



## “Role of Fixation of Urinary Catheter to Reduce Catheter Associated Urinary Tract Infection”

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### ABSTRACT

**Background:** Catheter-associated urinary tract infection (CAUTI) has been studied extensively since the 1970s and 1980s, after its role in UTIs was initially identified by Kass in 1957. About 30–40% of all hospital-acquired infections are caused by catheters, making catheter-associated urinary tract infection (CAUTI) the most frequent nosocomial infection worldwide. Catheters may also be poisonous and inflammatory, causing acute physical damage to the bladder epithelium. Inflammation and epithelial damage caused by bacteria may have a synergistic effect on patient symptoms. Our study was organized and performed to investigate the significance of urinary catheter fixation in reducing the risk of catheter-associated urinary tract infections. In our research, we considered and recommended a number of factors, one of which is the prevalence of CAUTI.

**Methods:** The study was a prospective cohort study on comparison of incidence of catheter associated UTI between fixed and non fixed Foley's catheter among the bedded patient's presenting in the department of General Surgery, Chhatrapati Shivaji Subharti Hospital during the period from July 2020 to July 2022.

### Inclusion Criteria

1. Patients subjected to Foleys catheterization in the hospital
2. Subjects whose initial urine routine microscopy at time of catheterization was negative for infection.

### Exclusion Criteria:

1. Patients with known allergy to latex or silicone.
2. Patients with placement of urethral catheter outside the hospital.
3. Patients with suprapubic catheters.
4. Patients where fixation is part of treatment eg: POC of TURBT
5. Patients where instrumentation in urinary tract has to be planned

6. Those patients whose report for inclusion criteria are received after 24 hours were also excluded

**Results-** In our study it can be concluded that the incidence of CAUTI was 17% .The Incidence of CAUTI was observed in 23 patients (19.83%) with free catheter while it is observed in 17 patients (15.04%) with fixed catheter. There is no significant association of incidence of CAUTI and method of fixation of catheter.

**Conclusions-** Understanding the risk factors for catheter associated urinary tract infection is essential for implementing prevention strategies in daily care of our patients. One of the potential risk factor observed in the literature is the method of fixation of urinary catheter.

**Keywords:** UTI, Catheter-associated urinary tract infection, Nosocomial infection, hospital-acquired infections

### I. INTRODUCTION:

About 40% of all hospital-acquired infections each year are related to the urinary system. In the United States, adult patients in the intensive care unit have a 23% incidence of hospital-acquired infections [1] fully 80% of these hospital-acquired UTIs are attributed to indwelling urethral catheters. [2,3]

Catheter-associated urinary tract infection (CAUTI) has been studied extensively since the 1970s and 1980s, after its role in UTIs was initially identified by **Kass in 1957** [4].

Despite advances in medicine, new diagnostic tools, and earlier patient releases, CAUTI remains the most common kind of nosocomial infection. While nephrostomy tubes and supra pubic catheters are not considered indwelling catheters, any tube that is placed into the urine bladder through the urethra is. [5] About 30–40% of all hospital-acquired infections are caused by catheters, making catheter-associated urinary



tract infection (CAUTI) the most frequent nosocomial infection worldwide.<sup>[6-7]</sup>

An indwelling catheter has been linked to 80% of all cases of urinary tract infection. According to the CDC's definition, a CAUTI occurs if a patient develops an infection in their urinary tract while an indwelling catheter is present, or within 48 hours before the infection develops.<sup>[8]</sup> Catheter-associated urinary tract infections (CAUTIs) affect 3–7% of catheterized patients in acute care settings (catheter used for 7 days), for >7 days, and nearly 100% of patients beyond 30 days.<sup>[9, 10]</sup> Complications from a catheter-associated urinary tract infection (CAUTI) include cystitis, pyelonephritis, gram-negative bacteremia, prostatitis, epididymitis, and orchitis in males, and endocarditis, vertebral osteomyelitis, septic arthritis, endophthalmitis, and meningitis in less common cases. CAUTI complications include patient distress, an extended hospital stay, higher healthcare costs, and even death.<sup>[11]</sup>

Pathogenesis of CAUTI comprises bacterial invasion into the bladder from either the outside or the inside of the catheter or through contamination of the catheter tip during insertion with the flora of the distal urethra. Catheterized patients are more likely to contract bacteriuria if they have pee still sitting in their bladders. Infection begins when bacteria attach to the urinary tract's epithelial cells or the catheter's surface. The bacteria then multiply on the catheter's surface, forming biofilms that are resistant to antibiotics and the body's immunological response.<sup>[12]</sup>

In a 6-week study involving 23 people, **Patronik (2002)** observed that the CAUTI rate dropped from 3.46 percent to zero when the **StatLock™** (strapfree device for foley catheter) was used, but climbed to 4.93 percent when it was no longer used.<sup>[13]</sup> The to-and-fro movement of the catheter, which traumatizes tissues and encourages their invasion by microbial pathogens, is significantly reduced when employing the StatLock fastening device, as was noted by **Darouiche et al. (2006)**, leading to a 45% reduction in the rate of symptomatic CAUTI.<sup>[14]</sup>



Figure no-1 showing placement and fixing of catheter.

Thus, a study was organized and performed to investigate the significance of urinary catheter fixation in reducing the risk of catheter-associated urinary tract infections. In our research, we considered and recommended a number of factors, one of which is the prevalence of CAUTI.

**Material and Methods:** The study was a prospective cohort study on comparison of incidence of catheter associated UTI between fixed and non fixed Foley's catheter among the bedded patient's presenting in the department of General Surgery, Chhatrapati Shivaji Subharti Hospital during the period from July 2020 to July 2022.

#### INCLUSION CRITERIA

1. Patients subjected to Foleys catheterization in the hospital
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#### EXCLUSION CRITERIA:

1. Patients with known allergy to latex or silicone.
2. Patients with placement of urethral catheter outside the hospital.
3. Patients with suprapubic catheters.
4. Patients where fixation is part of treatment, for example post-op case of TURBT
5. Patients where instrumentation in urinary tract has to be planned
6. Those patients whose report for inclusion criteria is received after 24 hours were also excluded.

**Placement of catheter** - Catheter inserted in all patients with no touch technique and under all aseptic precautions. Catheter is fixed over right or left side of lower abdomen using adhesive tape (micropore - 5 inch), (figure no-1) Prior to catheter fixation, part was properly cleaned, a gauze is placed over cleaned part over which tube of urobag is placed which is further fixed with a strip of micropore place over it (Fixed Group)



**II. RESULT:**

Prevention methods against catheter-related urinary tract infections can only be implemented once we have a firm grasp on the risk factors linked with these infections. The literature has identified the method of urinary catheter fixation as a potential risk factor. Catheter fixation may help prevent CAUTIs; however there is less data to support this claim (CAUTIs), hence, we conducted a prospective cohort research to compare the rates of catheter-associated UTIs in patients who were hospitalized and had presented to the Department of General Surgery for care with either a fixed or non-fixed Foley's catheter. Forty patients, or 17%, were diagnosed with CAUTI over the course of our study. Twenty-three patients

(19.83%) with a free catheter and seventeen patients (15.04%) with a fixed catheter were diagnosed with CAUTI.

There was no correlation between CAUTI rate and catheter securing strategy. (p=0.436) Depending on the study, the rate of catheter-associated urinary tract infections (CAUTIs) might be anywhere from 1.4 to 18 infections per 1000 catheter days [66–70]. Similar high rates of 26.6% have been observed in other Indian studies by **Vinoth M et al**<sup>[15]</sup>, **Hedawoo JB and Deshmukh KS**<sup>[16]</sup>, **Verma S et al**<sup>[17]</sup>. Possible explanations for the discrepancy are variations in study locations, patient populations, and study durations. Findings of the previous studies were highlighted below. (Table no-1)

Study	Country & Year	Rate of CAUTI
Our Study	India ,2022	Overall - (17%)
<b>Mehta A et al</b> <sup>[18]</sup>	India, 2007	1.41 cases per 1000 catheter days
<b>Rosenthal VD et al</b> <sup>[19]</sup>	Argentina 2006	8.9 cases per 1000 catheter days
<b>Inan D et al</b> <sup>[20]</sup>	Turkey, 2006	13.63 cases per 1000 catheter days
<b>Singhai M et al</b> <sup>[21]</sup>	Uttarakhand 2012	26.6%
<b>Kamat US et al</b> <sup>[22]</sup>	Goa 2009	33.6%
<b>Khan Y et al</b> <sup>[23]</sup>	Telangana 2016	59%
<b>Sushitha TS et al</b> <sup>[24]</sup>	Kerala, 2022	36%

Table no -1Rate of CAUTI in previous studies

**Fixity and type of catheterwise gender distribution**

In the women studied, we found that only 3 with a fixed catheter and 14 with a free catheter had CAUTI. There was a striking disparity in the prevalence of CAUTI infections between women with free and fixed catheters. (p=0.003). CAUTI occurred in 9 of the males who had a free catheter and 14 of those who had a fixed catheter. In men, we did not find evidence that the manner of catheter fixation made a difference in the rate of CAUTI infection. (p=0.243). Both sexes are equally susceptible to contracting an infection, although men seem to be more likely to get sick

than women. Our research supported previous notions suggesting that women are more likely to contract infections due to their shorter urethras<sup>[25]</sup>(Table no-2)

Out of 400 patients, with a male to female ratio of 1.23:1, 65 had CAUTI (16.25%), and 22 patients had symptomatic bacteriuria (non-CAUTI-5.5%), according to a study by **Dr. Jagadish B. Hedawoo et al**<sup>[16]</sup>. Male infection rates were 13.12%, while female rates were 20%11. After 48 hours of indwelling urinary catheterization, 19 patients had CAUTI, while 46 patients acquired CAUTI after 120 hours.

CAUTI	FEMALE		MALE	
	FIXED	FREE	FIXED	FREE
NO	35(15.28%)	26(11.35%)	61(26.63%)	67(29.25%)
YES N=(40)	3(1.31%)	14(6.11%)	14(6.11%)	9(3.93%)
P Value	0.003*		0.243	

Table no-2 showing Fixity and type of catheter wise gender distribution

**Fixity of Catheterwise Primary Diagnosis and CAUTI**

In Fixed catheter group ,seventeen patients had CAUTI , 5 patients amongst them had primary



diagnosis of intestinal obstruction followed by cellulitis of lower limb with sepsis in 4 patients and perforation peritonitis in 3 patients In free catheter group,23 patients had CAUTI , eight patients had head injury and 5 patients had intestinal obstruction . A study by **Kaur S et al 2021** <sup>[26]</sup> reported 25%

patients with the primary diagnosis of cardiac problems , 21% patients with gynae and obstretics problem , 27% with neurologic problems ,10.5% with orthopedic problems and 16.5% patients with surgical problems.(Table- no-3)

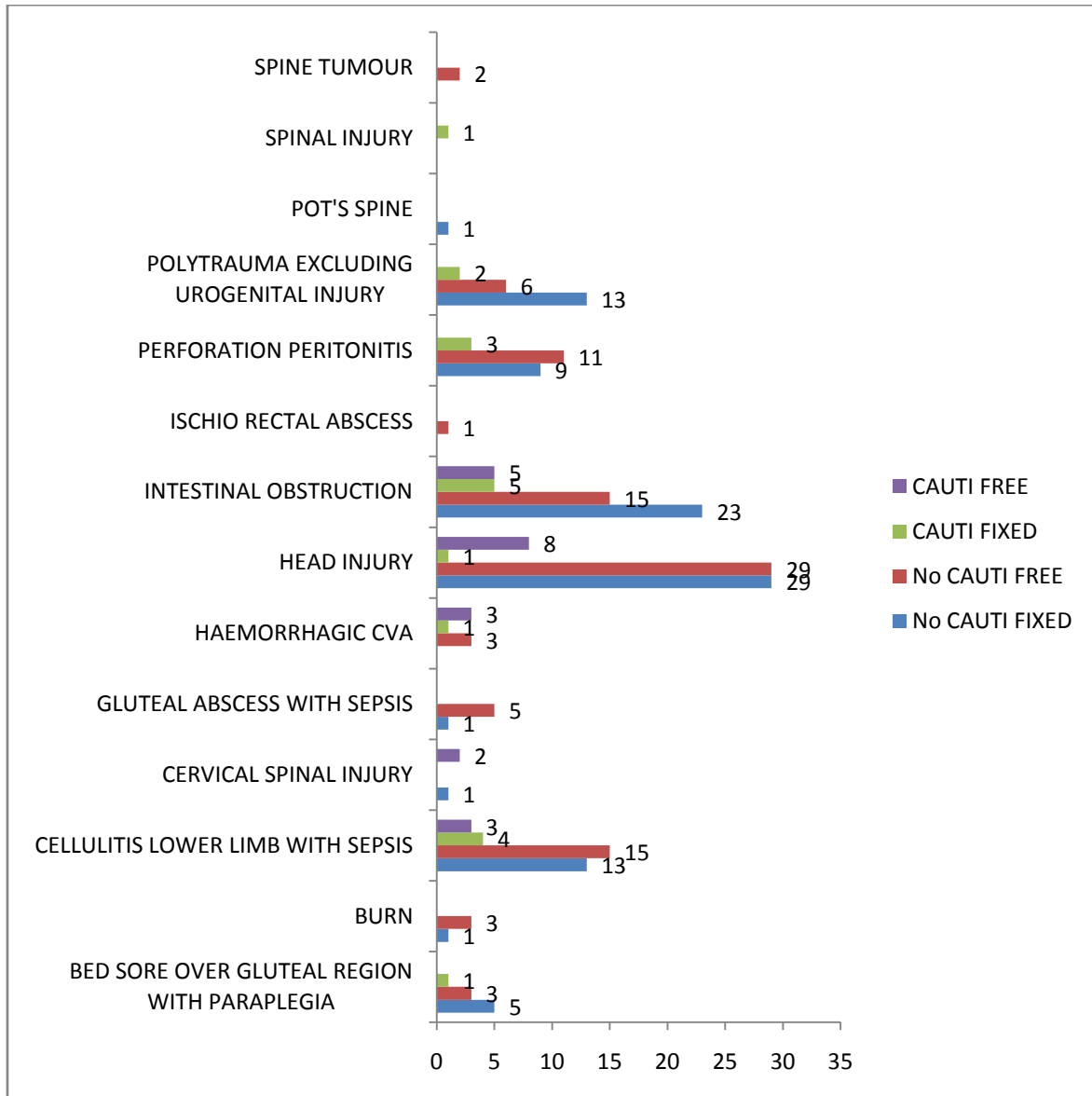


Table no-3 showing Fixity of Catheter wise Primary Diagnosis and CAUTI

### Past Medical History

We found no significant difference amongst history of DM on CAUTI in free catheter group (p=0.769)(Table no-4)

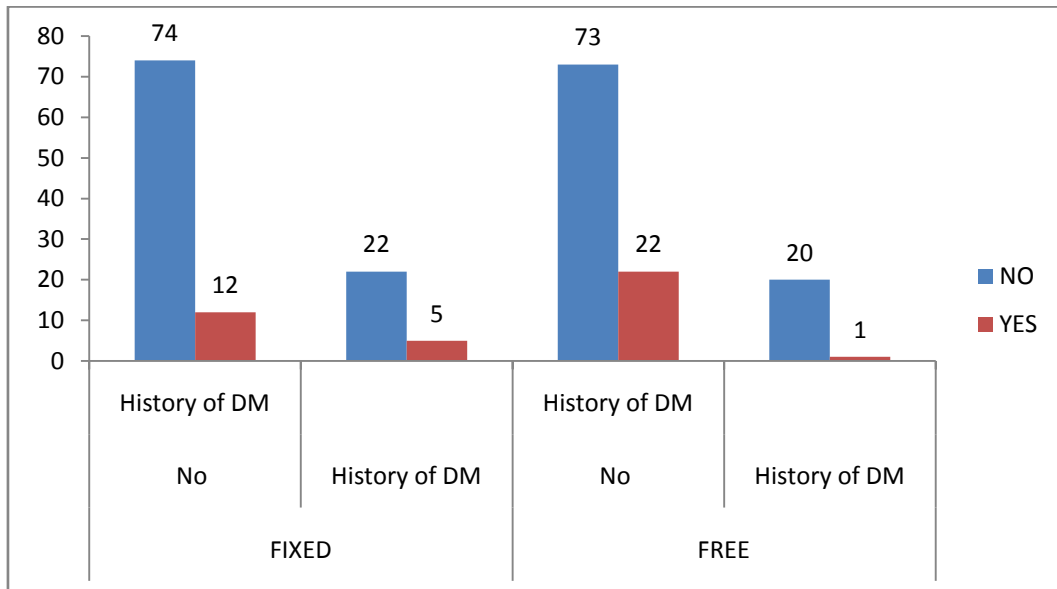


Table no-4 showing CAUTI amongst history of DM patients.

**Fixity of Catheterwise distribution of post catheterization symptoms in CAUTI**

We observed no significant difference in the post catheterization symptom distribution amongst patients in fixed and free group with CAUTI. (p=0.805).(Table no-5)

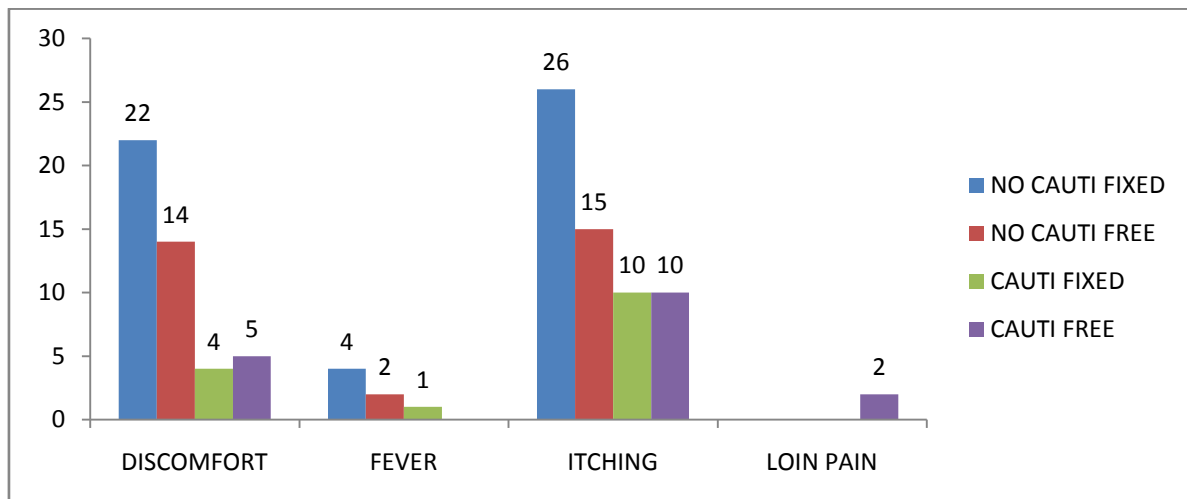


Table no-5 showing Fixity of Catheterwise distribution of post catheterization symptoms in CAUTI

A study by **Kaur S et al**<sup>26</sup> 2021 reported 18.5% patients with the post catheterization symptoms of fever , suprapubic tenderness in 26.5% , dysuria in 22.5% , Tenderness or pain in the costovertebral angle in 46.5% and rigors in 28% patients .

less 5 hpf urine pus cells and 5 patients (2.18%) had more than 5 hpf urine pus cells . Out of 23 patients in free catheter group, 15 patients (6.55%) had less than 5 hpf urine pus cells and 8 patients (3.49%) had more than 5 hpf urine pus cells. (Table no-6)

**Urine Pus Cells >5/hpf**

In our study , CAUTI was diagnosed based on clinical symptoms and positive urine culture .Amongst 40 such patients , 17 patients had fixed catheter out of these , 12 patients had (5.24%)



	<5/hpf		>5/hpf	
CAUTI	FIXED	FREE	FIXED	FREE
YES	12(5.24%)	15(6.55%)	5(2.18%)	8(3.49%)
P value	0.173		0.229	

Table no-6 showing pus cell and p-value

Nevertheless, **Gribble et al**, analyzing a cohort of occasionally catheterized patients with spinal cord damage, concluded that evaluation of the quantitative level of pyuria did not differentiate bacteriuric from abacteriuric patients<sup>[27]</sup>

In our study, positive culture was observed in 41 patients (17.90%). Out of them 40 patients had CAUTI (97.56%) and 1 patient (2.43%) had No CAUTI. One patient who didn't have CAUTI was in the free catheter group and showed positive culture for E.Coli (Table- no 7)

**Fixity of catheter based culture microorganism distribution in CAUTI**

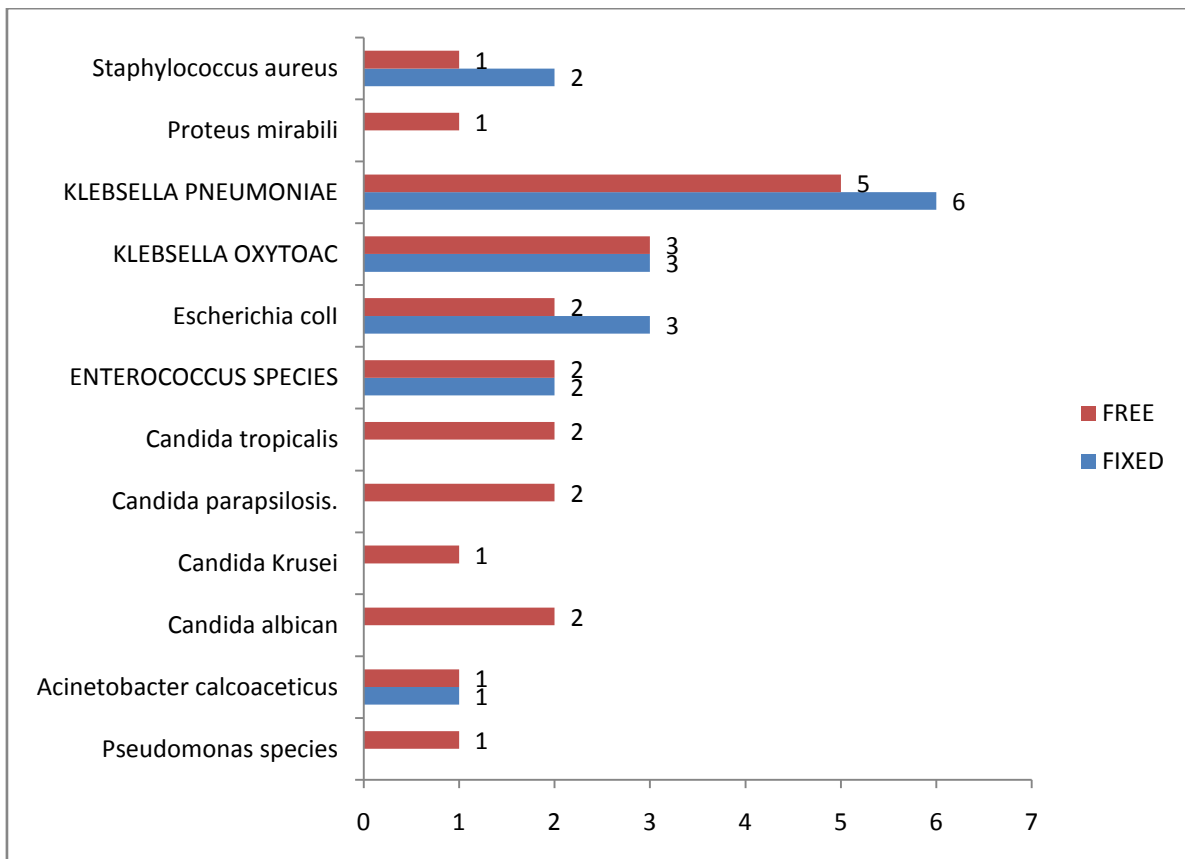


Table- no 7 showing Fixity of catheter based culture microorganism distribution in CAUTI

In Fixed catheter group, seventeen patients had CAUTI, out of them 6 patients (2.62%) showed positive culture for Klebsella Pneumoniae, 1 patient (0.43%) for A.Calcoaceticus, 2 patients for enterococcus species and 3 patients each for E.Coli and Klebsella oxytoac.

In Free catheter group, 23 patients had CAUTI, out of them 5 patients (2.18%) showed

positive culture for Klebsella Pneumoniae, 1 patient (0.43%) each for A.Calcoaceticus, pseudomonas species, candida crusei and proteus mirabilis, 2 patients (0.87%) each for candida albican, c.parapsilosis, C. tropicalis, E.Coli and enterococcus species and 3 patients (1.31%) each Klebsella oxytoac.



The findings of the previous studies were highlighted below. (Table no-8)

Study by	Year	CAUTI	MC organism causing CAUTI
<b>Our Study</b>	2023	40(17.54)%	KLEBSSELLA PNEUMONIAE
<b>Kizilbash et al.</b> <sup>[28]</sup>	2013	128 (42%)	Candida sp.
<b>Bhatia et al.</b> <sup>[29]</sup>	2010	20 (22%)	E. coli
<b>Taiwo and Aderounmu</b> <sup>[30]</sup>	2006	90 (74%)	Klebsiella sp.
<b>Tullu et.al.</b> <sup>[31]</sup>	1998	24 (47%)	E. coli
<b>Panjwani DM</b> <sup>[32]</sup>	2019	50 (41%)	E. coli

Table no- 8 common organism associated to CAUTI in previous studies

### III. CONCLUSION:

There is no significant association of incidence of CAUTI and method of fixation of catheter. Although approximately half of the total number of patients had developed post catheterization symptoms such as discomfort, fever, itching and loin pain, amongst them majority of patients with fixed catheterization had itching, Loin pain is the least common symptom. Most common organism which is seen in this study to be associated with CAUTI is KLEBSSELLA PNEUMONIAE.

#### LIMITATION –

- 1-Short follow up
- 2-Single institution.

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