Original Article

Detection of biofilm and bacterial colonization on DJ stent in obstructive uropathy

Ghulam Shabir Shaikh, Abdul Hussain Shar, Muhammad Imran, Amir Ali Shaikh, Nisar Ahmed Shaikh and Malik Hussain Jalbani

Departments of Pathology, Urology and Microbiology, Chandka Medical College Hospital, Larkana, Pakistan

Objective: To detect biofilm development and to see the culture and sensitivity on DJ stent in obstructive uropathy.

Methodology: This descriptive cross sectional study was conducted at Urology, Pathology and Microbiology Department of Chandka Medical College Hospital SMBBMU Larkana and SALU Khairpur from January 1, to July 31, 2018. DJ stents were removed from all patients either General or in Local Anesthesia with the help of cystoscope and foreign body forceps. Lower part of stent was cut for biofilm. Lower part of DJ stent was cleared with normal saline to eradicate surface contaminants then shifted to tryptic soy broth to see culture and sensitivity.

Results: Out of 55 patients, 35 were male and 20 females. Mean age of males was 27±13.1 and female 22±13.8 years. Among them, 15(27.27%) were found to form biofilm, which specially occurred in those patient who had DJ for longer than six weeks. Biofilm formation was seen in 10 out of 35 (28.57%) males 5 out of 20 (25%) females. Stent culture was positive in 22 out of 55 (40%) patients. It was positive in 14 out of 35 (40%) in males 8 out of 20 (40%) females. The most common organisms seen were Escherichia coli in 15 (68.18%), Pseudomonas in 2(13.3%), Klebsiella in 2(13.3%), Enterococci in 1(6.6%) and Staphylococcus coagulase negative in 2(13.3%) patients.

Conclusion: Biofilm formation and positive cultures are common in any period of time, so removal of DJ stent should be well-planned with appropriate antibiotic prophylaxis to avoid complications like systematic inflammatory response syndrome and urosepsis. (Rawal Med J 202;45:350-352).

Keywords: DJ stent, Biofilm development, culture and sensitivity.

INTRODUCTION

Biofilm is accumulation of bacteria and extracellular biopolymers over DJ stent and it was first noted in the early 1990s by Hasan et al.[1] Biofilm formation on ureteral stents is related to associated morbidity due to bacterial pathogenicity and antibiotic drug resistance. Pradere et al[2] stated that the duration lengthening are the risk of bacteriuria and colonization increased.

DJ stent is a thin, hollow tube placed in the ureter during surgery for obstructive uropathy to make sure free flow of urine in ante grade fashion from renal system towards urinary bladder.[3,4] Though it is used as friendly to patient, it may cause damage because of complications like formation of biofilm, encrustation of DJ stent, infection, and migration of DJ upward or downward, vesico-ureteral reflux, acute pyelonephritis and breakage of DJ stent.[5] Enterococci are most common pathogens that lead to biofilm formation.[6]

There are three types of DJ stent like Polyurethane, Metal stent and Gel-based stent but only polyurethane available in Pakistan. According to coating techniques, Heparin coating, Hydrogel based coating, Diamond like carbon coating, Tirclosan-eluting coating, Oxalate degrading enzyme coating and Nanoscale-body coating are manufactured. In Pakistan, only polyurethane DJ stent is available, which poses serious problem like biofilm formation, bacterial adhesions and encrustation.[6-9] The aim of this study was to detect biofilm development and and to see the culture and sensitivity on DJ stent in obstructive uropathy.

METHODOLOGY

This descriptive cross sectional study was

conducted at Urology, Pathology and Microbiology Departments of SMBBMU Larkana and SALU Khairpur from January 1, to July 31, 2018. All DJ stents removed from patients under either General or Local Anesthesia by cystoscope/ ureteroscope were sorted for biofilm formation. Approval for the study was taken from the scrutiny committee of SALU Khairpur. Obstructive uropathy patients having DJ stent in situ of all age groups were included in this study, while patients with stone disease, diabetes mellitus and patients on antibiotics treatment were exclude from this study design.

Detailed presenting complaints, age and gander were noted. Complete examination of patients was performed. Especially, time duration of DJ stent was noted. Basic investigations like Full blood count, Urinary detailed report, Urine C/S, Blood Urea Nitrogen level, Creatinine level, Ultrasound KUB, X-Ray KUB and X-Ray Chest were performed in all patients. Lower part of DJ stent was cut and irrigated with normal saline to remove surface contamination and then was transferred to tryptic soy broth for culture and sensitivity.

RESULTS

Out of 55 patients, 35 were male and 20 females. Mean age of males was 27±13.1 and female 22±13.8 years. 30 out of 55 patients (54.54%) had stent duration of greater than six weeks with mean time of 7.6 month. Among 55 patients, 15 patients developed Biofilm (Fig. 1).

Fig. 1. Patients with positive biofilm.

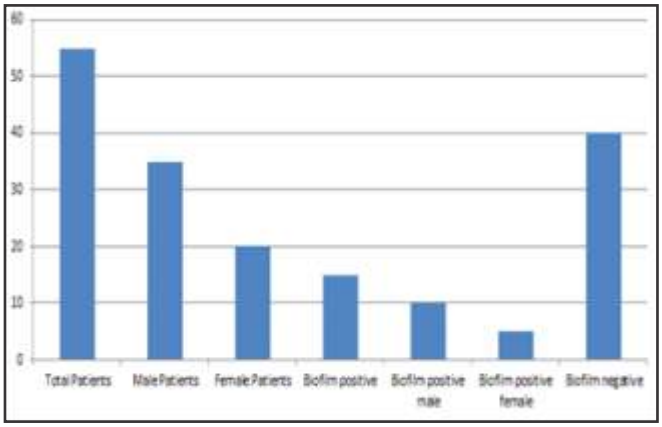
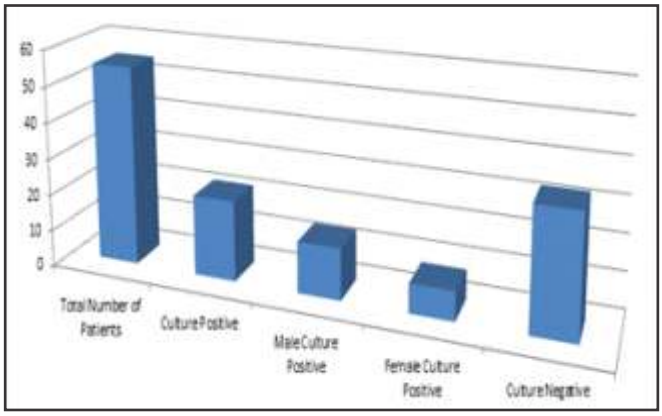


Fig. 2. Patients with positive culture.



Biofilm development was more common in men, 10 out of 35 male patients (28.57%), while 5 out of 20 female patients (25%) developed biofilm. Among these 15 biofilm forming patients, 10 patients had positive culture (Fig. 2).

DISCUSSION

DJ stents are a frequently used and essential tool in the field of urology.[10-13] Hassan et al[1] stated that 80% of Nosocomial urinary tract infections are associated with use of Percutaneous Nephrostomy, ureteric catheter and DJ stenting. Cormio et al[6] reported that 23 DJ stents were inserted which included 8 different types and after 6 weeks intubation, scanning with electron microscopy revealed sporadic bacteria in 7 (30%) ureteric stents and development of biofilm on only 2 (9%), which is comparable to our study.

Berat et al[14] and Zhang et al[15] found positive biofilms development in 10% patients and common pathogenic organism was E coli, and the pattern of drug resistance in bacterial biofilms on the ureteral stent was relatively higher. In our study, the commonest organism seen in culture was E coli, 15 out of 22 culture positive patients (68.18%). Other organisms included Pseudomonas (13.63%), Klebsiella pneumonia (9.09%) and Staphylococcus coagulase negative (9.09%). Higher resistance pattern was seen which is comparable to Zhang et al[15] and O'Toole et al.[11]

Gregor Reid et al[17] placed 30 stents for 5 days to 4 months after extracorporeal shock wave lithotripsy and evaluated for development of biofilms and bacterial adhesion and found 90% had adherent

pathogens. Isolated organisms showed, 77% Gram positive cocci, 15% showed Gram negative rods and 8% showed Candida and 15 cases of biofilm development. All uro-pathogens were responsible to attach and develop biofilms on stents within few hours.

et al[5] and LeRoy et al[12] also found 36% bacterial colonization of ureteral stents by saponification. Hasan et al[1] and Yaron and Romling[13] also found 29.9% bacterial colonization and common organisms were Staphylococcus coagulase negative and E. coli. Resistance to antibiotics is increasing, which seen in culture and sensitivity reports. It was observed in Quinolone (50%), Cephalosporin (60%), Gentamycin (55%), B-lactamase (30%), Penicillin (65%). Sensitivity pattern of antibiotics was also observed in few drugs. These included Amikacin (82%), Nitrofurantoin (92%), Fosfomycin (93%), pipracillin/Tazobactam (95%) and Meronium (96%). This is similar to results reported by to Saltzman et al[8] and GregorReid et al.[16]

CONCLUSION

This study revealed that development of biofilm and bacterial colonization on DJ stent was related to time duration. It is recommended to remove DJ stent as earlier as possible and routinely perform culture and sensitivity of part of stent to prevent biofilm formation and septicemia.

Author contributions:
Conception and design: Ghulam Shabir Shaikh
Collection and assembly of data: Abdul Hussain Shar
Analysis and interpretation of the data: Muhammad Imran
Drafting of the article: Aamir Ali
Critical revision of the article for important intellectual content: Nisar Ahmed Shaikh
Statistical expertise: Malik Hussain Jalbani
Final approval and guarantor of the article: Ghulam Shabir Shaikh
Corresponding author email: Nisar Ahmed Shaikh: drnisarshaikh@yahoo.com
Conflict of Interest: None declared
Rec. Date: Jul 27, 2019 Revision Rec. Date: Jan 9, 2020 Accept Date: Feb 16, 2020

REFERENCES

1. Hasan RA, Lokman I, Mustafa A, SelimG, Huseyin CD et al. Incidence of bacterial colonization after indwelling of double-J ureteral stent. Archivoitlantio di urologiaeandrologia 2015;87:291-94.
2. Pradere B, Doizi S, Proietti S, Brachlow J, Traxer O .Evaluation of guidelines for surgical management of urolithiasis. J Urol 2017;5:22-53.
3. Michelaen SJ. Medical evaluation and management of urolithiasis. Ther Adv Urol 2010; 2:3–9.
4. Preminger GM. Medical evaluation and treatment of nephrolithiasis. Semin Urol 1994;12: 51–5.
5. Zumstein V, Betschart P, Albrich WC, Buhmann MT, Ren Q, Schmid HP, et al. Biofilm formation on ureteral stents - Incidence, clinical impact, and prevention. Swiss Med Wkly 2017; 3:147-50
6. Cormio L, Vuopio-Varkila J, Siitonen A, Talja M, Ruutu M. Bacterial adhesion and biofilm formation on various double-J stents in vivo and in vitro. Scand J Urol Nephrol 1996;30:19-24.
7. Christian JH, Judy YC, Drek L, Rizwan M, Dale HR. Biofilm detection with Hematozylin-Eosin staining. Arch Otolaryngol Head Neck Surg 2010;136:453-6.
8. Saltzman B. Ureteral stents. Indications, variations and complications. UrolClin North Am 1988;15:481–91.
9. Abdelhak K , Mohammed Jamal El Fassi, Moulay Hassan Farih. Risk Factor Analysis and Management of Ureteral Double-J Stent Complications. Rev Urol 2010;12:147–51.
10. Rodney MD. Biofilm Formation: A Clinically Relevant Microbiological Process. Clinical Infect Dis 2001;33:1387–92.
11. O'Toole G, Kaplan HB, Kolter R. Biofilm formation as microbial development. Ann Rev Microbiol 2000;54:49-79.
12. LeRoy AJ, Williams HJ, Segura JW. In-dwelling ureteral stents: percutaneous management of complications. Radiology 1986;158:219–22.
13. Yaron S, Romling U. Biofilm formation by enteric pathogens and its role in plant colonization and persistence. Microb Biotechnol 2014;7:496-516.
14. Berat CO, Nedım Y, Omer B. Bacterial colonization of double J stents and bacteriuria frequency. Kaohsiung J Med Sci 2013;29:658-661.
15. Zhang JM, Liu JB, Wang KC, Zhang XA, Zhao TA, Luo HM. Observations of Bacterial Biofilm on Ureteral Stent and Studies on the Distribution of Pathogenic Bacteria and Drug Resistance**.** Urol Int 2018;101:320–6.
16. GregorReid D, Denstedt YS. Dominique LM, Carolyn NE. Microbial Adhesion and Biofilm Formation on Ureteral Stents in Vitro and in Vivo. J Urol 1992; 148:11592-4.