Original Article

JHSMR Journal of Health Science and Medical Research

A Novel Technique for Simple Double-J Stent Placement after Intraperitoneal Laparoscopic Ureterolithotomy

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Received 3 October 2024 ● Revised 3 December 2024 ● Accepted 9 December 2024 ● Published online 28 April 2025

Abstract:

Objective: The insertion of a double-J (DJ) stent during laparoscopic ureterolithotomy can be challenging, invasive, and time-consuming when using the various techniques available for its placement. This study aimed to present a simplified method for DJ stent placement following intraperitoneal laparoscopic ureterolithotomy.

Material and Methods: Twenty-five patients with proximal ureteral stones who underwent intraperitoneal laparoscopic ureterolithotomy and placement of DJ stent between November 2023 and February 2024 in a teaching hospital were selected for this study. After the stone was successfully removed, the ureteroscope was inserted through a 5-mm trocar and passed into the distal ureter, followed by threading the guidewire through it. Subsequently, the distal tip of a 6-French DJ stent was attached to the guidewire and inserted into the distal ureter. The proximal tip of the DJ stent was guided along the wire through the ureteral incision and advanced toward the pyelum.

Results: The stent was successfully placed in, on average, below 5.9 minutes. No complications were found. Postoperative plain abdominal X-ray confirmed the correct placement of the DJ stent. An efficient patient recovery was found with an average hospital stay of 2.7 days.

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J Health Sci Med Res
doi: 10.31584/jhsmr.20251193
www.jhsmr.org

Conclusion: This novel DJ stent placement technique, with its simple and efficient features, was found to be successful. Further comparative studies with larger patient populations are required in order to evaluate its efficacy.

Keywords: DJ stent, laparoscopy, ureteral calculus, ureteral obstruction, ureterolithiasis

Introduction

Treatment of ureteral stones larger than 10 mm using laparoscopic ureterolithotomy (LU) is known to be superior to ureteroscopy and extracorporeal shock wave lithotripsy (ESWL)[1,2]. However, the additional placement of a double-J (DJ) stent after LU is needed in order to provide internal drainage, ensure the patency of the urinary tract, prevent urinary leakage, promote better healing, and reduce the risk of ureteral stenosis[3]. The procedure can be performed using an extraperitoneal approach, which is more appropriate for proximal ureteral stones, or intraperitoneally for distal ureteral stones[4]. The extraperitoneal approach is preferred by surgeons due to the wider operative view it provides. The technique of DJ stent placement during intraperitoneal laparoscopic surgery remains a topic of debate. There are 2 described methods for placing a DJ stent during laparoscopic surgery: antegrade[3,6] and retrograde[7]. However, the most recent intraperitoneal technique, known as the "seagull technique"[6], requires a preoperative CT scan and dual-wire guide placement, rendering it less accessible within healthcare systems in lower-middle-income countries. Therefore, this study aimed to introduce a simplified technique for DJ stent placement following intraperitoneal laparoscopic ureterolithotomy.

Material and Methods

Study design

An observational study was conducted at Sultan Agung Islamic Hospital, Semarang, Indonesia, from November 2023 to February 2024, during which 25 patients underwent intraperitoneal laparoscopic ureterolithotomy with double-J stent placement performed by a single urology specialist at our institution. The distal and proximal ureter were separated by the pelvic rim. The inclusion criteria for this study were patients with proximal ureteral stones larger than 10 mm (Figure 2A) who consented to undergo laparoscopic ureterolithotomy and DJ stent placement. The exclusion criteria included distal ureteral stones, bladder tumors, ureteropelvic junction stones, total ureteral stenosis, and retroperitoneal adhesions. All data were obtained from direct observation and the patients' medical records. This study adhered to the tenets of the Declaration of Helsinki and obtained approval from the Research Ethics Committee of Sultan Agung Islamic Hospital (61/KEPK-RSISA/IV/2024).

Surgical technique

The patients with a ureter stone gave their written consent for laparoscopic ureterolithotomy. Preoperative examinations were conducted. The patients also consented to undergo DJ stent placement. The patients were positioned in the lumbotomy posture under the effects of general anesthesia. This procedure utilized a total of 3 ports. The initial port was placed in the belly button using the 11-mm Direct Trocar Insertion (DTI) method. The 5-mm trocar placed in the subxiphoid was used in the second port. The third 5-mm port was inserted into the right para rectus muscle. Insufflating the abdomen was done in order to maintain the position of all the trocars. Ureterolysis was performed using a Harmonic scalpel. Ureterotomy was carried out with a scalpel blade mounted on a laparoscopic needle holder. The laparoscopic instruments effectively accomplished the removal of the stone.

The bladder was filled with 300 ml of NaCl 0.9% through a urine catheter, which was then clamped to ensure that the distal tip of the DJ stent entered the bladder. The ureteroscope (URS) was inserted through a 5-mm trocar (Figure 1A), then passed into the distal ureter (Figure 1B), followed by threading the guidewire through it (Figure 1C-D). The URS sheath was inserted into a 5-mm laparoscopic trocar so that there was no leakage through the trocar because the distal hole of the URS sheath was closed by operator's finger, and the valve of the URS sheath was closed. Subsequently, the distal tip of a 6 French DJ (Ark Meditech System, Gujarat, India) stent was attached to the guidewire and inserted into the distal ureter (Figure 1E). The entire stent was pushed downward, leaving only the upper end visible. This helped maintain the upper end of the stent in a straight position after the guidewire was removed. If urine flowed out through the hole in the DJ stent, it confirmed that the distal tip of the stent was positioned in the bladder. The length of the DJ stent was then measured from the pyelum to the incision level on the ureter. A guidewire was subsequently inserted through the hole in the DJ stent at the level of the ureter incision until the proximal tip of the DJ stent, and the proximal tip of the DJ stent was inserted through the ureteral incision toward the pyelum by laparoscopic forceps. The proximal tip of the DJ stent was guided along the wire through the ureteral incision and advanced toward the pyelum with help from gentle laparoscopic forceps (Figure 1F). The patient underwent drain placement (Figure 2B).

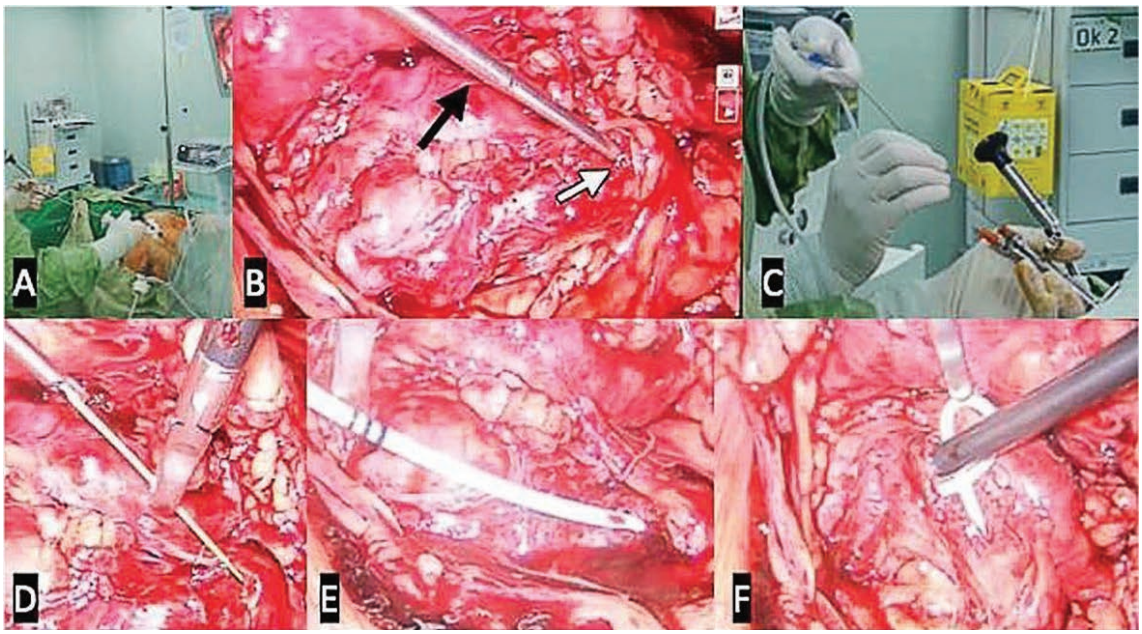

Figure 1 A novel technique for simple double-J stent placement. (A) The ureteroscope is inserted through a 5-mm trocart. (B) Insertion of ureteroscope (black arrow) into the ureter (white arrow) during laparoscopic nephrolithotomy. (C) Insertion of guidewire (D) to distal ureter. (E) Insertion of DJ stent into the distal ureter using atraumatic laparoscopic forceps. (F) Insertion of the DJ stent into the proximal ureter using atraumatic laparoscopic forceps.

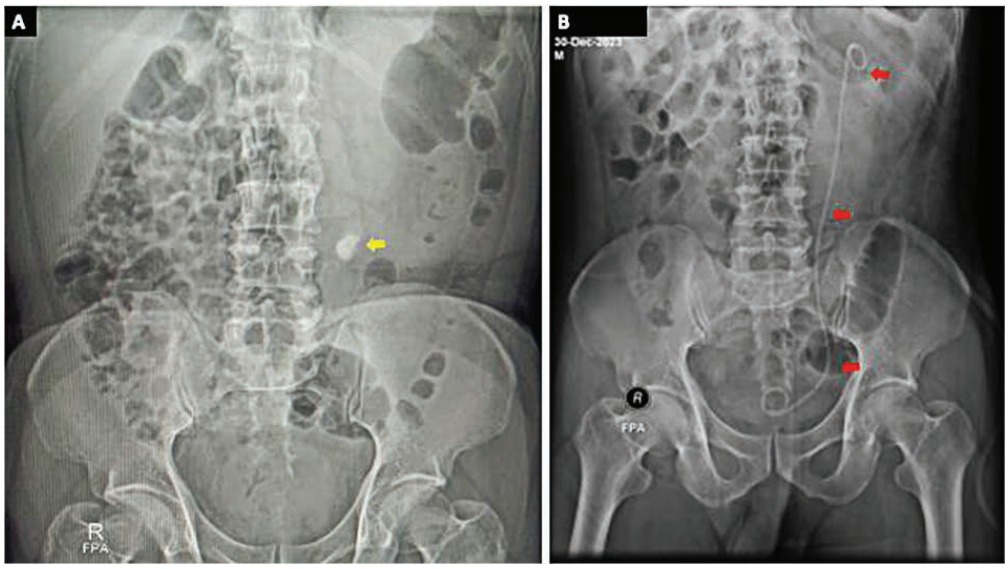

Figure 2 A kidney, ureter, and bladder (KUB) X-ray. (A) Postoperative proximal ureteral stone (yellow arrow). (B) Correct placement of the DJ stent in the ureter following laparoscopic ureterolithotomy (red arrow). All patients who underwent this technique had the correct placement confirmed by KUB X-ray.

Outcomes

The primary outcome was the percentage of the correct DJ stent placements. This study also reported the mean time for intraoperative stent placement, the length of hospitalization, complication rates, and stone-free rates. Pearson or Spearman correlation tests were used to assess the relationship between intraoperative stent placement time and hospitalization duration. Patients underwent a A kidney, ureter, and bladder (KUB) X-ray to assess DJ stent positioning and stone clearance rates. The DJ stent was removed 4 weeks post-surgery. Patients were considered stone-free if they had no remaining fragments or only fragments smaller than 4 mm[8]. Following stone analysis, patients with residual fragments were provided with oral medication for treatment. Hospitalization refers to the length of stay after surgery, reflecting patient recovery time. The data were analyzed using Microsoft Excel and GraphPad Prism 8.0.

Results

Patient characteristics

We successfully performed DJ stent placement using this technique in 25 patients who underwent laparoscopic ureterolithotomy at Sultan Agung Islamic Hospital from November 2023 to March 2024. The proximal ureteral stones in this study had an average size of 34.8±7.0 mm, with 15 patients having stones on the right side. Male patients were also more prevalent in this study. Patient characteristics and outcomes are summarized in Table 1.

Primary outcome

Postoperative KUB X-ray showed the correct placement of the DJ stent (Figure 2B). The percentage of patients with the correct placement of the DJ stent was 100%. The long-term follow-up was conducted at the time of DJ stent removal after 4 weeks. The distal tip of the DJ stent was clearly visible in the bladder of all patients during

the removal process, which was cystoscopically performed, indicating that the stent remained properly positioned.

Secondary outcome

We were able to place the stent with an average time of 5.9 minutes (ranging from 4 to 9 minutes). Intraoperative stent placement time showed a moderate positive correlation with the duration of hospitalization (r=0.41; p-value=0.04). The pain score results, based on the Visual Analog Scale (VAS), showed an average of 3.7±0.7, with the administration of post-operative ketorolac injection. None of our cases experienced prolonged urinary leakage or other complications. No patients developed urosepsis. Antibiotics, according to the local microbial pattern at Sultan Agung Islamic Hospital, were administered preoperatively and continued until discharge. Patients were discharged on average 2.7±0.6 days post-operation.

Discussion

There are 2 debated methods for DJ stent placement after LU: antegrade[3,6] and retrograde[7]. Placing the DJ stent before surgery in a retrograde manner is harder and frequently not successful with large ureteric stones. After the ureter stone is removed and the ureterotomy is sutured, another retrograde technique is carried out, necessitating a change in the patient's positioning from a full lateral position to a lithotomy position with flexed hips and elevated buttocks[7]. They did not report the operation time, but the technique we use does not require a change in position, and thus we are confident that our operation time is faster.

The newest method suggested is the "seagull technique", in which 2 wires are inserted into the DJ stent from both ends in order to straighten its terminal curve, imitating a seagull's wings[6]. Using 2 wires in the process raises the overall cost. The "seagull technique" requires an average time of 100 minutes, as the preparation and placement of the DJ stent take 8 minutes. The mean operative time for procedures using this method was 90±19.4 minutes, with the mean time for intraoperative stent placement being 5.9±1.4 minutes. The results of the analysis show that the mean time for intraoperative stent placement has a moderate relationship with the length of hospital stay. The previous study had the same operation time but did not elucidate the technique for DJ stent placement during LU[9,10].

Table 1 Main baseline and perioperative outcomes

No.	Variable	Sum	Mean±S.D.
1	Patient (n)	25	
2	Side (right/left)	15/10	
3	Sex (male/female)	17/8	
4	Mean stone size (mm)		34.8±7.0
5	Mean operative time (min)		90.0±19.4
6	Mean time for intraoperative stent placement (min)		5.9±1.4
7	Postoperative KUB (% correct DJ stent placement)	100	
8	Stone-free rate (%)	100	
9	Complication rate (%)	0	
10	Visual Analogue Scale		3.7±0.7
11	Mean length of hospitalization (days)		2.7 0.6

S.D.=standard deviation, n=amount, mm=millimeter

We reported no complications in all of our patients. The other known technique also does not involve complications, such as ureteral perforation or submucosal dissection[3,6,7]. Patients undergoing the extraperitoneal technique are more likely to experience intraoperative complications such as a breach in the peritoneum[11]. In another study of laparoscopic intraperitoneal ureterolithotomy involving 100 patients, complications occurred including one patient experiencing severe bleeding requiring transfusion, 2 cases of fever due to urosepsis, 2 patients experiencing prolonged urine leakage (modified Clavien grade 3a), and one case of ureteral stenosis[12]. Antibiotics, according to the bacterial pattern at the Sultan Agung Islamic Hospital, are Cefoperazone sulbactam 1 g twice daily, administered to patients before and until discharge to prevent urosepsis. The material of the non-rigid DJ stent used in this study also may prevent ureteral injury, which could otherwise prevent the prolongation of urine leakage[13].

We report a correct rate of DJ stent placement of 100% with a mean intraoperative stent deployment time of 5.9 (4-9) minutes. Research using the seagull technique reported a mean stent placement time of 5 (4-6) minutes and intraoperative stent placement with a 100% accuracy rate for DJ stent placement[6]. However, their average operation time may be longer for preparing the DJ stent, as the mean time for stent preparation with the 2 guidewires is 180 (120-230) seconds. Other studies have reported being able to place the DJ stent in less than 3 minutes[3,14]. Recents studies using the same method also found that the distal tip of the DJ stent was not positioned within the bladder for one of the patients[14]. The patient complained of moderate pain, which was managed with an injection of ketorolac postoperatively. Other studies did not provide data on pain scores or pain management strategies. Ketorolac reduces pain scores more effectively compared to ibuprofen or parecoxib while exhibiting milder side effects than opioid analgesics[15].

The present study had several limitations that constrained the generalizability of the findings. The study was limited by a small sample size, as ureteroscopy was the more commonly performed procedure at this hospital because the majority of patients presented with stone sizes less than 10 mm, and procedures were performed by only one operator. Future multicenter comparative studies with larger patient populations would help confirm these findings and further demonstrate the effectiveness, efficiency, and safety of this technique.

Conclusion

This novel technique for DJ stent placement offers a simple and efficient approach, reducing operative time and minimizing the risk of ureteral injury. These findings suggest that this technique may shorten overall operation time while achieving favorable surgical outcomes. Further studies are needed in order to evaluate the safety and efficacy of this technique in a larger patient population.

Acknowledgement

The authors would like to express our sincere gratitude to Sultan Agung Islamic University and Sultan Agung Islamic Hospital for their support and approval of this research.

Funding sources

This research did not receive any specific grant from funding agencies in the public, commercial, or not for profit sectors.

Conflict of interest

The authors do not have any conflicts of interest to disclose.

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