APPLICATIONS AND COMPLICATIONS OF POLYURETHANE STENTING IN UROLOGY

Arshad M, Shahzad S.Shah, Muhammad H. Abbasi
Department of Surgery, Combined Military Hospital, Kharian

Background: As surgeons working in a developing country, we decided to review our experience with polyurethane stents instead of the more expensive ones on common urological procedures and analyzing our experience with respect to their usefulness versus their problems and outcome. **Methods:** This stusy was carried out at Armed Forces Institute of Urology, Rawalpindi and Combined Military Hospital, Kharian Cantonment, Pakistan through March 2002 through May 2004. During this period 342 of patients were operated requiring stent and 220 patients out of these had polyurethane as stent material for different urological operations. **Results:** Among the 220 patients who underwent polyurethane stenting, early complications included fever, infection, voiding symptoms while stent migration, encrustation and stent stiffness was encountered as later complications. **Conclusion:** The benefits of Polyurethane stents are its strength, versatility and low cost. Poor biodurability and biocompatibility only limit its use; these are reasonably effective in our setup but should only be used for short duration.
Key words: Urology Stents, Polyurethane, Complications.

INTRODUCTION

Stents and catheters are commonly used in Urology for a wide range of indications ranging from Urolithiasis to reconstruction, trauma and transplantation. Infact they are a mainstay of today's urological armamentarium[1]. Stenting provides urinary diversion and it facilitates healing. Stricture formation is also prevented as injury site heals by forming a mould around which urothelium regenerates. It also maintains the diameter of the passage. In some cases stents are passed to facilitate intraoperative ureteral identification during difficult surgical dissection and prior to ESWL. From a Urologist's viewpoint, Stents must be easily maneuverable, radio opaque and affordable. This article discusses the use of polyurethane suction catheters and feeding tubes used as stents for urological operations. A significant number of urological operations entail opening of the urothelium, which under different circumstances behaves differently.

In this study, conducted at Armed Forces Institute of Urology, Rawalpindi and Combined Military Hospital Kharian , the generally available cheaper polyurethane stents were used instead of the more expensive custom made stents on 220 patients on procedures such as pyeloplasty, ureterolithotomy, ureteric reimplantation, pyelolithotomy, urinary diversion and Hypospadias repair. The common complications encountered were infection, voiding symptoms, stent migration, encrustation, stiffness and retained stent. Results regarding their benefits versus complications were accounted for.

MATERIAL AND METHODS

This study was undertaken at the Armed Forces Institute of Urology, Rawalpindi and the Combined Military Hospital, Kharian from March 2002 through May 2004.

Information regarding patient demographics, stent type, duration of placement and any complication resulting directly or indirectly from the stent were noted. Prior to any surgical procedure, a through medical evaluation was carried out including a detailed history with particular reference to any previous urological operation and any previous history of stent placement. A physical exam was done with special note to any factor that could influence healing. All patients were subjected to routine baseline investigations including complete blood count, urine routine exam, urea creatinine and electrolytes, blood glucose (fasting) and ultrasound of KUB area. Cystoscopy was routinely done for all patients presenting with hematuria .CT scan and MRI where indicated was also requested. Intravenous gentamycin (patients with normal renal tests) and cefuroxime was administered as prophylaxis and continued as treatment for patients developing signs of infection. The study included only those cases where polyurethane stenting was performed as an 'open procedure' and all endoscopic procedures were excluded. Also excluded were those patients where stent material other than Polyurethane was used. Stents were removed on the 7th post operative day in all cases except after urinary diversion where it was removed after three weeks. Urinary tract infection was documented by urinalysis and culture sensitivity reports. Voiding symptoms were expressed objectively and data was expressed as percentage of patients suffering from different complications. Early complications were recorded as those occurring during the first post operative week

RESULTS

Over a period of 26 months 342 patients underwent different open urological operations out of which 220 patients had a polyurethane stent placed. Table I shows the different urological procedures undertaken. Overall amongst the early complications, fever was seen in 3 %(n=7) of cases. This was recorded as that occurring or presenting after 36 hours of surgery, and responded to NSAIDS and antibiotics, in two patients however the fever persisted along with voiding symptoms. The stents were removed endoscopically resulting in an uneventful recovery. Infection occurred in 8% of cases (n=17) as documented by a positive urinalysis and culture sensitivity testing. Majority of the patients were managed by IV gentamycin where the renal function was normal along with IV cefuroxime.Except the 2 cases mentioned earlier where stent had to be removed, all were managed conservatively. Voiding symptoms including dysuria, hematuria and frequency were the most commonly observed complications accounting for 17 %(n=37).

Stent migration, both proximal and distal was observed in 16% (36 patients). Proximal migration was seen in 4 patients where the stent was short and not traversed the UV junction significantly, these were found in the renal pelvis and upper ureter. In one patient, open surgery was required for the retrieval while in the remaining it was removed endoscopically. Distal migration was more commonly encountered. This was seen predominantly in females as a significant majority passed it in their own and endoscopic removal required in the rest. Stent stiffness was seen in 4% of cases where polyurethane material had been in situ for more than 2 weeks. Retrieval was not difficult.

Encrustation occurred in three patients. 2 of the patients had been lost to follow up and both had been operated for ureteric calculi and reported only after 2 years due to loin pain in one and hematuria in the other. Both cases were managed by ESWL breaking up the encrustation and the Stent Late complications included stent migration in 16 %(n=36) while encrustation was seen in 1.3% of cases. 2 of the patients had a forgotten stent as a result of being unable to follow-up for domestic reasons. Stent stiffness was seen in 3.6 % of cases (n=8).

The greatest number of complications seen was in ureterolithotomy where polyurethane was used but overall its use outweighed the combined complications with stent migration distally as the most common complication. 2 of the patients mentioned earlier who had forgotten stents were worked up for persistent dysuria and found to have heavy encrustation. They were previously operated for ureteric calculi two years ago. The encrustation was broken up by ESWL and the stent later on removed at cystoscopy.

Stent stiffness was seen in 3.6% (n=8) of cases where polyurethane had been in situ for more than two weeks. Retrieval was not difficult. Encrustation occurred in 3 patients with polyurethane stents.2 of the patients had been lost to followup.Both had been operated for ureterolithotomy and reported after around 2 years due to loin pain in one and hematuria in the other. Both cases were managed by ESWL and later endoscopic removal. The third case was seen in a patient who had been operated for urinary diversion where an ileal conduit had been fashioned. The ureters had been stented with 7Fr polyurethane pediatric feeding tube and brought out through the ileostomy. The stents however retracted and the patient forgot about them as the 'urobag' caused no problem and was lost to follow up. The condition was diagnosed on a later visit (after 3 months) when they were removed with a little difficulty and were found to have encrustation on both.

A total of 21 patients who underwent pyeloplasty had polyurethane feeding tube placed as a stent.All repairs were dismemberment pyeloplasty of the Anderson Hynes type. Stent size 7-9Fr was used. The stent was brought out as a nephrostomy. The tube was removed on the 10th post operative day. Complications encountered were infection and voiding symptoms which ceased on removal. Amin-ul-haq and Isa khan[2] however conclude that stents and nephrostomy tubes are not needed as a routine except those needing secondary repairs or having inflammation.

Pyelolithotomy had voiding symptoms and stent migration as the most common complications. Ureteric reimplantation had polyurethane stenting in 12 patients and had the least complication rate. The stent was removed at three weeks.

90 patients ranging from 3 months to 15 years underwent Hypospadias repair of different types and polyurethane feeding tube used as a stent. The only complication seen was voiding symptoms in 22% of patients (n=20).

No complication regarding knotting, stent fracture or erosion was recorded in our study.

Table- 1: Procedures

Procedures	n
Pyeloplasty	21
Ureterolithotomy	30
Ureteric reimplantation	12
Pyelolithotomy	53
Urinary diversion	14
Hypospadias	90

Table-2: Early Complications

Procedure	n	Fever	Infection	Voiding symptoms
Pyeloplasty	21	-	5	10
Ureterolithotomy	30	6	2	15
Ureteric reimplantation	12	1	1	5
Pyelolithotomy	53	-	7	10
Urinary diversion	14	-	2	-
Hypospadias	90	-	-	20

Table- 3: Late complications

Procedure	N	Stent migration	Encrustation	Stent stiffness
Pyeloplasty	21	-	-	-
Ureterolithotomy	30	12	2	-
Ureteric reimplantation	12	-	-	2
Pyelolithotomy	53	21	-	6
Urinary diversion	14	3	1	-
Hypospadias	90	-	-	-

DISCUSSION

An unsettled issue in urology is the routine placement of stents after open urologic surgery, where urothelium has been opened. Recent studies have questioned the routine use of stents[2] there are numerous theoretic advantages to routine stenting after the urothelium has been breached iatrogenically or accidentally. The later development of oedema at the site may lead to obstruction of urine flow. Placement of stent in such a situation ensures that the renal function of that site remains functioning and decreases the chances of pain due to obstruction. Stent also aid in the passage of fragments of stone after ESWL. Stent also promote ureteral healing and prevent stricture formation[3, 4].

The ideal stent material does not exist but putting all in perspective, contemporary stents have improved flow characteristics and are relatively more tolerable once inserted. Mardis et al have provided a good insight into comparative evaluation of materials used for stents in urology. Materials of greater strength such as polyurethane, allow a greater inner to outer diameter ratio, increasing luminal urine flow and permitting passage over larger guide wires, also permitting large side holes along its length further improving drainage. Weaker stent material i.e. silicone must have a smaller inner diameter and, hence, poorer flow characteristics and easy compressibility[5]. Silicone has an inherent weakness as compared to other materials. Because coil retention is an important risk factor for migration, if this is of concern than one may want to avoid silicone as stent however a high retention coil may fail to unwind when pulled down. A radioopaque stent is important for accurate placement. Stents are normally placed under fluoroscopic guidance. Stent polymers are not radioopaque; therefore metallic salts are added to make them visible on fluoroscopic exam. Smaller diameter stents have been noted to be less radioopaque during fluoroscopic insertion [6].Biodurability describes the ability of a stent to resist degradation in vivo. Once inside the urinary tract, the stent is subjected to various factors in the urine and the urothelium that results in loss of strength, elasticity and flexibility. Biocompatibility refers to the degree to which the material affects the urothelium and vice versa. No stent is perfectly biocompatible. Marx et al studied the biocompatibility of stents. Urothelial ulceration and erosions were common with polyurethane[7]. So placement of stents is not without risks. Major reported complication includes stent fracture, erosion, encrustation and development of uretero-arterial fistula[8]. Other complications include those mentioned already in the study. Encrustation may lead to difficulty in removal and may be the cause of recurrence of obstructive symptoms. Stents which are in place for more than 3-4 weeks have a 15% chance of encrustation, and 76% that are left for more than 12 weeks [9, 10]. Knotting of the stent has also been reported[11]. Another complication is 'forgotten stent' usually due to poor follow up and inadequate patient communication. Recovery of such stents is a daunting task, making a complex surgical undertaking. All these complications are significantly more in stents made up of polyurethane as this is not the ideal stent material, although we have found it very useful in our setting. In a study by waterman et al, he concludes that success rate is not negatively impacted in Hypospadias repair using any particular stent[12], this translating into figures of considerable financial benefit as in our settings. One method of preventing complication of infection is by administering antibiotics at the time of insertion. It has been documented that antibiotics adhere to the stent surface at bactericidal levels and can delay adherence of bacteria to stents, but require patient compliance and may cause morbidity.[13] Notwithstanding the recognized complications, short term use of polyurethane stents would continue to have support where the ideal environments do not exist, such as in all developing and underdeveloped countries.

CONCLUSION

There remain many unanswered questions as regards stenting in urology. Stenting is no longer considered a routine but there remains a subgroup of patients who would likely benefit from stenting as evidenced by the higher readmission to hospital rate than in nonstented patients. The benefits of Polyurethane stents are its strength, versatility and low cost. Poor

biodurability and biocompatibility only limit its use; these are reasonably effective in our setup but should only be used for short duration.

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Address For Correspondence:
Dr. Shahzad S.Shah, Combined Military Hospital, Rawalpindi 46000, Pakistan.
E-mail: shahzadshah70@yahoo.co.uk