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Original Research Article

DJ STENT COLONIZATION PATTERNS: EXPLORING MICROBIAL PROFILES AND CLINICAL RELEVANCE

KUMAR J[1*], SHAIKH NA[2], SAMAD A[3], KURD BJ[4], AHMED SA[5], ZAIDI SZ[4]

[1]*Department of Urology, Suleman Roshan Medical College Tando Adam, Pakistan*
[2]*Department of Urology, DGH NHS Foundation Trust, Dudley, West Midland, UK*
[3]*Department of Urology, Isra University Hospital, Hyderabad, Pakistan*
[4]*Department of Urology, The Indus Hospital, Karachi, Pakistan*
[5]*Department of Urology, Shaukat Khanum Memorial Cancer Hospital Lahore, Pakistan*
**Correspondence author email address: drjay104@gmail.com*

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Abstract: *With the advancement of endourology, a great variety of biomaterial devices have been developed. Several studies have reported that the formation of biofilm and device infection are commonly observed manifestations that lead to urinary tract infections. An indwelling double J ureteral stent carries a significant risk; a negative urine culture does not rule out a colonized stent. Hence, assessing the extent of stent colonization without positive voided urine culture is crucial. This cross-sectional study involved 44 patients, aged between 14 to 88 years, coming to the Department of Urology at Indus Hospital Karachi to remove DJ stents from April 2019 to October 2019. The samples were collected through a non-probability consecutive technique. Urine samples, before removal of the stent along with distal portions of the DJ stent, were sent for cultural analysis to study bacteriuria and stent colonization. The whole data was analyzed on SPSS version 22.0. The study found that five patients (11.4%) had colonization of the distal end of the DJ stent, and Burkholderia cepacia was the most common microorganism. However, n=31; 70.4% of patients had colonization in post-DJ stent urine, and Pseudomonas was the most common microorganism (n=14; 45.2%). Stent colonization had no significant association with age, gender, and positive urine culture. Most colonized stents were asymptomatic. Despite these observations, it is critical to emphasize that using DJ stents is still a generally recognized and safe treatment. Future studies should look at other aspects that colonization patterns may impact in improving the safety and management of DJ stent use.*

Keywords: UTI, DJ Stent, DJ Stent Colonization

Introduction

With the advancements in endourology, a great variety of biomaterial devices have been introduced in urology, and with these new materials, biofilm formation, and device infection are issues becoming prominent (Ozgur et al., 2013). Urinary tract infection is one of the most seen infections and has a broad spectrum of presentation ranging from asymptomatic bacteriuria to acute pyelonephritis accompanied by sepsis. It could be associated with structural or functional abnormalities of the urinary system (Aydin et al., 2016a). If any surgery is done in the presence of a urinary tract infection could lead to sepsis, bacteremia, renal damage, and increased mortality. Hence pre-treatment of urine culture to prevent infection during surgery is very important. A ureteral stent could be one of the leading factors in urinary tract infection (Altunal et al., 2017). A person with an indwelling J ureteral stent can develop stent colonization and bacteriuria. However, a negative voided urine culture doesn't rule out a colonized stent. Bacteria cultured from urine after stent insertion and from the stents are more resistant to antibiotics (Lange et al., 2015; Shabeena et al., 2018). Hence it is important to assess if the stent is colonized with bacteria even in absence of voided urine culture being sterile. A study conducted at Barcelona Spain in 2014 reported that 43 (58.9%) stents out of 73 DJ stents cultures were colonized with bacteria (García-Aparicio et al., 2015). A study done in Turkey in 2018 reported the incidence of bacteriuria and colonization as 7.4% and 26% respectively (Kati et al., 2017). Studies conducted in India reported that bacterial colonization ranges from 16 % (Garg et al., 2017) to 47.2% (Shabeena et al., 2018) and reported that 81.3% and 66.7% of the stents were colonized when placed

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for 3–4 months and 2–3 months, respectively (citation needed).

As the use of indwelling ureteral stents has increased, existing literature shows an increase in stent-associated infection; however, there is a dearth of local and international studies to support this finding. Bacterial colonization in the stent is constitutive to the pathogenesis of stent-associated infections, so it is crucial to understand the microorganisms involved in the stent colonization, and their sensitivity profile will assist in the treatment regimen and prognosis of urological disease and LUTS. Our study aimed to find the frequency of DJ stent colonization among patients admitted at the Department of Urology, Indus Hospital, Karachi.

Methodology

This cross-sectional study involved patients coming to the Department of Urology at Indus Hospital Karachi to remove double J stents from April 2019 to October 2019. A total of 44 patients aged between 14 to 88 years participated in this study. Samples were collected through a non-probability consecutive technique by using predesigned proforma. Patients with a history of bleeding diathesis (on medical record), Pre procedural urological diseases that cause LUTs symptoms or bladder aches, prostate diseases (like benign prostate enlargement, prostatitis, and prostate cancer), interstitial cystitis, overactive bladder, and painful bladder syndrome, Patients on medications with alpha-blockers, anti-cholinergic, analgesics, anti-depressant, or diuretics and patient with proven UTI during DJ stent insertion were excluded from this study. Informed consent was obtained from the patients undergoing stent removal after eight weeks of stent insertion, fulfilling the inclusion and exclusion criteria. Patient data, including MR, age, gender, comorbid, indication for DJ stent insertion, baseline urine culture, and antibiotics given if urine culture positive. Samples for urine cultures were collected immediately before the procedure, and then DJS was removed under sterile conditions. Most stents were safely removed under local anesthesia via cystoscope with two-pronged rigid or flexible biopsy forceps. The proximal and distal ends of the stent were removed, and samples were sent for culture in a dry sterile container. Data were analyzed by performing chi-square and †Fisher-exact tests using SPSS version 22.0.

Results

No technical problems or violations of asepsis were recorded during the procedures. A total of 44 patients were enrolled in the study, with a mean age of 39.2±11.4 (Table 1). Most (n=26; 59.1%) of the patients were males, and (n=18; 50.9%) were females (Figure 1).

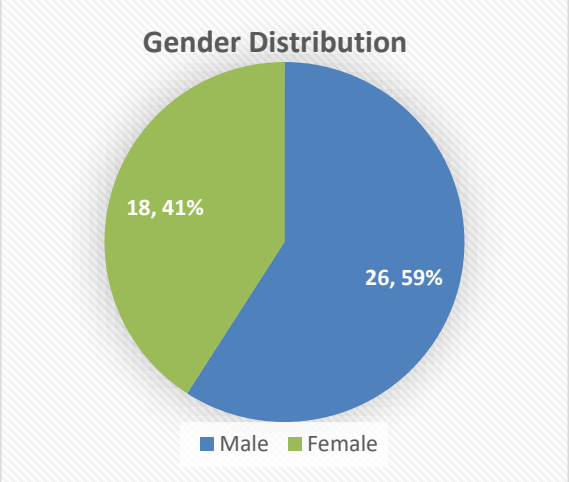

Figure 1 Gender Distribution: Number of Males and Females

29% of patients had comorbidity; the most common was hypertension, which was present in about 18% of patients. The indwelling duration of the DJ stent was 45.2 ± 11.4 days (Table 2).

Furthermore, Five (11.4%) patients had colonization of the distal end of the DJ stent, and Burkholderia cepacia was found to be the most common microorganism (n=2; 40% Table 3), and other organisms were Trichosporon, Candida, Serratia species, and Enterobacter. Moreover, positive post-DJ stent insertion urine culture was found in 70.4% of patients, and Pseudomonas was the most common microorganism seen (n=14; 45.2% Table 3). Other organisms were E.coli, Klebsiella, Enterobacter, Morganella, Providencia, Acinetobacter, Enterococcus, Coagulase -ve Staph, and Candida.

To find an association of colonization of DJ stent's distal end with the age, gender, comorbidities (diabetes, hypertension, hepatitis), and post-DJ stent insertion urine culture, were found to be non-significant (p=0.235; 1.000; 0.81 and 0.376 Table 4).

Table 1 Patient Age Distribution:

Age Distribution					
	N	Minimum	Maximum	Mean	S.D
Age	44	15	65	39.2	11.4

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Table 2 DJ Stent Indwelling Duration

	N	Minimum	Maximum	Mean	S.D
Indwelling time (days)	44	21	63	54.2	11.4

Table 3 Bacterial Colonization Frequencies and Percentages: DJ Stent and Urine

	frequency	percentage	Bacterial colony n(%)
DJ Stent colonization	5	11.4%	Burkholderia cepacia 2 (40) Enterobacter 1 (20) Serratia species 1 (20) Yeast cell (trichosporon sp) 1 (20) Candida 1 (20)
Urine culture colonization	31	70.4%	Pseudomonas 14 (45.2) Coagulase -ve Staph 10 (32.3) Acinetobacter 2 (6.5) E. coli 1 (3.2) Klebsiella 1 (3.2) Enterobacter 1 (3.2) Enterococcus 1 (3.2) Candida 1 (3.2) Any other 9 (29)

Table 4 Correlation between DJ Stent Colonization and Age, Gender, Urine Colonization, and Comorbidity

Variables	Constructs	Positive N(%)	Negative N(%)	Total N(%)	*P*-value
Gender	Male	17(54.8)	9(69.2)	26(59.1)	0.376[ǂ]
	Female	14(45.2)	4(30.8)	18(40.9)	
Age	<39	13(41.9)	8(61.5)	21(47.7)	0.235[ǂ]
	>39	18(58.1)	5(38.5)	23(52.3)	
Urine culture	Positive	4(12.9)	1(7.7)	5(11.4)	1.000[†]
	Negative	27(87.1)	12(92.3)	39(88.6)	
Comorbidities	HTN	5(16.1)	3(23.1)	8 (18.2)	0.811[ǂ]
	DM	4(12.9)	1(7.7)	5 (11.4)	
	Hepatitis	2(6.5)	0(0)	2 (4.5)	
	None	22(71)	10(76.9)	32 (72.7)	

Discussion

Urology is one of the fields in the world where surgery has been mostly replaced from open to minimally invasive surgery, especially endoscopic surgery for upper urinary tract stone disease. Endoscopic surgery is becoming least invasive over time, and DJ stent has become an essential part of urological surgery (Javed et al., 2016). It presents many advantages as it provides good urinary drainage during the healing process of ureteric mucosa. It is also generally safe, least invasive, and associated with minimal tissue reaction (Chew and Lange, 2009). However, being foreign to the patient, they usually behave as such and can cause many complications like pain, frequency, hematuria, dysuria, and some complications like stent encrustation arise due to long indwelling time (Akay et al., 2007; Vallejo Herrador et al., 1998). DJ stent insertion's most severe adverse effects are stent migration, fragmentation, flank pain, and infection. Stent-related infections are usually uncommon and asymptomatic; however, when symptomatic, they have high morbidities, such as fever, acute pyelonephritis, vesicoureteral reflux, chronic renal failure, and even death (Paick et al., 2003). Biofilm formation around the stents is usually the cause of infective complications in DJ stents. Unfortunately, biofilm management is always tricky because it consists of rapidly growing and slow-growing bacteria, and the biofilm allows attachment to various surfaces, including surrounding mucosal surfaces, walls of catheters, and stents (Reid et al., 1992; Vlastarakos et al., 2007). Manipulation and disturbance of that biofilm, especially during procedures, can release the microorganisms trapped in that biofilm, leading to uncomplicated UTI up to urosepsis (Gautam et al., 2006).

Our study's urine cultures were all negative at the start of the study. Five patients (70.4%) had positive post-

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DJ stent insertion urine culture; all cases were asymptomatic, while 5 (11.4%) had colonization at the distal end of the DJ stent. Moreover, Burkholderia cepacia was the most common DJ stent's distal end colonizer, while Pseudomonas was the most common urine colonizer. Unlike other studies, we found no correlation between age, gender, comorbidity, and post-DJ stent insertion urine culture.

Joshi et al. reviewed 46 patients with a DJ stent inserted, with 14 lost to follow-up. Positive urine cultures before surgery were seen in 10 patients (21.7%), with 13 patients (28.3%) on the day of stent removal, and colonization of the stent was seen in 30.4% (14 of 46). Of the pathogens identified, E. coli was the most common (Joshi et al., 2011). *Paz et al*. reviewed 100 cases (47 elective and 53 emergency insertions) of DJ stent insertion. 13 patients had a DJ stent placed urgently due to fever and were not accounted for to review any febrile complications. Of the remaining 87, 19(56%) of the urgent group (n=34) developed fever, as opposed to only 3(6%) of the elective insertion patients. 6 of these 22 patients (27%) who developed fever had a positive urine culture after insertion of DJ stent (Paz et al., 2005). While our study showed that only 11.4% of patients had post DJ stent positive urine culture, and all patients were afebrile. *Aydin HR et al*. studied 102 patients with a mean DJ stent indwelling time of 33.91 ± 22.42 days. Bacterial colonization of stent was found in 29.4% (30 of 102 patients), while similar to our study, they did not observe statistical differences between the patients with colonization, age, gender, and duration of stenting (Aydin et al., 2016b). *Ze Ondo C et al.* analyzed the urine cultures and DJ stent cultures of 56 patients, which revealed colonization in 9(16%) patients (Ze Ondo et al., 2019). These results are much less than our study.

Ulker et al. reviewed 35 patients with a mean DJ stent indwelling time of 39 days. Seven patients(20%) had their DJ stents colonized, with staphylococcus epidermidis being the most commonly colonized organism (3 patients, 28%); however, no statistical correlation was found with gender, age and stent colonization (p= >0.05) (Ulker et al., 2019). A study performed in Pakistan in 2019 assessed the cultures of 55 patients were sent of which 22 patients (40%) had a positive DJ stent culture. The commonest organism was E coli(15 out of 22- 68%), with pseudomonas the 2nd most common organism 3(13%) (Shaikh et al., 2019). *Oka et al.* did a study on 30 patients to determine the frequency of bacterial colonization in diabetic and chronic kidney disease (CKD) patients. They reported bacterial colonization in 60% of patients with DM and CKD (p= 0.018 p=0.040, respectively) (Gede Oka et al., 2019).

Another study was done in Pakistan by *Shabeena KS et al.* on 72 patients who underwent stent insertion. Their results showed that Bacterial colonization of DJ stent was found in 47.2% (34 of 72) of patients. Of the multiple pathogens identified, *Escherichia coli* (20%) was the most common, followed by *Streptococcus* sp. (17.5%) and *Pseudomonas* sp. (12.5%). However, they observed that Bacteriuria and stent colonization gradually increases with the duration of stent retention in the body (Shabeena et al., 2018).

Finally, the present study aimed to investigate the effects of DJ stent colonization. Our study suggests no significant correlation between DJ stent colonization and age, gender, comorbidities, and post-DJ stent insertion urine culture. Further research is required to explore other factors impacted by DJ stent colonization. Understanding the complex dynamics of DJ stent colonization is crucial to optimize patient management and reduce associated complications.

Conclusion

We found no significant correlation between DJ stent colonization and age, gender, comorbidities, and post-DJ stent insertion urine culture. Furthermore, most patients with colonized stents were asymptomatic. Pseudomonas was common in urine culture, and Burkholderia cepacia was common in DJ stent colonization. Despite these observations, it is essential to highlight that DJ stent use remains a widely accepted and safe procedure. Although our study did not establish direct correlations, it contributes to the understanding that the complexities of DJ stent colonization extend beyond the examined variables. Future research should explore additional factors that colonization patterns may influence and further enhance the safety and management of DJ stent usage.

Conflict of interest

The authors declared an absence of conflict of interest.

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