

Frequency of Ureteral Stent Encrustations in a Urology Unit of Tertiary Care Hospital

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ABSTRACT

Objective: To determine the frequency of encrustations of ureteral stents in a tertiary care hospital of Pakistan.

Patients and Methods: In this study we included 150 patients of Urology Unit of Ibn e Sina Hospital and Research Institute Multan, Pakistan in whom ureteral stents implantation was done. The study duration was April-2020 to July-2020. Patients with ureteral stents having renal stone, ureteric stone, ureteral stricture, pelviureteric junction obstruction (PUJO), trauma or malignant disease as primary pathology and duration of implantation >2 weeks to <2 years were included.

Results: Mean age of patients included in this study was 46.46±12.26 years. Mean duration of stent placement was 11.96±6.01 weeks. There were 97 (64.7%) male and 53 (35.3%) female patients. There were 72 (48%) patients with renal stone disease, 32 (21.33%) patients with ureteric stone, 11 (7.33%) patients with pyeloplasty, 22 (14.67%) patients with partial nephrectomy and 13 (8.67%) patients with obstruction sec. to malignancy were included in this study. Stent encrustation was diagnosed 52 (34.67%) patients.

Conclusion: After implantation, ureteral stent encrustation is still a cause for concern for urologists. Because its encrustation management may involve additional urologic procedures. In present study, stent encrustation was found in 62 (32.29%) patients.

Keywords: Double-J stents, stent encrustation.

INTRODUCTION

Since their initial use in 1967, ureteral stents have seen widespread adoption.¹ After retroperitoneal tumor or fibrosis removal, ureteral stricture repair, uretero-pelvic junction obstruction treatment, or ureteral stone removal, double-J stents (DJS) have become a standard part of many urologic procedures.² In addition to protecting and defining the ureter during preoperative complex abdominal procedures, stents may be inserted after iatrogenic injuries have occurred.³ Moreover, the treatment of ureteral obstruction has been revolutionized by the introduction of ureteral stents. Hydronephrosis, renal colic, and renal failure may all be treated promptly with stents.⁴

Stents can cause the development of stones when they become covered in organic and mineral encrustations after coming into contact with urine. As a matter of fact, the composition of urine is a complex environment that affects biomaterial adhesion. Organic layers (conditioning film), uropathogens, and salts in the urine can all contribute to encrustation of ureteral stents.⁵ Sixty-eight percent to ninety percent of ureteral stents become colonized despite a rate of bacteriuria of only twenty-seven percent to thirty percent, which has led some authors to conclude that UTIs are the primary cause of organic layer formation.² A salt crust can't form without this biofilm as its foundation.

Encrustation is still a major issue when placing a ureteral stent, despite advancements in design and materials.⁶ In this study, we sought to quantify the occurrence of encrustations on ureteral stents.

METHODS

In this study we included 150 patients of Urology Unit of Ibn e Sina Hospital and Research Institute Multan, Pakistan in whom ureteral stents implantation was done. The study duration was April-2020 to July-2020. Patients with ureteral stents having renal stone, ureteric stone, ureteral stricture, pelviureteric junction obstruction (PUJO), trauma or malignant disease as primary pathology and duration of implantation >2 weeks to <2 years were included. Patients having diabetes mellitus (diagnosed on the basis of medical history of patients) were excluded because there is a high risk of infections and hence encrustation in diabetic patients.

A written informed consent was taken from all patients before including them in study. After that, in all patient's X-ray KUB or NCCT was done to diagnose stent encrustation.

Data regarding patients age, gender, BMI, etiology of stent placement and frequency of stent encrustation was collected for every patient.

Frequency and percentage was calculated for qualitative variables such as gender, etiology of stent placement and stent encrustation.

RESULTS

Mean age of patients included in this study was 46.46±12.26 years. Mean duration of stent placement was 11.96±6.01 weeks. Mean body mass index (BMI) of patients included during the study was 26.12±4.10 kg/m². There were 97 (64.7%) male and 53 (35.3%) female patients.

The highest number of patients for etiology of stent placement was of renal stone disease. There were 72 (48%) patients with renal stone disease, 32 (21.33%) patients with ureteric stone, 11 (7.33%) patients with pyeloplasty, 22 (14.67%) patients with partial nephrectomy and 13 (8.67%) patients with obstruction sec. to malignancy were included in this study (Figure 1).

Stent encrustation was diagnosed 52 (34.67%) patients (Figure 2).

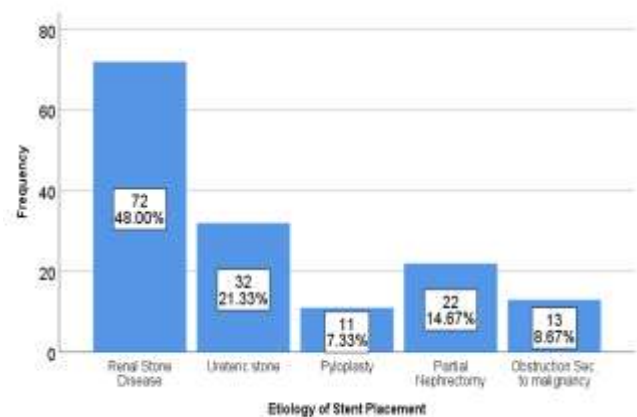


Figure 1. Etiology of Stent Placement.

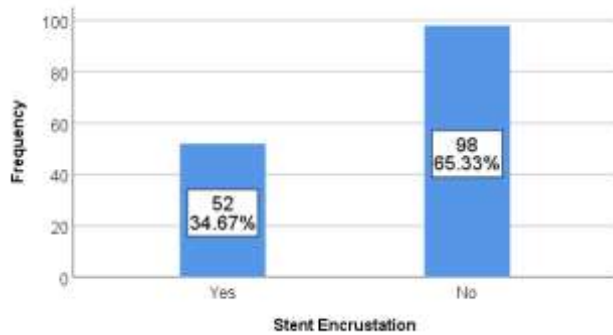


Figure 2. Frequency of Stent Encrustation.

DISCUSSION

Now more than ever, urologists must deal with complications such as stent migration, occlusion, encrustation, fragmentation, and stone formation after placing ureteral stents.^{7,8} 109,110 Chemotherapy, metabolic abnormalities, urolithiasis, bacteriuria, and pregnancy are all risk factors for stent encrustation. The urinary tract does not contain any inactive stents. Protein is absorbed onto the biomaterial, and bacterial organic molecules deposit on the protein substrate to form a conditioning film, both of which contribute to encrustation as they interact with the stent surface and the collecting system environment in sequence.⁸ Afterward, the bacteria attach and multiply, eventually forming a biofilm. Afterwards, crystals precipitate from the extracellular matrix, attracting more cations, and the crystals grow by themselves. Stents made of polyurethane (PU) are the most popular choice because they provide the longest period of protection against encrustation by common uropathogens. Severe encrustation occurs most often at the renal and bladder ends of the stent, with the ureteric segment typically becoming involved last due to peristaltic wiping. Surface coatings applied to stents can affect these procedures. The presence of hyaluronic acid and covalently bound heparin delays encrustation compared to non-coated PU stents because they prevent the nucleation, growth, and aggregation of salts.⁹

In present, stent encrustation occurred in 62 (32.29%) patients while there were 130 (67.71%) patients with no stent encrustation.

A study conducted by Kawahara et al. found stent encrustation 56.9% in patients with stent indwelling time 6-12 weeks.⁸ While in a review article, the authors reported stent encrustation in 47.5% patients with stent indwelling time 6-12 weeks.¹⁰ While a recent study has reported stent encrustation in only 23.5% patients within the same duration.¹¹

According to a study that was conducted by el-Faqih and associates, the rate of stent encrustation rises from 9.2% when the stent has been in place for less than 6 weeks to 47.5% when it has been in place for 6 to 12 weeks to 76.3% when it has been in place for more than 12 weeks.¹² Encrustation and migration have been found to occur at a frequency of 2.8% and 3.7%, respectively, according to Radecka et al.¹³ According to Singh et al., encrustation was found in 5% of patients who had been lost to follow up. These patients all presented with loin pain or haematuria after a period of more than three months.¹⁴ Memon NA et al. found that stent encrustation occurred in 17.5% of patients, but after 12 weeks, it occurred in only 4.2% of patients, and stent migration occurred in 11.7% of patients.¹⁵ Nawaz H et al. reported that stent encrustation occurred in 10.5% of the cases, and stent migration occurred in 3.5% of the cases.¹⁶ Patients in the study conducted by Arshad M and colleagues showed signs of stent migration, while 2% showed signs of stent encrustation.¹⁷ El Faqih and colleagues examined 299 stents implanted in 290 stone patients and found encrustation on 9.2% of the stents that were retrieved after a period of six weeks. 47.5% and 76.3% of the 119 stents that had

been implanted in the ureter for 6 to 12 weeks or more showed signs of encrustation, respectively. It was discovered that the associated morbidity was low if the length of time spent in residence was less than six weeks.¹²

When it comes to encrustation, the rate of encrustation is affected by the surface properties, such as how rough or irregular the surface is. To begin the encrustation process, the stent must first have proteins absorbed onto it. This is despite the fact that the actual mechanism that causes encrustation is complex and involves multiple steps.^{18,19} Encrustation in infected urine occurs as a result of organic components in the urine crystallizing out onto the surface of the biomaterial and becoming incorporated into a bacterial biofilm layer. This process occurs as a result of a mechanism known as encrustation. The bacteria continue to multiply, which results in the production of urease. Urease breaks down urea, which in turn causes an increase in the urinary pH. Because of the elevated pH, calcium and magnesium ions are drawn to the biofilm matrix, which ultimately leads to the formation of crystals.^{20,21}

CONCLUSION

After implantation, ureteral stent encrustation is still a cause for concern for urologists. Because its encrustation management may involve additional urologic procedures. In present study, stent encrustation was found in 62 (32.29%) patients.

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