinary Tract Infections are the most common hospital acquired infections and can results in sepsis, prolonged hospital stay & increased mortality[12,13].Catheter associated urinary tract infections constitutes about 40-50% of all hospital infections.Because of CAUTI the patients stay in hospital will increases and also use of higher antibiotics and overall the total cost of health system increase.If proper catheter care & preventive protocols of CAUTI are not maintained or followed, CAUTI can occour with higher incidence. [11,14]

Increased use of indwelling urinary catheters is associated with increased risk for development of CAUTI.[10,15,16] After insertion of catheter CAUTI infections are caused by biofilms composed of microorganisms having extra celluler matrix present on both the surface of catheters and then asend from catheter to urinary bladder[11].If the urinary catheter is present in urinary tract then this catheter can decreases our body ability to eliminate bacteria from lower urinary tract[12]. If Urinary catheter is kept unnecessarily for more days these patients have greater risk of development of infections. Seventy percent of CAUTI can be preventable with following measures or care.

1. Insertion only when it is indicated.
2. Proper insertion of catheter.
3. Proper catheter care .
4. Speedy removal or simply remove the catheter when it is no longer required or recommended[9,13].

Confusion or changes in mental status can be signs of CAUTI in aged patients and also diagnosis of CAUTI in unconscious patients is also difficult[17,18]

The present study intends to study the trauma/injury caused by the urethral catheterisation & CAUTI and the compliance with catheter care in the tertiary care teaching hospital.

Review Of Literature

Types Of Urinary Catheters

- Indwelling catheters
- External catheters
- ntermittent (short term catheters)

More other types of catheters

- Straight single use catheters
- 3-way foley catheter
- Corved or COUDE catheters
- 2-way foley catheters[2,26]

Types Of Catheter Material

- Silicon
- Latex rubber
- Polyvinyl chloride(PVC)

Indications Of Urethral Catheterisation

1. Diagnostic

- Collection of uncontaminated urine sample
- Urine output documentation
- plays an important role while performing Urodynamic studies

2. Therapeutic

- Acute urinary retention
- Useful for urinary bladder irrigation
- Intermittent decompression for neurogenic bladder
- Intavesical chemothearpy

Foleys Catheter

Foleys catheter was discovered by the Frederic Eugene Basil Foley in 1929[3,4,5,6,7,8]

Complications Of Urethral Catheterisation

1. Short term complications

- Traumatic catheterisation
- False passage
- Haematuria
- UTI

2. Long term complications

- Colonisation by bacteria
- Urethral sloughing
- Malignancy
- Stones
- Haematuria and Obstruction[30,31,32,33,34]

Traumatic Catheterisation

Traumatic urinary catheterisation is the most common complication of urethral catheterisation. It can occur in both men and women but male patients sufferred more from traumatic catheterisation because longer urethra and sometimes enlarged prostate and some other obstructive conditions in lower urinary tract.The most common cause of traumatic catheterisation is improper or faulty urinary catheter insertion technique. Bleeding due to traumatic catheterisation usually stops within short period of time and rarely it require urological intervention.

Pain
Pain or discomfort is also common complaint of most of the patients during urinary catheterisation. Pain may be worsened by tension or anxiety. Adequate catheter lubrication along the entire length of the catheter in men and correct positioning of the urethra can decrease pain. Pain and discomfort usually subside within a short period of time.

Hematuria
Hematuria is commonly seen in patients who have long duration catheters .Sometimes bleeding may occur during the procedure of catheter insertion, but, if the bleeding persists, urine cytology and a cystoscopy should be taken into consideration

Bacteriuria
Bacteriuria (bacteria in the urine) is commonly seen in patients with catheter with a duration of 2-10 days. Various organisms are present in the periurethral area and in the distal part of the urethra that may get colonise into the bladder at the time of catheter insertion.

Other factors that increase the risk of bacteriuria are the presence of residual urine because of inadequate bladder drainage in the bladder (urine stasis promotes bacterial growth) and ischemic damage to the bladder mucosa through overdistention and mechanical irritation from the presence of a catheter, and biofilm formation on the catheter intraluminal surface

Catheter Encrustation
Encrustations are caused by mineral deposition within the catheter , which are unique to biofilms formed on urinary catheters. Encrustations are seen typically on the inner surface of the catheter and can block catheter flow completely. Long-term catheterization is associated with encrustation, because it has a direct relationship with the duration of catheterization. Alkaline urinary pH is an important factor in causing catheter encrustations.

False Passage
False passage is the important complication of urethral catheterisation . It is seen mainly in mens.Men with enlarged prostate and pre-existing urethral strictures are at more risk or prone to develop false passage. Most common site of false passage is just distal to prosatete. False passage may needs urological intervention.

Urethral Srtictures
Urethral strictures has tendency to occur in the anterior portion of the male urethra (meatus, penile urethra, bulbar urethra) or in the posterior portion (membranous urethra and prostatic urethra). These strictures occurs due to an inflammatory response from repeated trauma to urethra.. Increased frequency of catheterization may associated with urethral damage.When hydrophilic catheters are used there are less chances of stricture formation. If a stricture is suspected, a retrograde urethrogram or voiding cystourethrogram is a investigation of choice. Prevalence of urethral strictures and false passages tend to increase with chronic use of intermittent and traumatic catheterization.

Cauti- Catheter Associated Urinary Tract Infections
One of the most common and severe complication that occour with the improper urinary catheter use is a UTI, refered to as a 'Catheter Associated Urinary Tract Infections or CAUTI'.[13,35]

A CAUTI is most commonly encountered in hospitals and contributes to more than 40% of hospital acquired infections[19]. Female subjects are more prone to develop CAUTIs than men subjects because of shorter length of female urethra and close proximity of female urethra to anus &bacteria have shorter distance to travel from anus to reach lower urinary tract and produce infection in short time[36].

The presence of urinary catheter and its catheter days is the single most important risk factor for development of CAUTIs[27,39].CAUTI can lerad to urospsis , septicemia , infections. Urinary catheter is the common cause for introduction of microorganism into urinary bladder and promot their growth or colonisation[39].

Pathogenesis Of Cauti
Most of the bacterias causing CAUTIs can gain access to urinary tract either extraluminaly or intraluminaly[39]. After insertion of catheter CAUTI infections are formed by biofilms contents microorganisms[40].The presence of catheter in urinary system can decreases the human body's ability to eliminate bacteria from lower urinary tract[12].

In a patient with spinal cord injury diagnosis of catheter associated infections is difficult because of abcence of localising symtomps.

Extraluminal contamination is the most common source of contamination,may occur as soon as the catheter is inserted & by contamination of the catheter from any of external source. Microorganisms from the perineum area causesextraluminal contamination by ascending from the perineum along the surface of the catheter. Feacal strains contaminate the perineum and urethral meatus, and then ascend to the bladder along the external surface to cause bacteriuria, catheter biofilm formation, and encrustation[40,39].Following are the intraluminal causes of contamination by spread of bacteria from a unsterilised catheter, drainage tube, or urobag.

Microorganisms can take1 to 3 days to migrate up the urinarybladder from catheter. At least 66% of CAUTIs result from extraluminal contamination, whereas 34% as result of the intraluminal route.

There are three catheter-associated entry points for bacteria into urinary system :-
1. The urethral meatus, at the time of insertion of the urinary catheter.
2. The point of the catheter &bag connection, mostly when there is a break in the closed catheter system.
3. The drainage port of the collection bag.

All the above mentioned points are responsible for CAUTI.
Once an indwelling urinary catheter is inserted, bacterial colonisation occurs ,also known as biofilms (living layers) that adhere to the catheter surface material and urobag.

Biofilms can begin to develop within the first 24 hours after catheter insertion.A biofilm is formed of a collection of microorganisms with altered phenotypes that colonize the surface of a medical device such as an indwelling urinary catheter.[40]

Biofilms on the urinary catheter initially composed of single organisms, but over a time or prolonged exposure lead to multi-organism biofilms. Bacteria in biofilms have longer survival over other microorganisms & they are extremely resistant to antibiotic therapy.

Biofilm can provides a sustained reservoir for microorganisms that infect the patient. These biofilms cause further problems if the enzyme urease is produced by bacteria.

Ulkalisation of urine causes production of ammonium ions, followed by crystallization of calcium and magnesium phosphate within the urine and these crystals are then incorporated into the biofilm, resulting in encrustation of the catheter.

Biofilm can inhibit antimicrobial activity, organisms within the biofilm cannot be eradicated by antimicrobial therapy alone. The urinary biofilm provides a protective environment for the microorganisms and also attactment to catheter surfaces in a manner that prevents removal with gentle rinsing, such as irrigation. Biofilms over a time period can block lumen of catheter.[40]

Clinical Features Of Cautis Or Defination
1. Indwelling urinary catheter in place for more than 2 days of infection
2. At least one of following

Fever >38c
- Supra pubic tenderness
- Dysuria
- Urinary frequency
- Urinary urgency
- Tenderness or pain in renal angle

3. Positive urine culture with two or fewer species of microorganism grown, with at least one being a bacterium with $>10^5$CFU/ml.

Risk Factors For Cauti
- Prolonged catheterisation
- Female gender
- Catheter insertion done outside operating room
- Urology service
- Other active site of infection
- Diabetes mellitus

- Malnutrition
- Azotemia
- Ureteral stents
- Monitering of urine output
- Drainage tube above bladder but above collection
- Antibiotics usage[40]

Cauti Prevention

It is fact that the 70% of catheter associated infections are preventable by simple measures like, 1.Insertion of catheter only when indicated. 2.Removing catheter as soon as the indication of catheter insertion is no longer present. 3.Alternatives to indwelling urinary catheters to reduce risk of CAUTI are intermitttant catheters and condom catheters for males.It is not always possible to avoid insertion of indwelling urinary catheters so following are strategies to minimise CAUTI.

- Sterile procedure for insertion.
- Speedy removal.
- Maintain a closed drainage system.
- Maintain gravity drainage.
- Avoid routine irrigation.
- Regularly emptying urine bag.[17,19,20,39]

Aim And Objectives

Aim- To study the complications of urethral catheterization .

Objectives-

- To study the catheter associated urinary tract infections
- To study the trauma/injury caused by the urethral catheterization
- To study the compliance with the urinary catheter care

Material And Methods

Study Design- Observational study.
Study Place- Tertiary care hospital
Study Duration- 1 year and 6 months

Inclusion Criteria

All In patient department(IPD) catheterized subjects from surgical wards, Surgical intensive care unit(SICU), urology wards of both gender and all age group willing for participate in study.

Exclusion Criteria

Pre existing urethral diseases , strictures, urinary tract infections(UTIs), urethral diverticulosis, fistulas, periurethral abcess etc.
Patient not willing for inclusion in the study.

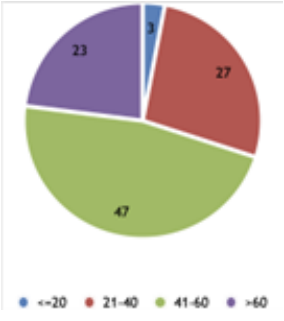
Data Analysis

Data was transfered to appropriate software for analysis and was analysed with the help of statistician.

OBSERVATIONS AND RESULTS

Table No.1:- Age Group Wise Distribution Of Study Subjects. (n=100)

Age Group(Years)	No. Of Cases(n)	Percentage
<=20	3	3
21-40	27	27
41-60	47	47
>60	23	23
Total	100	100

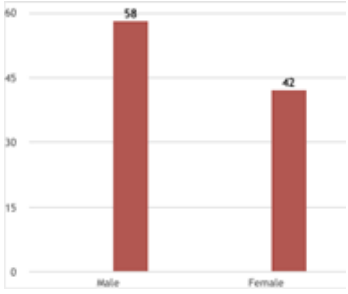


Graph 1 :- age group wise distribution of study subjects

In present study maximum number of cases are of age group of 41 to 60 years age group ie 47 (47%) .

Table No.2:- Gender Wise Distribution Of Study Subjects (n=100)

Gender	No. Of Cases	Percentage
Male	58	58%
Female	42	42%
Total	100	100%

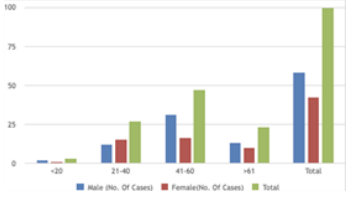


Graph No.2 : Gender Wise Distribution Of Study Subjects

In a present study number of male study subjects were 58 i.e. (58%) and that of females were 42 i..e (42%)

Table no.3 :- Age Group And Gender Wise Distribution Of Study Subjects (n = 100)

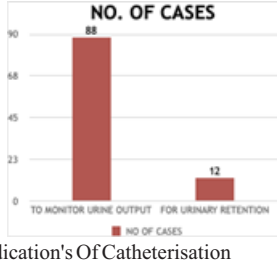
Age Group(Years)	Male (No. Of Cases)	Female(No. Of Cases)	Total
<20	2	1	3
21-40	12	15	27
41-60	31	16	47
>61	13	10	23
Total	58	42	100



Graph No.3:- Age And Gender Wise Distribution Of Study Subjects

Table No.4:- Indications Of Catheterisation (N =100)

Indication	No. Of Cases	Persentage
To Monitor Urine Output	88	88%
For Urinary Retention	12	12%
Total	100	100%

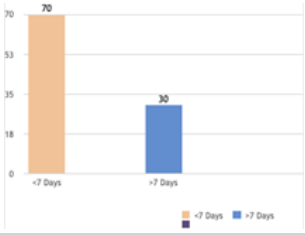


Graph No. 4:- Indication's Of Catheterisation

In a present study 88 subjects were catheterised to moniter urine output and 12 subjects were catheterised to relive urinary retention.

Table No.5 :- Catheterisation Days In Study Subjects

Catheterisation Days	No. Of Cases
<7 Days	70
>7 Days	30
Total	100

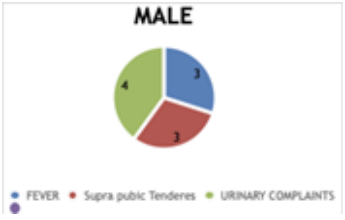


Graph No.5:- Catheterisation Days In Study Subjects

In a present study 70 cases who had urinary catheter less than 7 days and 30 cases who had catheter for more than 7 days .

Table No.6 :- Various Clinical Presentation's Of Cauti (n=100)

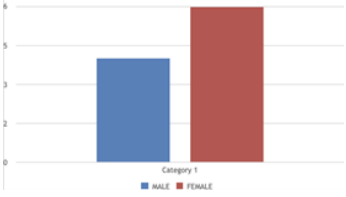
Clinical Presentaion	Male	Females
Fever	3	5
Supra Pubic Tenderness	3	2
URINARY COMPLAINTS (Dysuria, Frequency ,Urgency)	4	3



Graph No.6:- Various Clinical Presentation Of Cauti

Table No.7 :- Number Of Cauti Cases Observed In Present Study (n=100)

Male	Female	Total
4	6	10



Graph On.7:-number Of Cauti Cases In Present Study

In a present study CAUTI rate was more in females than male patients

Table No.8 :- Number Of Cauti And Complications Of Urethral Catheterisation Cases In Present Study (n=100)

Cauti	Complications Other Than CAUTI
10	15
10%	15%

Graph No.8 No Of Cauti And Complication's Of Urethral Catheterisation Cases In Present Study

Table No.9:- Compications Of Urethral Catheterisation In Study Subjects (n=60)

Compications	Male	Female	Total
Traumatic Catheterisation	6	2	8
Paraphimosis	2	0	2
False Passage	1	0	1
Urethral Fistula	1	0	1
Retained catheter	1	0	1
Encrustation	1	0	1
Urethral Stricture	1	0	1
Total	13	2	15

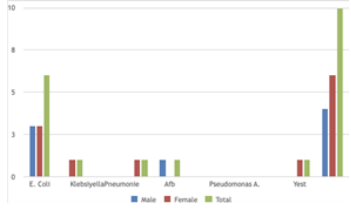
Graph No.9:-compications Of Urethral Catheterisation In Study Subjects

Table No.10 :- Compliance With Urinary Cathter Care(n=100)

Compliance	No. Of Cases (n)
Good	86
Poor	14
Total	100

Table No.11 :- Organisms Causing Cauti (n=100)

Microorganisam	Male	Female	Total
E. Coli	3	3	6
Enterobacter	0	1	1
Klebsiyella Pneumonie	0	0	0
Citrobacter	0	1	1
Acid fast bacilli	1	0	1
Poly- microbial	0	0	0
Pseudomonas A.	0	O	0
Staph.A.	0	0	0
Yeast	0	1	1
Total	4	6	10



Graph No.11:- Organisms Causing Cauti

RESULTS

In the present observational study 100 cases were enrolled by purposive sampling technique. Patients age range was 20-70 years who had urinary catheterisation. Out of 100 cases 58(58%) were male and 42 were female cases (42%).

Fifteen patients suffered from complications of urethral catheterization (15%) and 10 patients had CAUTI (10%) out of total 100 patients.

Maximum number of cases were seen in the 41-60 years age group ie 47% Eighty eight patients were required catheterisation to moniter urine output (88%) and 12 patients were catheterized to relive urinary retention (12%)

Thirty cases required catheter for more than seven days and 70 cases required catheter for less than seven days. Urinary complaints like frequency,urgency,dysuria was seen in 3 female and 4 male patients.Fever was seen in 5 female and 3 male patients. Suprapubic tenderness was seen in 3 male and 2 female patients.

Urine culture was used as investigation tool for CAUTI cases. Traumatic catheterisation was observed in 6 male and 2 female subjects.

Mean age group in present study years Mean catheter days in present study days CAUTI rate was more in female subjects.

Compliance with the urinary catheter care was good in 86 subjects and poor in 14 subjects. E.COLI was the most common organism responsible for CAUTI.

DISCUSSION

The observational study conducted at the Department Of General Surgery in a Tertiary care Hospital. The aim of the study was to study the Catheter Associated Urinary Tract Infections(CAUTI) and trauma/ injury caused by the urethral catheterization and compliance with urinary catheter care. The total 100 patients were enrolled for the study over the duration of of 1 year and 6 months .

Table No.12:-age Group Wise Comparism .

Present study revealed that the maximum number of cases found in age group of 41-60 .These findings are not comparable with findings of study conducted by S.Vasanthi et al[51](2016) which revealed that the maximum number of cases in the age group of 18-30 years.

Table No.13:- Gender Wise Comparism

Gender	Present study,N=100	S.Vasanthi et al [51] N=100
Male	58%	57%
Female	42%	43%

In a present study 58% cases were males and 42% cases were females where as study conducted by S.Vasanthi al[51] revealed that 57% were males and 43% were females the findings of studies are comparable.

Table No.14- Comparison Of Catheter Days With Other Study.

Catheter Days	Present Study(N=100)	S.Vasanthi et al[51], (N=100)
<7 Days	**70**	**11**
>7 Days	**30**	**89**

in a present study 30 cases were had catheter for more then 7 days and study by S.Vasanthi et al[51] revealed that 89 cases were had catheter for more than 7 days .

Table No.15:-comparison Of Indications Of Catheterisation.

Indication	Present study(N=100)	S.Vasanthi et al[51] (N=100)
To moniter urine output	88%	96%
For urinary retention	12%	**4%**

In a present study (N=100) catheterization done to moniter urine output in 88 subjects (88%) and for urinary retention 12 subjects(12%) as compared to study by S.Vasanthi et al[51] (N=100) 96 subjects(96%) catheterized to moniter urine output and 4 subjects(4%) for urinary retention.

Catheter Associated Urinary Tract Infections are the common health care associated infection. In present study out of 100 patients 10 patients developed CAUTI during their course of hospitalization. Improper urinary catheter insertion technique and catheter care and duration of catheter days was associated with high CAUTI rates in the present study.

Incidence of CAUTI was higher in females in a both the studies. Duration of catheterization and length of hospital stay is the important risk factor for development of CAUTI, as per present study 30 subjects had catheter more than 7 days .In a present study 30 subjects who had urinary catheter more than 7 days out of which 10 patients developed CAUTI reveal that the duration of urinary catheter days is responsible for development of urinary tract infections.

In a present study it was observed that the improper or faulty urinary catheter insertion techinque was responsible for complications of urethral catheterisation .

Table No.16:-comparison Of Most Common Micro-organism Causing Cauti In Various Studies

Sr no.	Study	Organism
1	Present study	E.coli
2	Tullums et al[52] 1998	E.coli
3	Wazait et al [53]2003	E.coli
4	Taiwo et al 2006	Klebsiella
5	S.Vasanthi et al [51]2016	E.coli

In a present study E.coli was the most common microoraganism isolated and also in most of the above mention studies.

Summary

- The incidence of CAUTI and complications of urethral catheterization was observed more in age group of 41 to 60 years.
- Fifty eight cases were male and 42% cases were females.
- Most common indication of urethral catheterization was to moniter urine output in a case of critical patients.
- Catheterisation for more than 7 days was associated with the development of urinary tract infections (UTIs).
- Fever was the most common symptom of CAUTI followed by urinary complaints like(dysuria, frequency, urgency) and suprapubic tenderness .
- CAUTI was more com mon in females i.e.60%
- Most common microorganism responsible for CAUTI was E.Coli.
- Compliance with catheter care was good in 86% cases.
- Among the UTI cases one case of acid fast bacilli (AFB) and one case of yeast was observed.

CONCLUSION

- From the present observational study conducted at Department of General Surgery, in a tertiary care hospital it is concluded that the traumatic catheterisation was the most common complication caused during urethral catheterization in both the gender.
- It is also concluded that the most common microorganism associated/causing Catheter Associated Urinary Tract Infections(CAUTI) in both the gender was Escherichia coli.
- It is also concluded that Enterobactor was the most resistant organism in CAUTI cases
- • Urinary catheter care is very essentital to avoid unnecessary urinary tract infections.

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