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A Prospective Study of Risk Factors for Catheter Associated Bacteriuria in Medical Wards

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Abstract
Most of the urinary tract infections (UTI) occur due to urinary catheterization. UTI is common cause of sepsis, morbidity and death. So the present study was aimed to determine relative risk factors for catheter associated bacteriuria (CAB) such as age, gender, diabetes mellitus, duration of catheterization and duration hospital stay in medical wards. This prospective study was conducted on128 patients meeting the requirements of inclusion criteria. A quantitative urine culture was performed once weekly or prior to removal of catheter or when clinical manifestations of UTI occurred. Fisher's Exact test was used for categorical variables. The relative risk was calculated with 95% CI. Duration of catheterization (P=0.0307) and duration of hospital stay in medical wards (P=0.0027**) both were found as the risk factors of catheter associated bacteriuria. Age, gender, diabetes mellitus were not found as significant risk factors. We did not find that giving antibiotics is a protective factor.*
Keywords: *CAB (catheter associated bacteriuria), risk factors etc.*

Introduction

Urinary tract is one of the most common sites of nosocomial infections.[1]Most of the urinary tract infections (UTI) are due to instrumentation of the urinary tract, mainly urinary catheterization. UTI is common cause of significant sepsis, morbidity and death.[2] Most frequently bacteria from the urethral meatus ascend between the catheter and urethral surfaces to the urinary bladder. Bacteria can also ascend with the urine drainage systems following contamination of catheter tubing junction or drainage bag. The presence of bacteria in the urinary bladder constitutes a potential reservoir for multi-drug resistant bacteria.[3,4]

Indwelling urinary catheter required to monitor urine output which increases risk of infection. Combined effect of the patient's own flora and invasive devices leads to 25-50% of nosocomial infections.[5] Most of the catheter associated infections causes minimal symptoms and no fever. These catheter associated infections can resolve after withdrawal of the urinary catheter. Gram negative bacteremia is the most common complication of catheter induced UTIs which

occurs after catheter associated bacteriuria (CAB) in 1-2% cases.[6]

The present study was aimed to assess risk factors for catheter associated bacteriuria such as duration of catheterization, duration hospital stay in medical wards, diabetes mellitus, age and gender of the patient. This could help better understanding and reduction of urinary tract infections.

Material and Methods

The present prospectivestudy was carried out in 18 months period from January 2016 to June 2017 in MIMER Medical College & BSTR Hospital, Talegaon Dabhade, Pune after ethics committee approval. During this period we set up a database including all adult patients requiring an indwelling catheter for longer than 48 hours. Only the patients having initial urine culture free of bacterial growth were screened and included in the study. Patients with two or more different urinary infections during the hospitalization period and those who were admitted to the medical wards with catheters or having suprapubic catheterization were excluded from the study. After written informed consent, patients were enrolled in the study.

The patients were catheterized during their stay in the hospital ward and were followed up from the date of admission up to discharge or death. Indwelling urethral catheters were inserted by doctors or nurses under all aseptic precautions by meatal disinfection with povidine-iodine and insertion of the sterile equipment. Perineal and meatal care was provided daily. Careful attention was given to the drainage system, limiting the duration of catheterization, disposing the urine accumulated in the collection bag and replacing a malfunctioning collection system. A quantitative urine culture was performed once weekly or prior to removal of catheter or when clinical manifestations of UTI occurred.

Urine specimen was aspirated with a sterile syringe aseptically from the sampling port of the catheter, after disinfecting the port. Urine specimen was taken immediately to the microbiology laboratory. Standard culture and bacteriological techniques were used to identify isolated organisms.[7]

Laboratory evaluations like urine routine microscopy, urine culture and sensitivity, blood urea, serum creatinine, hematocrit %, white blood cell count were done. CAB was defined as a quantitative culture containing ≥105 CFU/ml with no more than two different species of organism according to the criteria of the Centers for Disease Control. [8] If more than two species were isolated, the sample was considered contaminated.

Statistical Analysis

Statistical analysis was done by using graph pad prism software. In the univariate analysis, Fisher's Exact Test was used for categorical variables. All tests were two-sided. A p- value of less than 0.05was considered significant. The Relative Risk was calculated with 95%confidence intervals (CI).

Result

Table 1: Univariate analysis for the risk factors associated with bacterial catheter-associated urinary tract.

Risk factors	CAB		Total	Relative Risk	P value	95% CI
	No	Yes				
Age Group(years)						
45 to 55	23 95.8%	1 4.2%	24 100.0%	1.076	0.4679 ^{ns}	0.9705 to 1.193
56 to 65	68 90.7%	7 9.3%	75 100.0%	1.018	0.8142 ^{ns}	0.9261 to 1.119
66 to 75	23 79.3%	6 20.7%	29 100.0%	0.8905	0.2126 ^{ns}	0.7323 to 1.083
Total	114	14	128	Ref	-	-
Duration of Catheterization						
3-7	28 100%	0 0%	28 100%	1.123	0.0757^{ns}	1.057 - 1.193

8-14	76 89.4%	9 10.6%	85 100%	1.004	1.0000^{ns}	0.912 - 1.104
15-21	10 66.7%	5 33.3%	15 100%	0.7485	0.0307 *	0.520 - 1.076
Total	114	14	128	Ref	-	-
Duration Hospital stay						
<1 week	33 100%	0 0%	33 100%	1.123	0.0756^{ns}	1.057 -1.193
1-2 weeks	77 89.5%	9 10.5%	86 100%	1.005	1.0000^{ns}	0.914 - 1.105
2-3 Weeks	4 44.4%	5 55.6%	9 100%	0.4990	0.0027 **	0.239- 1.039
Total	114	14	128	Ref	-	-
	89.1%	10.9%	100.0%			
Diabetes mellitus						
No	84 89.36%	10 10.63%	94 100%	1.013	1.000^{ns}	0.879- 1.166
Yes	30 88.23%	4 11.76%	34 100%			
Total	114	14	128			
Gender						
Female	31 88.57%	4 11.43%	35 100%	0.9924	1.0000^{ns}	0.864- 1.140
Male	83 89.25%	10 10.75%	93 100%			
Total	114	14	128			

Table 2: Univariate analysis for the antibiotic exposure associated with bacterial catheter-associated urinary tract.

Antibiotic Exposure						
No	5 71.4%	2 28.56%	7 100%	0.7929	0.1697^{ns}	0.494 - 1.272
Yes	109 90.09%	12 9.91%	121 100%			
Total	114	14	128	-	-	-

Discussion

In the present study variables like age, gender, duration of bladder catheterization, duration of medical wards stay and diabetes mellitus were considered as risk factors for CAB.

We found the duration of catheterization to be an independent risk factor for CAB. With 8 to 14 days of catheterization, 10.6% patients had developed CAB while with15 to 21 days catheterization 33.3% patients had developed CAB. We found statistically significant (p=0.0307*) difference of increased proportion of patients with increased duration of catheterization developing CAB.

These results may be due to the pathogenesis of CAB, including the following two previously identified mechanisms of infection:[9]

1.Infection by direct inoculation while inserting catheter or infection ascending from the perineum.

2. Infection by reflux of the organisms into the catheter lumen facilitated by contamination of the urine collection bag.

In both cases, the duration of catheterization increased the risk of an external mucous film being formed. This result suggests the necessity to reduce the duration of catheterization to prevent occurrence of bacteriuria in ward patients.

We found significant increase of CAB patients with increased duration of hospital stay. Within one week, not a single patient had CAB. During 1 to 2 weeks hospital stay, out of 86 patients, 10.5% had CAB while in 2 to 3 weeks hospital stay 55.6% patients had developed CAB. Similar

results found in other study that increased duration of hospitalization increases CAB.[10]

Theoretically, preventive antimicrobial therapy could minimize the risk of CAB. But as reported by other researchers[11], we did not find that giving antibiotics as a protective factor. Prophylactic antibiotics are not recommended because of the cost, potential adverse effects and emergence of antibiotic drug resistance.

In the present study the female gender was not found to be a significant risk factor for CAB. However, several other studies[11,12] have highlighted the role of gender of the patient in the occurrence of bacteriuria. These contradictory results are possibly related to the epidemiology of the infection.

Age, gender and diabetes mellitus were not found as significant risk factors. We conclude that duration of catheterization and duration of hospital stay in medical wards were independently associated with an increased risk of catheter associated bacteriuria. To prevent CAB there should be justified use of urinary catheterization and the removal of the catheter as early as possible.

Limitations

1) A quantitative urine culture was performed only once weekly. This practice is insufficient to determine precisely when CAB occurred.
2) The number of patients (128) may not be enough to identify other risk factors for CAB.

There was no any conflict of interest.

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