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ORIGINAL PAPER

Incidence of bacterial colonisation after indwelling of double-J ureteral stent

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Summary *Objective: To determine the bacterial colonisation after double-J stent use and the risk factors for bacteriuria linked to the stent.*
Materials and Methods: A total of 102 patients (61 men and 41 women, mean age 47.5 ± 14.16) were examined. The stents were removed under aseptic conditions, and a urine culture was obtained before the removal of the stents. After the stents were removed, the upper, central and lower sections were separated, and washing water was sent through the stent.
Results: Bacterial colonisation was found in 29.4% (30 of 102) of the stents. The most frequently observed microorganisms were determined as staphylococcus, coagulase negative (8 of 30) and E. coli (5 of 30). The washing fluid used to clean the interior of the catheter produced pathogens in 8 patients (7.8%), and these pathogens were observed to be the same microorganisms that colonised the outside of the stent. There was no statistical difference between the patients with colonisation and those without in terms of age, gender, duration of stenting and reason for stent insertion.
Conclusions: Though stent colonisation does not always entail symptomatic urinary tract infections, as shown in our study, the pathogens in the urine culture are the same as those colonising the stent, confirming the reality that colonisation is the main factor in these events. Additionally, according to our study, significant colonisation may be found in the first 3 weeks, contrary to the literature, causing us to consider that urinary tract infections may develop even in the early period.

KEY WORDS: *Bacterial adhesion; Risk factors; Ureteral catheterization; Urinary tract infection.*

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INTRODUCTION

In urology practice, the use of the double-J stent had significantly influenced endourologic developments and techniques. The double-J stent is used in a very broad area, including treatments for ureter and kidney stones, hydronephrosis linked to pregnancy or oncological diseases, cleaning fragments after shock wave lithotripsy and treatment of urinary leaks (1-3).
In spite of increasing experience linked to the frequent use of double-J stents, early intolerance and a variety of late complications are present (4). Eighty percent of nosocomial urinary tract infections are linked to urological instrumentation, especially the use of the double-J stent (5). The increase in the use of the stent is related to stent-linked infections, and bacterial stent colonisation plays an important role in infections linked to the stent (6, 7). In this study, we aimed to determine the bacterial colonisation after double-J stent use and the risk factors for bacteriuria linked to the stent.

MATERIALS AND METHODS

The study prospectively included 102 patients with double-J stentsused from July through December 2014 for a variety of reasons. The patients gave written consent to participate. Double-j stents are generally produced from polyurethane. Patients using antibiotics for any reason, patients with immunosuppression and those with bacteria in urine cultures were excluded from the study. All patients were given a single dose of antibiotic (iv 1 g cephalozin) before the procedure. The stents were removed under aseptic conditions, and a urine culture was obtained before the stents were removed. After the stents were removed, the upper, central and lower sections were separated, and washing water was sent through the stent. The suspension to wash the inner surface was normal saline jetted through a 10 ml 21-gauge needle syringe into the inner portion of the stent segment. All samples were inoculated on eosin methylene blue agar and blood agar. Positive cultures were defined as the growth of > 105 colony-forming units (cfu)/ml of a single pathogen. IBM SPSS for Windows, version 21.0 (*Chicago, USA*) was used for statistical analysis. Data were calculated as mean ± standard deviation. The Chi-square, Pearson Chi-square and Fisher's Exact tests were used, and $p < 0.05$ was accepted as significant.

RESULTS

A total of 102 double-J stents from 102 patients were taken for assessment. The mean age of patients was 47.5

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± 14.16 years, with 61 male (59.8%) and 41 female (40.2%) patients. The mean duration of stent insertion was 33.91 ± 22.42 days. The indications for stent insertion were urinary system stone disease in 86 patients (84.4%), ureteral stenosis in 7 patients (6.9%), malignancy in 6 patients (5.9%), hydronephrosis linked to pregnancy in 2 patients (2%) and UPJ stenosis in 1 patient (1%).

Bacterial colonisation of the stent was observed in a total of 30 patients (29.4%). The most frequently observed microorganisms were determined as staphylococcus, coagulase negative and E. coli (Table 1). In patients with proliferation, the same pathogen was found to colonise all 3 catheter fragments. The washing fluid used to clean the interior of the catheter produced pathogens in 8 patients (7.8%), and these pathogens were observed to be the same microorganisms that colonised the outside of the stent.

The urine culture sampling on the same day as the stent was removed found proliferation in 4 (13.3%) of the 30 patients with colonisation. These pathogens were the same as those colonising the stent, with one patient having MRSA staph aureus and the other 3 having E. coli. Twenty-six patients (86.7%) had a sterile urine culture. Colonisation was found in 19 (31.1%) of the 61 male patients and in 11 (26.8%) of the 41 female patients. There was no statistical difference between the patients with colonisation and those without in terms of age, gender, duration of stent and reason for stent insertion (Table 2).

Table 1.
Pathogens colonizing the stent.

Microorganism	N	%
Sterile	72	70.6
Staphylococcus, coagulase negative	8	7.8
E. coli	5	4.9
Candida	4	3.9
Group B *Streptococcus*	3	2.9
Staphylococcus epidermidis	2	1.96
Diphtheroid	2	1.96
Staph Aureus (MRSA)	2	1.96
Enterobacter	2	1.96
Enterococcus	1	0.98
Acinetobacter baumoni	1	0.98

Table 2.
Comparison of patients with and without colonisation in terms of age, gender, stent duration and reason for insertion.

	Colonisation			
Groups	Present	Absent	Total	P
Gender				
Male	19	42	61	0.639
Female	11	30	41	
Total	30	72	102	
Age				
20-29	7	12	19	0.367
30-39	7	11	18	
40 and ↑	16	49	65	
Total	30	72	102	
Stent duration				
1-21	9	22	31	0.974
22-42	15	37	52	
43 and ↑	6	13	19	
Total	30	72	102	
Reason for insertion				
Stone	26	60	86	0.773
Other	4	12	16	
Total	30	72	102	

Discussion

The use of double-J stents has become an essential routine in urology practice. While the first studies reported minimal complications linked to stents, the increased frequency of the use of stents has revealed that, in addition to early complications like suprapubic pain, hematuria, the frequent need to urinate and burning during urination, more serious late complications like stent migration, stent fragmentation, encrustation, vesicoureteral reflux, acute pyelonephritis, bacteriemia and chronic renal failure may develop (8-10). Bacterial colonisation on the stent plays the main role in infections linked to the stent, though as these infections may follow a subclinical progression, they may result in sepsis leading to death (11).

A biofilm layer formed by protein, electrolytes and an unknown variety of molecules causing bacterial adhesion and deposition on the stent is responsible for the first stage of these events (12).

The literature presents a variety of rates related to bacterial stent colonisation. *Riedl et al.* reported rates of 100% in permanent stents and 69% for temporary stents (13). Similarly, in another study, this rate was given as 68% (14). When other studies are examined, *Paick et al.* published 44%, *Akay et al.* reported 31% proximal and 34% distal, and *Özgür et al.* reported bacteria colonisation of 10% (15-17). In our study, the rate was the samefor each piece of the stent (proximal, central and distal) at 29.4%. The differences between these rates may be linked to the type of stent, duration of insertion and use of antibiotics. When the bacteriuria rates are examined in these studies, they vary from 21-45% with the general view that, just as every stent colonisation will not cause bacteriuria, every negative urine culture does not mean that there is no stent colonisation.

In our study, in the 30 patients with stent colonisation, the fact that only 4 (13.3%) had bacteriuria supports this opinion. Additionally, as the pathogen found in urine samples from these 4 patients was the same pathogen that colonised their stents, the reality that the main cause of urinary tract infection is stent colonisation should not be forgotten.

A variety of risk factors for bacteria colonisation have been researched. *Kehinde et al.* mentioned that the risk increased 2 times for women (18). Similarly, *Atay et al.*

found higher rates of colonisation in women (16). In our study,colonisation was found in 31.1% of men and 26.8% of women, with the difference not significant. When the duration of stent use is assessed,
Farsi et al. stated that, as the stent duration increased, the colonisation rates increased (before 1 month 58.6%, after 3 months 75.1%) (14). Similarly, *Kehinde et al.* stated that, as the duration lengthened, the risk of bacteriuria and colonisation increased (1st month 4.2%, 3rd month 34%) (18). *Özgür et al.* grouped patients according to stent duration as less than 4 weeks, 4-6 weeks and more than 6 weeks and found a significantly increased risk of colonisation after 6 weeks (17).
Paick emphasised that colonisation began after 2 weeks and that antibiotic use for stents that would be removed before this duration was unnecessary (15). In our study, we divided patients according to stent durations as 1-21 days, 22-42 days and more than 43 days. Though the colonisation rates were higher for those with stents inserted for 43 days or more, the difference was not statistically significant similar to Akay's study. However, when it is considered that the stents will remain in the majority of patients for around 4 weeks, the longer duration will likely increase the risk of colonisation.
In our study, 9 patients had hypertension, and 2 patients were pregnant. As immunosuppressive and diabetic patients were excluded from the study, we did not assess the effect of comorbidities on colonisation. However, as previous studies have shown, because situations such as chronic renal failure (CRF), diabetes mellitus (DM) and pregnancy weaken the immune system, it is possible to mention an increased colonisation risk in these patients (16, 18). Rates of urinary system infections may increase due to situations linked to age such as bladder outlet obstruction, hormonal changes and changes in bladder connective tissue (19).
In our study, when the patients were divided according to age groups like 20-29, 30-39 and 40 years and above, there was no significant difference determined in terms of colonisation. Additionally, when colonisation rates are examined according to reason for stent insertion, comparing urinary system stone disease and other reasons, it was found there was no effect from reason for insertion on colonisation.

Conclusions

Double-J stents are a frequently used, essential tool of urological instrumentation and are one of the leading choices for temporary urinary diversion. Additionally, it should not be forgotten that there is a range of early and late complications due to stents. One of the most important of these complications is urinary system infection. Though stent colonisation does not always entail symptomatic urinary tract infections, as shown in our study, the pathogens in the urine culture are the same as those colonising the stent, confirming the reality that colonisation is the main factor in these events. Moreover, according to our study, significant colonisation may be found in the first three weeks, contrary to the literature, causing us to consider that urinary tract infections may develop even in the early period. As a result, the indications for stent insertion should be carefully considered, the duration of the stenting period should be especially optimised, appropriate antibiotic prophylaxis should be organised, and the treatment of patients with risky comorbidities should be well-planned.
In our study, though there was no effect of stent duration, age, gender and reason for insertion on colonisation, lengthened stent durations may especially increase the risk of bacterial colonisation and bacteriuria, and it should be remembered that those with diseases like chronic renal failure (CRF) and diabetes mellitus (DM) may be at risk.

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