

## ORIGINAL PAPER

# Should patients with encrusted JJ stents involving the proximal/renal loop undergo primarily endoscopic combined intrarenal surgery?

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**Summary** *Background: Ureteral stents are one of the most used devices in Urology, allowing drainage of the upper urinary system, and can be used either in elective or emergency procedures. However, as a foreign body inside the urinary system, they are subject to encrustation. Encrustation is one of the burdens seen with double-J stents and, to date, there is no consensus about its best management. This study aims to prove that Endoscopic Combined Intra-Renal Surgery (ECIRS) is the best choice when there's an encrusted proximal loop of a ureteral stent.*

*Methods: The authors conducted a retrospective cohort study of patients with an encrusted proximal loop of the ureteral stent who underwent surgery at a single center, comparing ECIRS with other procedures.*

*Results: Between July 2011 and June of 2024, 33 patients (18 females and 15 males) were submitted to surgery. The median indwelling time of the stent was 11 (8-19) months and a stent-free rate of 100% was achieved. The authors demonstrated a significant stone-free rate of 61.1% following ECIRS compared to merely 20% with other procedures ( $p = 0.023$ ). Notably, while the complication rate was low across all procedures, the ECIRS group exhibited fewer complications (5.6%) than those undergoing alternate techniques (13.3%), though this difference was not statistically significant ( $p = 0.439$ ).*

*Conclusions: Our study advocates for ECIRS as the preferred initial treatment for encrusted proximal ureteral stents, as it facilitates superior stone clearance, minimizes complications, and maintains comparable operative efficiency. This research contributes valuable insights into the management of challenging cases involving encrusted ureteral stents, calling for future studies to further validate these findings.*

**KEY WORDS:** Encrusted stent; Lithiasis; Endoscopic combined intra-renal surgery.

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## INTRODUCTION

Ureteral stents are one of the most used devices in Urology. They allow the drainage of the upper urinary system and are a powerful tool to use either in elective or emergency procedures. However, as a foreign body inside the urinary system, they are subject to encrustation.

Encrustation is one of the burdens seen with double-J

stents (1). An encrusted stent is defined as one that cannot be removed simply by cystoscopy due to calcification or stone formation around the stent (1, 2). Several risk factors have been described, namely indwelling time and bacterial colonization, as well as patient specific factors and the physical characteristics of the stent (3). *El-Faqih et al.* proved that the incidence of stent encrustation increases with indwelling time, reporting 9.2% of stents removed before 6 weeks were encrusted compared to 47.5% removed between 6 to 12 weeks (4).

Nowadays there is no consensus around the best management of this type of complication. Its approach depends on the severity and location of the encrustation. Some classification for the *encrusted stents* (ESs) had been published in the last years, namely the KUB score and the *forgotten, encrusted and calcified* (FECal) grading system. The first one, KUB system is based on the degree of encrustation of the stent in the kidney, ureter and bladder, grading it from 1 to 5, and it's supposed to identify those that will be surgically challenging to remove (5). The later, is based on the stone size, location and degree of stent encrustation, and graded from 1 to 5, proposing also a treatment algorithm (2, 6). In 2021, *Manzo et al.* proposed a novel system, the V-GUES, which aims to propose a visual classification for ESs that help to guide the choice of the appropriate treatment. This system is based on visual interpretation of CT scans and divides it into 4 categories: group A includes distal calcification, sparing the ureteral and proximal portions of the stent; group B includes calcification of the distal and ureteral portions of the stent, sparing the proximal loop; group C includes proximal calcification, with or without calcification of the distal portion, but sparing the ureteral portion of the stent; and finally group D includes calcification of the proximal and ureteral portions of the stent, with or without calcification of the distal portion. The authors advocate that their classification system is associated with the number of procedures required for a patient to be stent-free, stone-free rate and complications. They suggested that this classification will allow urologist to choose the most reliable intervention (1).

Based on the aforementioned studies, the authors intended to prove that the *Endoscopic Combined Intra-Renal Surgery* (ECIRS) is the best choice when there's an encrusted proximal loop of a ureteral stent.

## MATERIALS AND METHODS

We conducted a retrospective cohort study of all patients who were found to have an encrusted JJ stent and underwent surgical procedures for its removal in our center between July 2011 and June of 2024 (54 patients). From this group of patients, the ones with proximal loop encrustation were selected, based on preoperative CT scans and the V-GUES classification. The patients selected belonged to the C and D groups from this classification. All patients without a preoperative CT scan were excluded.

All clinical and surgical data were collected from patients' files, focusing on age, sex, height and weight and renal function (serum creatinine levels). We also gathered information about the procedure during which the stent was initially placed, the time of diagnosis of the encrustation and the duration of the catheterization. We registered the type and number of procedures needed to achieve a stone free status, that was defined as the absence of any fragments in the postoperative imaging studies, and a stent-free status.

All patients underwent surgery in our hospital, by a single surgeon. Treatment decisions were based on the surgeon's preference. The surgeries performed were *semirigid ureteroscopy* (srURS), *flexible ureteroscopy* (fURS), *percutaneous nephrolithotomy* (PCNL) and *endoscopic combined intrarenal surgery* (ECIRS). All patients with positive cultures were treated with antibiotics before the surgery, and all were given perioperative antibiotic prophylaxis. Other data collected included the postoperative complications, including the first 30 days, and classified according to the Clavien-Dindo classification.

Data was collected in a SPSS file. We conducted descriptive statistics for all the variables, presenting their means or median according to the presence (or not) of a normal distribution. The categorical and nominal variables are presented in frequency tables. To compare means between variables we used a t-sample test. The correlation between variables was ascertained using Pearson correlation and logistic regression was made to obtain odds ratio of the variables, were applicable. Differences were considered statistically significant if  $p < 0.05$ .

The study was made in accordance with the Helsinki Declaration.

## RESULTS

Between July 2011 and June of 2024, 33 patients with an encrusted proximal/kidney loop of a ureteral stent were submitted to surgery in our centre. There were 18 females and 15 males, with a mean age of 53.9 ( $\pm 19.0$ ) years. The mean height and weight were 1.62 ( $\pm 0.1$ ) m and 74.1 ( $\pm 19.4$ ) kg, respectively. The mean BMI was 27.8 ( $\pm 6.0$ ). In 11 cases the encrusted JJ stent was on the left and in 20 cases on the right; we had 2 cases of encrusted stents in a renal transplant. The preoperative serum creatinine levels were 1.1 ( $\pm 0.6$ ) mg/dl and the postoperative was 1.1 ( $\pm 0.4$ ) mg/dl. We found no statistically significant difference in the creatinine levels pre- and post-operatively ( $p = 0.961$ ).

Preoperative urine cultures were also taken, with a positive result in 10 cases and negative in 9. In 12 cases the lab was not able to isolate the bacteria probably due to contamination of the sample. In the other 2 cases the pre-

**Table 1.**  
Results of urine cultures.

Urine culture	Frequency (%)
E. coli	6 (60.7%)
P. mirabilis	3 (30%)
C. albicans	1 (10%)

**Table 2.**  
Frequency table of the surgeries performed.

Surgery	Frequency (%)
Combined access	18 (54.5%)
PCNL	8 (24.2%)
Flexible ureteroscopy	6 (18.2%)
Semirigid ureteroscopy	1 (3%)

operative urine culture was not available. The isolated strain was *Escherichia coli* in 6 patients, followed by *Proteus mirabilis* in 3 cases, and 1 case of *Candida albicans*. These results can be consulted on Table 1.

The median indwelling time of the stent was 11 (8-19) months, varying between 5 and 71 months. We found no correlation between indwelling time and the occurrence of complications ( $p = 0.830$ ) or the stone-free rate ( $p = 0.423$ ).

Regarding surgical approach, the most performed surgery was endoscopic combined intrarenal surgery in 18 cases of 35 (54.5%), as can be seen on table 2. In 8 patients (24.2%) the surgery chosen was PCNL, 6 patients (18.2%) underwent fURS and 1 patient (3%) underwent srURS.

The mean time of procedure was 121.1 ( $\pm 44.3$ ) min. When comparing ECIRS with other procedures, the authors found a mean time for combined surgery of 123.6 ( $\pm 50.9$ ) min and a mean time a 118.1 ( $\pm 36.5$ ) min for other surgeries. There was no statically significant difference between the groups ( $p = 0.727$ ). We also found no difference between the procedure time and the occurrence of complications ( $p = 0.523$ ) and the stone-free rate ( $p = 0.487$ ).

In all the cases (100%) the encrusted stent was removed in the first procedure.

Regarding the stone-free state, 14 patients (42.4%) were stone free after the first procedure, with 19 (57.6%) patients not achieving this state. Comparing the ECIRS procedure with the other surgeries performed, a stone-free rate of 61.1% was achieved with the ECIRS procedure, while other procedures resulted in a 20% stone-free rate. Comparing these rates, we found a correlation between the choice of ECIRS and the stone-free rate ( $p = 0.023$ , OR 6.3, 95% CI:1.3-30.5). This data can be seen on Table 3.

**Table 3.**  
Comparing ECIRS with other procedures regarding stent-free, stone-free and complication rate.

	Combined procedure	Other procedures	P
Stent-free after one procedure	18 (100%)	15 (100%)	N/A
Stone-free after one procedure	11 (61.1%)	3 (20%)	0.0023
Complication rate	1 (5.6%)	2 (13.3%)	0.439

**Table 4.**  
Description of complications.

	Procedure	Type of complication	Management	Clavien-Dindo classification
Complication n°1	ECIRS	UTI	antibiotics	II
Complication n°2	Other	UTI	antibiotics	II
Complication n°3	Other	Urinary leakage	Vesical catheterization + antibiotics	II

The median hospital stay was 3 (2-3) days. Overall, there were 3 cases (9.1%) of postoperative complications in the first 30 days. Two cases of fever with *urinary tract infection* (UTI) and 1 case of urinary leakage. Regarding the Clavien-Dindo classification, all fall into the II classification. Comparing ECIRS with other procedures, we found a complication rate of 5.6% with ECIRS and a 13.8% rate with other procedures; we found no statistically significant correlation between these variables ( $p = 0.439$ ). The complications and its frequencies can be seen on table 4. Regarding the necessity of a second procedure, 2 patients needed other surgery - 1 patient a FURS (first procedure was a mini-PCNL), 1 mini-PCNL (first procedure was FURS). No complication was reported on these cases.

## DISCUSSION

Encrusted ureteral stents are a complex problem to manage and it may be difficult and risky to treat it (7, 8). Classification systems appear to facilitate the approach of this type of patients. According to *Juliebo-Jones et al.* (7), it is recommended to use one of the classification systems available. In this study, the authors chose to use the V-GUES classification system as it appears as the most reliable and useful. The KUB system is based on X-ray images alone, which may render some limitations. The FECal system, despite its more broaden classification, it is only based on 9 patients. (1, 2). The classification was used to select patients to enter the study, and only the ones categorized as C or D were selected - which means with the presence of encrusted proximal loop of the stent was the selection criteria.

Some authors already proposed that the location of the encrustation will determine the surgical modality required for the management of the ureteral stent, and the authors from V-GUES already suggest that combined surgery was associated with best stone-free and stent-free rate (1, 2). The main objective of this study is to propose ECIRS, with combined percutaneous surgery and retrograde endoscopic surgery, as the best first approach to managed encrusted proximal loops of ureteral stents.

This study harbours some limitations inherent to its retrospective design and relatively small patient cohort. However, due to the nature of this type of cases and its relative scarcity, the authors believe that a prospective study is not feasible. The cases were all performed by the same surgeon, with plenty of experience in lithiasis surgery, which could help to explain the good results.

The data collected gathered information from patients with an encrusted proximal/kidney loop of a ureteral stent that were submitted to surgery in our centre for a

period of roughly 13 years. The sample obtained was 33 patients, with 18 women and 15 men. Given the scarcity of reports on these subject, and its relative infrequent occurrence, this number are in line with other single center reports.

The median indwelling time of the stent was 11 (8-19) months. It is known that the prolonged indwelling time of stents increases the prevalence and severity of all complications (8). However, we could not find a correlation

between the occurrence of complications or stone-free rate and the indwelling time of the ureteral stent. We hypothesize that this could be explained by the low level of complications present in the sample.

The mean time of procedure for ECIRS was 123.6 ( $\pm 50.9$ ) min, that was not statistically significantly different from the mean time of the other procedures ( $p = 0.727$ ). This shows that, even when comparing operative time, the use of a more complex surgery, like the combined approach, does not imply longer operative times, advocating for its use.

There was a 100% rate of stent-free patients after the first procedure, independently of the procedure used. This excellent stent-free rate can be explained by the relative short number of cases and the experience of the surgeon. When focusing on the stone-free state, 42.4% of the patients achieved this state after the first procedure. When comparing the two groups, we found a higher stone-free rate when using ECIRS comparing to other procedures (61.1% vs 20%, respectively). In this case, we found a positive correlation between the use of ECIRS and the stone-free status, with a OR of 6.3 ( $p = 0.023$ , 95% CI: 1.3-30.5). This shows that ECIRS is a more effective procedure comparing to the other procedures, in cases of encrusted stent, namely with proximal loop encrustation. Some authors already proposed that PCNL should be used in encrusted proximal loops stent. *Pais et al.* state that only 8% of the stents could be removed by PCNL alone, suggesting that additional procedures may be needed (9). Our results show that in proximal loops, ECIRS should be preferred as first-line as it is the most successful surgery.

When looking at the complications rate, the group had a very low complication rate and only with Clavien-Dindo II. Once again, this could probably be explained by the experience of the surgeon and the limited number of cases analysed. Despite not being statistically significant, the complication rate was lower when using the combined approach, supporting its primary use.

There was need for a second procedure in 2 patients. All the patients needed at least one procedure with a percutaneous access and others with retrograde endoscopic surgery. This is also in favour with the proposed theory (all needed combined surgery), even if it was in two separate procedures. This supports the theory of using combined approach as the first choice in this type of patients. In the remaining patients, the residual stone burden was very little and didn't need other procedure.

*Weeding et al.* reported that patient with proximal encrusted stents required more procedures to remove the stent and the stone burden (10). Our study group reports that

the used of combined surgery approach can improve outcomes and reduce the number of surgeries needed to treat this type of patients.

## CONCLUSIONS

Encrusted ureteral stents poses a significant challenge for urologist. There is a lack of standardized treatment in this area. The authors propose combined surgery as the first choice for the treatment of encrusted proximal loops of ureteral stents, as it is associated with better stone-free rate and fewer complications, while not increasing operative time.

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**Conflict of interest:** The authors declare no potential conflict of interest.