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BACTERIURIA AMONG HOSPITALIZED PATIENTS DUE TO CATHETERIZATION

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Abstract:

In this study, to determine cases of bacteriuria in hospitalized patients who underwent catheterization, 259 urine samples were collected from 103 patients admitted to Services Hospital Lahore. Of 73 patients who had no urinary tract infection or contamination, 40 (54.8%) developed bacteriuria at the end of catheterization. The incidence of bacteriuria in patients under 40 years of age was 55.5% and 53.5% in patients over 40 years of age. Organisms isolated from the urine culture of patients were most often gram-negative Enterobacteriaceae, including E. coli (38). %) and Klebsiella pneumoniae (17%) had the highest frequency.

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INTRODUCTION:

Urinary catheters, especially those that live in, are the most common cause of urinary tract infections in hospitalized patients. In 1956, Kass reported that without the use of a closed urinary drainage system, 95% of catheterized patients develop bacteriuria rapidly within 96 hours (most of them within the first 24 hours).

The Centers for Disease Control, citing cases of nosocomial urinary tract infection in the US, reported that some 75% of patients with nosocomial urinary tract infection had used some form of urological equipment (mainly urinary catheters) prior to infection.

Although urinary drainage through catheterization is a complementary therapeutic method for patients, and although the use of closed rather than open urinary drainage systems has resulted in a reduction in the frequency of urinary tract infections, basic research indicates that in most patients whose catheterization exceeds two weeks, a closed urinary drainage system. They cause bacteriuria. Studies show that despite using this system, approximately 15-30% of patients still suffer from urinary tract infections within five days after the start of catheterization.

This study, aimed at determining the incidence of bacteriuria found among hospitalized patients, reveals that, despite some precautions taken at the time of introduction, the incidence of bacteriuria among catheterized patients was relatively high.

MATERIALS AND METHODS:

Two hundred and fifty-nine urine samples were collected from 103 catheterized patients (98 women and 5 men) hospitalized in Medicine and Surgical Unit II of Services Hospital Lahore for one-year duration form March 2018 to March 2019. Most of these patients are women who have been admitted to various surgical procedures, such as caesarean section, hysterectomy, laparotomy, curettage, etc.

Sampling methods

Three urine samples were collected from each patient (one before catheter insertion, one during catheter insertion, and a third one after catheter removal); all have been tested. The first sample was examined to determine the presence or absence of urinary tract infection in patients prior to catheterization. A third sample was examined after catheter removal to determine the role of catheterization in bacteriuria production. Both the first and the third sample were taken by the patients themselves in sterilized tubes (16 x 125 mm) from middle urine. Second samples were taken from the end of the catheter in the operating room nurse or related physician, all under aseptic conditions.

In most patients, the catheter was left in place for at least 24 hours (67%). This period for some patients (except for cases related to catheter replacement, which lasted from 10 to 23 days) lasted from a minimum of 12 hours (in 17.5% of patients) to a maximum of 72 hours (in 5.8% of patients). In other words, each patient tolerated an average of 26 hours. For this reason, efforts were made to collect urine samples from the midstream at least 48 hours after the end of prophylactic antibiotics (the third day after the start of catheterization).

The catheters used in all of the hospital wards studied were the «Foley» variety produced in Japan, with sizes typically 18F or 20F.

Prophylactic antibiotics have been prescribed 96 out of 103 patients (93%) to prevent probable infections, with the type, dose and duration of use varying under different conditions. Initially, patients were given parenteral ampicillin or cephalothin (Ig / q6 h for 1-2 days), and then changed to an oral dose of 500 mg / q 6 h for 5-7 days.

Specimen culture

Observing the conditions necessary to prevent bacterial growth, the collected samples were transferred to the laboratory as soon as possible. There, the samples were inoculated on a chocolate agar medium plate for colony counting (integer) and on MacConkey agar medium or on eosin methylene agar (EMB) medium to isolate gram-negative bacteria.

Inoculated plates were placed 18 to 24 hours in an incubator at 35 ° C and then examined to determine bacterial growth. By counting the number of colonies on the chocolate agar medium and by taking into account the appropriate dilution factor, the total number of bacteria present in one milliliter of urine was determined. Plates on which a maximum of two species were isolated and which contained more than 1,000 developed organisms in each milliliter of urine, 9.16 were selected as criteria for "bacteriuria" and subsequent diagnostic and differential testing was carried out on them. After preparing smears from chocolate or MacConkey colonies and staining them by Gram staining, 6 and after determining Gram-negative and Gram-positive bacteria, differential and biochemical tests were performed to determine the identity of related organisms by standard methods.

RESULTS:

To assess the role of catheterization in bacteriuria formation. 259 urine samples were collected in three stages (before and during catheter insertion and after removal) from hospitalized patients.

The main and main criterion taken into account when defining urinary tract infections is the presence ((significant bacteriuria)) reported by urine culture and the number of colonies of patients' urine samples. Although the most common indicator of urinary tract infection is the presence of 10 bacteria in each milliliter of urine. some studies indicate that in other conditions this figure may be below 10.

In this study, more than 10 bacteria are present in each milliliter of urine with one. or at most. Two species of pathogens. was considered a criterion ((significant bacteriuria)) in patients. Therefore. 30 urine samples (belonging to 30 patients) that were infected or infected prior to catheterization (i.e. colony samples exceeding 10 bacteria in each ml of urine and / or more than two species of pathogens) were excluded from the study.

Table I. A summary of patient's condition after cultivation of «before and during catheterization» urine specimens

Patients' Condition	Case Number	%
Total number of patients studied	103 cases	100
Cases afflicted with urinary infection before catheterization	21	20.4
Cases contaminated before catheterization	9	8.7
Cases contaminated and infected while inserting catheter	0	0
Remaining patients whose first and second specimens were negative	73	70.9

Moreover. culture results of urine samples collected during catheterization. directly from catheters. all were negative. These results showed that the bladder urine of the patients studied was sterile and did not contain any organisms. Table I summarizes the condition of patients after inoculation of two urine samples. Before and during catheterization. Of 73 patients whose urine samples were negative before and during catheterization after catheter removal. 13 cases (17.9% had a colony count of 103_104 cases (9.6%) had from 104-105 and 25 cases (34.3%) had more than 10 organisms per milliliter of urine. Thus, removing five cases (6.9%) samples (due to the growth of more than two bacterial species), a total of 40
cases had a colony count exceeding 103 bacteria per milliliter of urine. The results of urine culture in these 73 patients are presented in Table II.

Table II. Results obtained from incubation and haterial counts ofthe third specimens of the 73 patients whose first and second specimens were negative

Bacterial species	One SP.	Two SP.	Three SP.	Total/%
Numher of colonies in 1 ml urine	No pt/%	No pt/%	No pt/%	
10^3-10^4	8/11	1/1.4	4/5.5	13/17.9
10^4-10^5	2/2.8	5/6.8	0/0	7/9.6
$> 10^5$	17/23.3	7/9.6	1/1.4	25/34.3
Total	27/37.1	13/17.8	5/6.9	45/61.8

So. this cannot be done. That 40 patients developed bacteriuria after the catheterization period. in fact. the incidence of bacteriuria was 54.8% in this study (Table III).

Table III. Number of casesafflicted with bacteriuria and the incidence of bacteriuria due to catheterization

Patients' conditionafter removalofthecatheters	No pts.	Incidenceof bacteriuria
Afflicted bybacteriuria due to catheterization	40	54.80
Number of contaminated cases	5	6.90
Patients with negative results of urine cultures	28	38.3
Total	73	100

The distribution of prevalence and percentage of bacteriuria (by patient age) was studied in 73 patients. The results show that bacteriuria is most common in the 30-39 age group; the lowest percentage was recorded among the age groups of 10–19 years and 60–69 years (Table IV).

Table IV. Profusion distribution of patients and the percentage of hacteriuria due to catheterization in various age groups

Age by Years	Noof Pts	# cases due to catheterization	% of 73 Patients	% of all 40 cases
10-19	4	2	2.7	5
20-29	17	8	11	20
30-39	24	15	20.6	37.5
40-49	17	9	12.3	22.5
50-59	7	4	5.5	10.0
60-69	4	2	2.7	5.0
Total	73	40	54.8	100

So. Considering the average age of patients in this study, the percentage of bacteriuria in patients under 40 years of age was 55.5IX, and in patients over 40 years of age 53.5% (Table V).

Table V. Number of patients studied and the percentage of bacteriuria according to the average of their ages (40 years)

Average age by years	Patients Number	studied Percent	Bacteriuria due to c.*	
			Number	Percent
< 40	45	61.6%	25	55.5%
> 40	28	38.4%	15	53.5%
Total	73	100%	40	—

• Catheter

Organisms isolated by cultures or urine samples
Bacteria isolated in urine culture were mostly Gram-negative bacteria and belonged to Enterobacteriaceae. In fact, they were the same pathogens that are thought to be responsible for most urinary tract infections.

Of the 52 bacterial strains isolated in culture of the third sample (samples taken after catheter removal), E. coli in 20 cases (3%) was the most common, and Klebsiella pneumoniae in nine cases (17%) the second most often. The percentage of isolated organisms are given in Table VI.

Table VI. Types of organisms isolated in the culture of the third urine specimens of patients after removal of catheters

TYPE OF ORGANISM	Number isolated	%
E. coli	20	38
Klebsiella pneumoniae	9	17
Staphylococcus epidermidis	4	7
Enterobacter agglomerans	3	6
Diphteroid bacilli	3	6
Proteus mirabilis	2	4
Staphylococcus aureus	2	4
Pseudomonas cepacia	2	4
Candida albicans	2	4
Staphylococcus saprophyticus	1	2
Streptococcus viridans	1	2
Klebsiella ozaenae	1	2
Citrobacter diversus	1	2
Serratia rubidaea	1	2
Total	52	100

DISCUSSION:

The extent of the prevalence of bacteriuria due to catheterization of nosocomial patients or other patients who are maintained under this system, indicates that catheterization is the most predisposing factor to bacteriuria and urinary tract infections among these patients, so much so that 75 to 80% of urinary tract infections are said to be caused by catheterization.

Although scientific data has established that the use of a closed urinary drainage system in aseptic conditions, together with proper care, has been able to reduce the incidence of bacteriuria to 15-30% of patients five days after catheterization, yet the results of the present study, in spite of the use of closed urinary drainage systems, shows that bacteriuria arising from catheterization (after deleting the 30 cases who were contaminated or afflicted with bacteriuria prior to catheterization), developed in 54.S% within 12 to 72 hours after catheterization. In other words, one out of every two cases under study became afflicted by bacteriuria in a short time after receiving catheters.

As the performed studies indicate that prolongation of the period of catheterization causes an increase in bacteriuria among the patients,7 therefore one may claim that if the catheterization period in the studied patients had lasted longer, the percentages of resultant bacteriuria would be more than the 54.8% figure already obtained. However, if the results are considered on the basis of the average age Df these patients (40 years), then no appreciable difference would be observed, from the bacteriuria point of view, between the patients less than 40 years old (55.5%) and patients above 40 years (53.5%).

The following may be regarded as some of the most important factors that contributed to the increase of bacteriuria incidence among the catheterized patients studied:

1. Violation of aseptic and/or sterility conditions during catheterization and absence or inadequacy of the necessary care after insertion of catheters by the personnel responsible for catheterization.
2. Changes in persons assigned to the task of catheterization and/or lack of adequate proficiency in
   catheterization. As some of the studies indicate, a relation exists between the professional training of the person responsible for catheterizing and risk of bacteriuria (Table VII).

Table VII. Relationship between the professional status of the person inserting the urethral catheter with the risk of acquiring bacteriuria as a result of it. (22)

Person performing catheterization	No of pts catheterized	Pts with bacteriuria within 48 hours
Practiced nurses	35	12 (34.3%)
Graduate nurses	62	13 (21%)
Physicians	99	10 (10.1%)

3. The influence of the situation and place in which catheterization takes place; the level of contamination can be different from one ward to another, and from one hospital to another.
4. Excessive patient referrals and overcrowded hospital conditions, insufficient supplies, equipment and personnel of hospital wards, which in some instances entailing long delays before a patient is assigned to a hospital bed.
5. The sex of patients. As studies indicate, the prevalence of bacteriuria due to catheterization among women is greater and at times may even be double that of men.
   Therefore, considering that 95% of the patients in this study were female, on the basis of the anatomic situation of the urinary tract, these patients were exposed to greater risk.

Organisms Isolated
Of the organisms that were isolated from culture of patients' urine, the highest percentage belonged to E. coli (38%) and Klebsiella pneumnoniae (17%) and minor percentages associated to other organisms including Staphylococcus epidermidis, Proteus mirabilis and others (Table VI). As can be noticed,

these organisms are mostly the gram-negative bacilli and belong to the family of Enterobacteriaceae, whose sources are in the patients' feces. Since the majority of patients in this study were women, the isolated organisms may well have arisen from the patients' own GI flora that migrated upwards to the urinary tract, as is confirmed by studies as well. Also, in this study, 7% of the isolated organisms belong to Staphylococcus epidermidis, which in itself can be an evidence of the increasing role of this bacterium in generating urinary tract infections among catheterized patients. Staphylococcus saprophyticus, which is now recognized as a urinary pathogen among young women and Staphylococcus aureus, which is regarded as a urinary pathogen in patients who have used some sort of urologic instrument (such as a catheter) were isolated in a lesser percentage from the surveyed patients.

Prescription of Prophylactic Antibiotics

About 93% of the studied patients received prophylactic antibiotics either orally or parenterally. Although certain studies indicate that the use of prophylactic antibiotics does reduce incidence of bacteriuria, however, this effect is confined only to the first few days of catheterization, therefore, it must be admitted that:

-The use of prophylactic antibiotics by patients in this study did, to some extent, cause a reduction in the incidence of bacteriuria among them and, had they not used these prescribed antibiotics, we would surely witness a higher percentage (more than 54.8%) of such incidence.

-Considering that the purpose of prescribing prophylactic regimes is, generally, to prevent secondary infections, therefore if such antibiotics as nitrofurantoin, nalidixic acid or trimetho-primsulphamethoxazole (sxt), which are all passed in the urine with considerable density, be prescribed along with the prophylactic regimes, these can, while preventing the occurrence of secondary infections at the site of injury, also prevent the occurrence of bacteriuria by catheterization.

It is necessary to emphasize this point regarding the use of care and precaution in prescribing prophylactic antibiotics, and differentiation must be made between patients with indwelling urinary catheters who are exposed for longer periods to infection, and patients who are catheterized for a short period, especially in respect of therapeutic regimes.

Without a doubt, the significant use of the urinary catheters in nosocomial patients and others, the side effects arising from their use, especially the role of these catheters in relation to bacteremia and sepsis and its accompanying mortality, demand that the prevention of such side-effects and occurrences of bacteriuria from catheterization be accorded the necessary priority.

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