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Forgotten and Encrusted Ureteric Stents: A New Classification

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Abstract **Original Research Article**

The double pigtail stents are commonly used in urology. Their forgetfulness in the urinary ways leads to complications. The encrustation, fragmentation or migration are the most common complications. We conducted a four-year retrospective study to identify Demographic, clinical, radiological and therapeutic aspects of forgotten ureteral stents. ***Material and Methods:*** Retrospective study of 16 cases of forgotten and complicated ureteral stents lasts for four years. The encrusted stents were classified according to our own classification: KUB classification. Patients were treated by either extra corporeal shocwaves, endourology or open surgery according to a well-established therapeutic algorithm. ***Results:*** Average age: 36,6 years. The indications of ureteral stents were dominated by lithiasis: 87%. the average stenting time was 14.6 months. The Complications were dominated by the encrustation: 93%, with only one case of fragmentation and 4 cases of infection. The treatment was multimodal, combining several techniques mainly endourological, with an average number of entry to the operating room of 1.6. The average number of surgical procedures: 1.3. The average hospital stay is 4 days. ***Conclusion:*** The forgotten ureteral stents present a real problem of management. The extraction of the stent may require several surgical procedures which are stresfuls for the surgical team and the patient. Our classification allows a better therapeutic and prognosis correlation. Prevention must be at the forefront.

Keywords: Forgotten ureteral stents, complications of ureteral stents, classification of encrustation of ureteral stents, fragmentation of ureteral stents.

INTRODUCTION

The ureteral stent is an invention that has revolutionized the world of urology for 40 years. Currently, it becomes essential in our everyday practice. Its role is to ensure a good drainage of the excretory ways in case of obstruction, to avoid postoperative stenosis. Its contact with the hostile urinary environment exposes in case of forgetfulness serious complications whose management is not always simple.

MATERIAL AND METHODS

We have collected all the cases of forgotten ureteral stents in the excretory ways which presents an impossibility of simple retrograde withdrawal by cystoscopy. For a period of 4 years from 2012 to 2016, 16 cases were studied. Our patients were treated according to an algorithm (Fig 1). The first step consists of a biological evaluation of the renal function by measuring the glomerular filtration rate, urinalysis and urine culture. The radiological evaluation consists of the practice of a plain abdominal radiography and pelviabdominal contrast injected CT scan in case the renal function allows it. The presence of signs of obstruction associated with impaired renal function or infection requires nephrostomy. The CT scan allows a precise study of the renal state.

A highly impaired cortex with a DMSA renal scintigraphy below 10% indicates nephrectomy. The CT scan allows secondly an extensive assessment of calcifications: their size, their location, their extent and their density. In case of fragmentation or migration, the CT scan searches precisely for the location of the various fragments of the stent as well as the associated damage. These calcifications may affect any segment of the stent and were classified according to our new classification: KUB classification (FIG 2). Our classification makes it possible by dividing the stent into three parts: a renal part designated by K, a ureteral part by U and a bladder part by B. The incrustations of each segment are classified from 0 to 3 according to

their volume. Grade 1 encrustations are not obstructive and do not stop the removal of the stent. Grade 2 represents calcifications less than 2 cm of thickness at the renal and bladder level and less than 1 cm at the ureteral level.

Grade 3 represents thicker calcifications exceeding 2 cm at the renal and bladder level and 1 cm at the ureteral level. Therapeutic indication was based on the volume and location of stones classified by the KUB classification. Grade 2 can be treated as first-line by extra corporeal shockwave (ESW) and if failed, by ureteroscopy at the ureteral level or percutaneous nephrolithotomy (PCNL) at the renal level. Grade 3 may require a more aggressive attitude: PCNL at the renal level, ureteroscopy at the ureteral level, and percutaneous cystolithotomy (PCL) at the bladder level. Open surgery is the ultimate solution after the failure of mini invasive procedures. FIG 2 demonstrates our algorithm.

RESULTS

6 women and 10 men were included with an average age of 36.6 years all the stents were made from silicone. The average duration of stenting is 14.6 months (6-46 m).

The indication for placing the catheters was the management of urinary lithiasis in 14 cases, one case for pyeloureteral junction syndrom and one case for ureteral stenosis as complication of radiation for uterine cervix cancer. The complications were encrustation of the catheter in 14 cases, fragmentation in 2 cases, and 6 cases of urinary infection. All stones were radioopaque. the proximal loop was encrusted in 12 cases (75%), the distal loop in 3 cases (18.7%) and the ureteral segment in 6 cases (37.5%). Extraction was possible in 100% of the cases but the stone free rate was only 56.2%.

Management required several surgery sessions: 1.6 on average, with 1.3 surgical procedures on average. The average duration of hospitalization was 4 days. Urinary tract infections were dominated by Echirichia coli in 4 cases and 2 cases of klepsiella pneumonia. One case presented multi resistant urinary infection despite well conducted antibiotherapy which forced us to operate the patient despite infected urine. Table 1 presents the results of our patients.

Table-1: demagraphic data of patients presenting with forgotten ureteral stents ESW: extracorporeal shockwave PCNL: percutaneous nephrolithotomy PCL: percutaneous cystolithotomy URS: ureteroscopy PUJ : Pyeloureteral Junction

Patient	Age	Indication	Duration (Month)	Complication	Treatment	Number of surgical sessions	Hospitalization (Day)
1	50	Lithiasis	11	K0U0B2+ Infection	Endovesical Endolithotomy	1	2
2	23	Lithiasis	9	K3 U0 B0	pyelotomy	1	12
3	56	Ureteral stenosis	6	Fragmentation	PCNL	2	6
4	49	Lithiasis	22	K0 U2 B3 Infection	PCL +URS	3	7
5	26	Lithiasis	19	K2 U2 B0	ESW	1	2
6	30	Lithiasis	6	K3 U2 B0	PCNL +URS	2	10
7	44	Lithiasis	10	K0 U0 B2 Infection	Open	2	4
8	29	Lithiasis	17	K1 U2 B0	URS	1	2
9	35	Lithiasis	7	K2 U2 B0 Infection	ESW+PCNL	2	7
10	32	Lithiasis	11	Fragmentation	URS	2	3
11	41	Lithiasis	9	K1 U2 B0	ESW	1	1
12	27	Lithiasis	21	K2 U2 B0	ESW+URS	2	3
13	35	Lithiasis	17	K0 U1 B3	Open	2	3
14	18	PUJ syndrom	10	K3 U0 B0	PCNL	3	10
15	38	Lithiasis	14	K1 U2 B0	ESW	1	4
16	53	Lithiasis	46	K0 U2 B0	URS	1	2

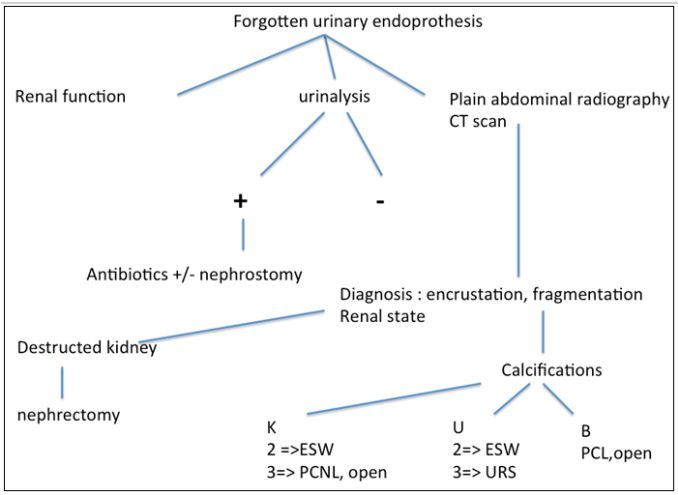

Fig-1: Algorithm of management of forgotten ureteral stent PCL : percutaneous cystolithotomy ESW : extra corporeal shockwave URS : ureteroscopy Open : open surgery

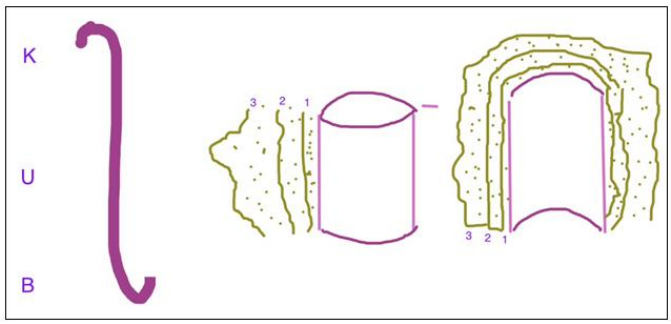

Fig-2: KUB classification K : kidney U : ureter B : bladder

DISCUSSION

The forgotten stents pose a real problem of management. Forgetting can be attributed as much to the practitioner as to the hospital center and even to the patient himself. The lack of traceability or communication between the doctor and his patient can lead to a state of confusion. Some patients especially in our context, even well informed, may deny the need of removal of the stent for purely financial reasons. Also some psychological profiles of elderly, confused, or unruly patients are risk profiles.

Encrustation, fragmentation or migration are complications resulting from a bad interaction between the catheter and the body of the patient, in this case the urinary environment. The ideal material of a stent does not exist [1]. Indeed each type of biomaterial has its own limits.

Encrustation

Silicone is considered to be the most resistant biomaterial for urinary stents [1]. Despite this and according to Bouzidi *et al*. a protein layer envelopes the stent and then begins to grow from the second week [2]. This phenomenon is time dependent [2]. Indeed, the encrustation rate according to Takashi and al. is 26.8% in the sixth week, 56.8% between the sixth and twelfth week and 75.9% in the twelfth week. Even if the silicone stents are guaranteed by the manufacturer for a period of use of 6 months and more, this does not eliminate the risk of encrustation especially in a lithogenic context. In our study, 2 patients presented grade 2 and 3 encrustations with relatively short stenting time. A patient even presented a fragmentation of its stent after 6 months of stenting which evokes probability of a manufacturing defect.

In addition to the nature of the biomaterial and the duration of stenting, infection, chemotherapy and pregnancy are all contributing factors cited in the literature [5]. Our study confirms that patients who have had stent placement due to lithiasis are most at risk of encrusting their stents. In fact 14 of 16 patients (87%) presented urinary stone before stenting. Robert M. has objectified a risk of encrustation of stent multiplied by 3 for lithiasic patients [13]. Concerning the physicochemical nature of encrustations, and according to Bouzidi, it is mainly oxalocalcic [2]. Only one study in the literature has been interested in comparing the physicochemical nature of encrustations to the stones preceding stent placement. These are the same in 63% of cases [4]. The authors concluded that the metabolic treatment can be based on the nature of encrustations if the physicochemical study of the initial stone is not available.

Fragmentation

Fragmentation is another known but rarer complication of forgotten stents. It occurs in 0.3% of stented patients. In general, it corresponds to a duration of stenting much longer than that of the encrustation [5].

In both of our patients the occurrence of fragmentation was faster. Stenturia is the natural removal of fragments detached from the stent. It can be considered as the pathognomonic sign of fragmentation of the stent. The mechanism is an alteration of the polymers constituting the Biomaterial.

A manufacturing defect cannot be eliminated. In one patient the duration of fragmentation was very short : 6 months. The patient had no biological abnormalities in his urine. And in addition, the absence of lithogenic context makes the hypothesis of a weakening of the stent by encrustation unlikely.

Infection

The stent as foreign equipment of the body is exposed to infection. This infection is dominated by asymptomatic colonization which can reach 69% and appear from the first days [6]. Infections are dominated by Echerichia coli. Antibiotic resistance is common and can reach 60% [7].

The time of stay of the stent in the excretory tract is a risk factor for infection. Diabetes and chronic renal failure are also major risk factors [7]. In our series there were 6 cases of urinary tract infection, 3 cases of Echerichia coli and one case of kleptielle pneumonia. With a case of multi-resistant bacillus.

Management

The management of these complications is still a therapeutic challenge, especially for a relatively young and active population.

The average age is 34 years old. In this sense, the classification of encrustations aims to standardize the description of this phenomenon and thus a better comparison of surgical outcomes.

To our knowledge, literature mentioned only one classification which is the Acosta one [3]. In our opinion, our classification has more simplicity and has a better therapeutic correlation.

It is difficult to acquire one 's own surgical experience regarding the treatment of encrusted stents for several reasons. First, given the rarity of this phenomenon especially in developed countries. Secondly, endourological interventions become difficult and perilous because of inflammation and infection. The multitude of operative times is the rule, with a long hospital stay which reflects the economic impact of these complications.

This heavy economic aspect is enhanced by the relatively low rate of stone free. Residual calculus debris after removal of the stent exposes to additional complications and treatments.

Prevention

Prevention is the key element of care. It is based on 2 pillars: good communication with the patient and good documentation of the use of the stent.

The communication with the patient is a crucial element of all medical practice regardeless of its medicolegal character.

The patient must be informed both in pre and postoperative time. Something that is not always obvious especially in centers with large flow. Joshi and colleagues in 2001 reported that 80% of patients were not satisfied with the communication they received prior to stent placement [9].

When the decision of placing an urinary stent is taken, it must be giving special attention. The screening of the psychological profiles at risk is done during first contact with the patient. Sharing information with a close family member is an acceptable solution.

Some studies have tried to analyze the causes of noncompliance of patients; factors have been identified as male gender, age under 40, and low socioeconomic level [8].

In countries where there is no compulsory social care, the risk of denial of ureteral stents retrieval due to financial reason is high. In this sense, we have proposed to our hospital, to include the withdrawal fees at the first intervention of the placement of the stent.

Many European and American centers are adopting a procedure to call the patient for the appointment of the removal of the stent via automated computer systems. For example, the system stent extraction reminder program (Turkey), stent extraction reminder facility (London).

But in general, the current electronic systems have a great interest in reducing the risk of forgetfulness which has been proved by countless studies [10].

Simpler prevention systems based on cards issued to patients were found to be ineffective, as was the case with Tang and coworkers [11] who postponed the failure of their stent card tracking system. They specified that the stent register was inefficient and time consuming.

Marc *et al*. have developed a system independent of the intervention of the care team or the patient which allows an actualisation and generalization of data to all the health structures and operators[12].

In Morocco, we have proposed to our hospital the use of a service presented by a local telecom operator called SMS connect. This system allows the automatic sending of a reminder SMS at a predetermined date of removal of the stent. The cost is $ 0.05.

General measures include : the use as far as possible of silicone stents. The rapid removal as much as possible of the stent, the use of stent with external wires or external ureteral stent may be useful in some situation, a good diuresis, a metabolic management of urinary stones in lithogenic patients to modify the biological field, close follow-up of patients with chronic obstructions or lithogenic sites.

CONCLUSION

The forgotten stents are a source of significant morbidity. The CT scan allows the lesional checkup. The KUB classification has therapeutic and prognosis value. The treatment is multimodal based on endourology. The key is prevention.

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