Comparison of ureteral stents removal by rigid cystoscope versus rigid ureteroscope: A prospective study

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ABSTRACT

Introduction: Ureteral stents are regularly used after different urological procedures to keep the ureter patent. They are commonly removed by rigid cystoscope under local anesthesia, and patients often experience significant pain during and after stent removal. Due to its small caliber, a rigid ureteroscope may cause less pain and discomfort. The authors compared the pain scores during ureteral stent removal by rigid cystoscope and rigid ureteroscope. **Methods:** In this prospective comparative study, 105 patients undergoing ureteral stent removal under local anesthesia were randomly assigned to two groups. In group A (55 cases), the stent was removed by rigid cystoscope, while a rigid ureteroscope was used in group B (50 cases). The pain experienced during the procedure, at first void, and at 24 hours was noted using a visual analog scale (VAS) pain score (0 to 10). The lower urinary tract symptoms and other complications were also recorded. **Results:** The VAS pain score during the procedure and at first void was significantly higher in group A as compared to group B (3.65±1.9 vs 2.60±0.7, p<0.001; and 1.91±1.2 vs 1.24±0.8, p=0.002). The irritative voiding symptoms were also more in the rigid cystoscope group than the rigid ureteroscope group (2.65±2.0 vs 1.56±1.1, p=0.001). However, the pain, urinary symptoms at 24 hours, and other complications were comparable in both groups. **Conclusions**: Ureteral stent removal by rigid ureteroscope is less painful and more tolerable by patients as compared to rigid cystoscope. Thus, the use of a rigid ureteroscope is a safe and effective method for ureteral stent removal.

Keywords: Pain, rigid cystoscope, rigid ureteroscope, ureteral stent.

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INTRODUCTION

Ureteral double-J (DJ) stents are commonly used by urologists primarily to keep the ureter patent. They relieve obstruction and maintain adequate drainage of urine through the ureter. Hence, they are used after surgical procedures of the ureter and kidneys, in various ureteral and kidney pathologies, and prophylactically before pelvic surgeries and extracorporeal shock wave lithotripsy (ESWL).[1] Ureteral stents are associated with some degree of stent-related symptoms in the majority of patients, and they often experience generalized urinary discomfort, pain during micturition, hematuria, urgency, and urinary tract infection (UTI).[2] The stents are thus removed as soon as the purpose is served. DJ stents are mostly removed in an office setting under local anesthesia using lignocaine gel by a rigid cystoscope.[3] The procedure is short; however, many patients experience significant pain during stent removal, and discomfort during voiding can last for a few days in some.[4] The pain is particularly higher in male patients who have a longer urethra and an enlarged prostate.

Various methods have been suggested to decrease the pain and discomfort during stent removal, such as pre-procedural analgesics,

procedure under general anesthesia, use of flexible cystoscope, and stent modifications like biodegradable stent and magnetic stent.[5-9] However, these methods are not widely accepted and are not very effective as well. Regional and general anesthesia will be painless, but these are associated with more cost, longer hospital stays, and higher anesthetic risk to the patients for such a short procedure.[10] The rigid cystoscope has a larger diameter and is inflexible, which leads to potential tissue damage, pain, hematuria, and lower urinary tract symptoms. Hence, a reduction in the diameter of the scope may be an effective approach to decrease the pain. One such instrument is a rigid ureteroscope, which has a much smaller diameter and is available in the armamentarium of all urologists.

Limited studies have been performed in Nepal on the use of a rigid ureteroscope during DJ stent removal. This prospective study was conducted to compare the pain experienced during ureteral stent removal by rigid cystoscope and rigid ureteroscope.

METHODS

This hospital-based, prospective, comparative study was performed in Gandaki Medical College Teaching Hospital & Research Center, Pokhara, Nepal, from October 2024 to April 2025. This study was reviewed and approved by the Institutional Review Committee (Ref. No. 01/081/082). Written informed consent was obtained from each patient after explaining the procedure in their language before they were enrolled in the study. All the patients aged 18 years and above undergoing DJ removal under local anesthesia were included in the study. Patients with bilateral DJ stents, migrated stents, residual stones in the ureter, urethral stricture, significant lower urinary tract symptoms, and UTI or prostatitis were excluded from the study. Similarly, patients who had complications during the stent removal like severe hematuria and mucosal injury, and those unable to understand the visual analogue scale (VAS) were also not included in the study.

A total of 125 patients were assessed for the eligibility in the study, but only 114 patients who fulfilled the criteria were enrolled in the study. These patients were randomly divided into two groups by using a computer-generated random number table. In Group A, ureteral stents were retrieved by a 19.5 Fr rigid cystoscope (Richard Wolf, Knittlingen, Germany) with grasping forceps. Group B comprised patients who had their DJ stents removed by a 6/7.5 Fr rigid ureteroscope (Richard Wolf, Knittlingen, Germany). The stent was removed by using the standard technique with grasping forceps, and 2% Xylocaine jelly into the urethra was used as a local anesthetic agent. The pain experienced by the patients was assessed by VAS score, ranging from 0 to 10 (where 0 refers to no pain and 10 denotes the maximum pain a patient has ever experienced). VAS score was measured at the end of the procedure, at the first micturition, and at 24 hours after the procedure. Pain score at 24 hours was noted by contacting the patients through telephone. The lower urinary tract symptoms were assessed by calculating the International Prostate Symptom Score (IPSS) after the procedure and at 24 hours.

The patient's demographic details, duration of stent placement, laterality of stent, indication for stent placement, pain score, IPSS score, and any complications of the procedure (like hematuria, urinary retention, UTI, fever) were recorded in the preformed proforma sheets. The primary outcome was VAS pain score perceived at various time intervals, and the secondary outcome variables were IPSS score and complications of the procedure. Finally, the data were analyzed using Statistical Package for the Social Sciences (SPSS), version 25.0. Discrete variables were evaluated by chi-square test and continuous variables by unpaired student t-test. All statistical tests were based on two-tailed probability, and a p-value <0.05 was considered statistically significant.

RESULTS

In this study, out of 114 patients who were enrolled for assessment, 105 patients completed the study and hence analyzed. (Figure 1)

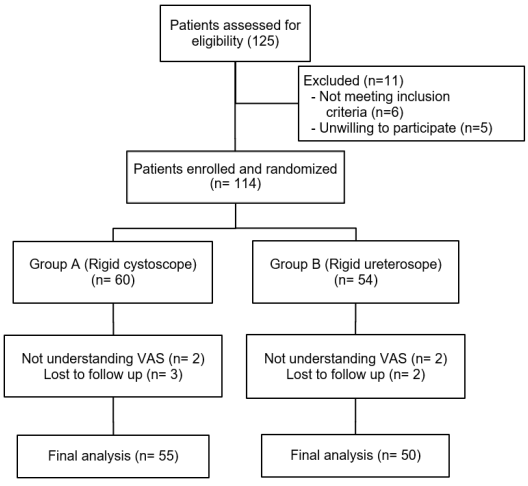

Figure 1: Flow diagram of the study

The mean age of the patients was 41.81±15.4 years. There was slight male preponderance with male: female ratio of 1.23:1. Figure 2 shows the age distribution of the patients, and most patients were young adults. The demographic

parameters, the side of the stent and duration of stent placement were comparable between the two groups. (Table 1) The most common indication for DJ stenting was ureteroscopic lithotripsy (URSL) followed by percutaneous nephrolithotomy (PCNL).

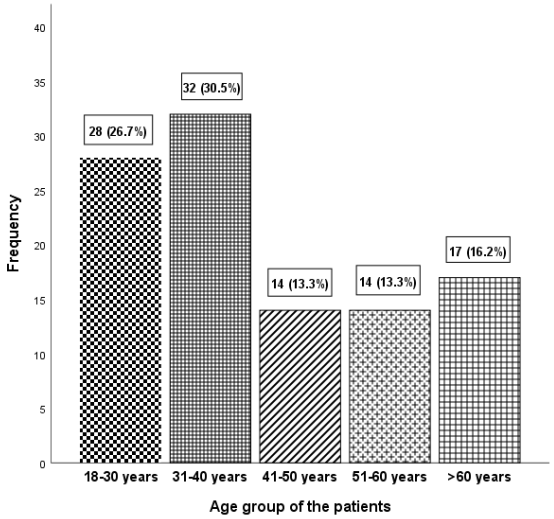

Figure 2: Age distribution of the patients

Table 1: Patients' baseline characteristics

Parameters	Total (n=105)	Group A† (n=55)	Group B†† (n=50)	p-value
Age in years*	41.81±15.4	42.04±15.8	41.56±15.1	0.875
Male/Female**	58/47	33/22	25 /25	0.303
Stent laterality Right/Left**	61/44	29/26	32/18	0.242
Duration of stent* (days)	24.03±6.8	23.93±6.1	24.14±7.6	0.875
Indications for stenting n(%)				
URSL	52(49.5%)	26(47.3%)	26(52%)	
PCNL	41(39%)	21(38.2%)	20(40%)	
Hydronephrosis	6(5.7%)	3(5.5%)	3(6%)	
RIRS	3(2.9%)	2(3.6%)	1(2%)	
Open surgery	3(2.9%)	3(5.5%)	0	

*analysis by student t-test; **analysis by chi-square test; †rigid cystoscope; ††rigid ureteroscope

The VAS pain score experienced by the patients during the ureteral stent removal using rigid cystoscope was significantly higher than that of rigid ureteroscope (3.65±1.9 vs 2.60±0.7, p<0.001). Furthermore, the pain experienced at first void was also higher in group A as compared to group B, which was statistically significant (1.91±1.2 vs 1.24±0.8, p=0.002). Similarly, the lower urinary tract symptoms (measured by IPPS score) after the procedure were significantly greater in the rigid cystoscopy group (2.65±2.0 vs 1.56±1.1, p=0.001. However, pain and discomfort, as well as the lower urinary symptoms at 24 hours post-procedure, were comparable between the two groups. (Table 2) A mild degree of hematuria occurred in 23(21.9%) patients, which was statistically no different between rigid cystoscopy and ureteroscope. None of the patients reported the occurrence of urinary retention and fever.

Table 2: VAS pain score, IPSS symptom score and complications

Timing	Total (n=105)	Group A† (n=55)	Group B†† (n=50)	p-value
Pain during procedure*	3.15±1.5	3.65±1.9	2.60±0.7	<0.001‡
Pain during first micturition*	1.59±1.1	1.91±1.2	1.24±0.8	0.002‡
Pain at 24 hours*	0.58±0.7	0.69±0.9	0.46±0.5	0.131
IPSS score after procedure*	2.13±1.7	2.65±2.0	1.56±1.1	0.001‡
IPSS score at 24 hours*	1.06±1.1	1.24±1.2	0. 86±1.0	0.094
Hematuria incidence n(%)**				
At first micturition	23(21.9%)	15(27.3%)	8(16%)	0.163
At 24 hours	6(5.7%)	3(5.4%)	3(6%)	0.904
Urinary retention	None	None	None	
Fever / UTI	None	None	None	

*analysis by student t-test; **analysis by chi-square test; †rigid cystoscope; ††rigid ureteroscope; ‡denotes statistical significance (p<0.05)

Table 3: Comparison of pain score and other parameters between male and female patients

Parameters	Male (n=58)	Female (n=47)	p-value
Age in years*	43.07±15.1	40.26±15.6	0.254
Stent laterality (n)**			
Right / Left	35/23	26/21	0.604
Duration of stent* (days)	24.88±6.4	22.98±7.2	0.159
Pain during procedure*	3.55±1.7	2.66±1.1	0.003†
Pain during first micturition*	1.86±1.1	1.26±0.9	0.005†
Pain at 24 hours*	0.67±0.7	0.47±0.8	0.184
IPSS score after procedure*	2.52±1.9	1.66±1.4	0.013†
IPSS score at 24 hours*	1.19±1.1	0.89±1.1	0.191

*analysis by student t-test; **analysis by chi-square test; †denotes statistical significance (p<0.05)

Subgroup analysis was performed between male and female patients and the parameters were compared (Table 3). The demographic parameters, stent laterality, and duration of the DJ stent were similar in both sexes. However, the VAS pain score during the procedure and at first void, and symptoms score after the procedure were significantly lower in females as compared to male patients (p=0.003; p=0.005 and p=0.013).

Table 4: Comparison of pain and other parameters among male patients in two groups

Parameters	Total male (n=58)	Rigid cystoscope (n=33)	Rigid ureteroscope (n=25)	p-value
Age in years*	43.07±15.1	44.15 ± 16.3	41.64±13.6	0.538
Stent laterality (n)**				
Right/Left	35/23	18 /17	15/8	0.300
Duration of stent (days)*	24.88± 6.4	24.45±5.3	25.44±7.7	0.570
Pain during procedure*	3.55 ±1.7	4.12±2.0	2.80±0.6	0.003†
Pain during first micturition*	1.86±1.1	2.18±1.2	1.44±0.8	0.013†
Pain at 24 hours*	0.67±0.7	0.73±0.8	0.60±0.5	0.518
IPSS score after procedure*	2.52±1.9	3.09±2.2	1.76±1.2	0.009†
IPSS score at 24 hours*	1.19±1.1	1.30±1.2	1.04± 1.0	0.404

*analysis by student t-test; **analysis by chi-square test; †denotes statistical significance (p<0.05)

We also compared the parameters among the male patients in the cystoscopy and ureteroscopy groups (Table 4). The VAS pain score during procedure and at first void, and IPSS score after stent removal were significantly greater in patients in whom a rigid cystoscope was used (p=0.003; p=0.013 & p=0.009). However, the discomfort and lower urinary tract symptoms at 24 hours and the incidence of hematuria were similar in both groups.

DISCUSSION

Since their first use in 1967, ureteral stents have been widely used in urological practice.[11] Pain and discomfort are experienced by as many as 80% of patients who have in-situ ureteral stents, and the pain is more significant during the act of micturition.[12] While most of the literature focuses on the morbidity of the in-situ ureteral stent, however, patients also experience significant pain, discomfort, and other lower urinary tract (LUTS) symptoms during and after removal of DJ stents. In a study by Theckumparampil et al., 64% of patients who underwent ureteral stent removal under local anesthesia experienced one or more symptoms, including pain, frequency, urgency, hematuria, urinary retention, or fever.[13]

Various non-endoscopic methods for the stent removal have been described, such as a stent with a tethered string at the distal end, magnetic stent, wire loops, and crochet hook–like retrievers, but these methods didn't get much acceptance.[8,14-16] In the modification with incorporated extraction strings, fine suture material is tethered at the distal end of the stent. These strings are visible externally at the urethral meatus and avoid the need of cystoscopy for stent removal. However, this practice is less popular among urologists because of the probable risks like string irritation, infection, stent dislodgement, broken strings and other safety concerns.[17] The flexible cystoscope reduces the degree of pain especially in men because of its easy negotiability through the curved urethra. Hence, it has become a preferred method of ureteral stent retrieval in more affluent countries. However, its use is less in practice, largely due to its higher cost and lack of availability in many places around the world.[1,18,19] The conventional method for the retrieval of stents is by using the widely available rigid cystoscope and grasping forceps. Rigid cystoscopy is still routinely used in most developing countries. Because of its inflexibility and large diameter, rigid cystoscopy often results in trauma to the urethra, leading to pain, discomfort, hematuria, and lower urinary tract symptoms, especially in men who have longer urethrae and enlarged prostates.

In recent years, many studies have used a rigid ureteroscope for ureteral stent removal. Rigid ureteroscope has a much thinner diameter than rigid cystoscope and is available in all urological setups. Hence, it is emerging as an alternative that can be less expensive than the flexible cystoscope and less painful than the rigid cystoscope.[20] However, the urethral penetration by rigid ureteroscope may be technically more difficult than rigid cystoscope, especially for younger doctors due to a smaller field of vision, poor visual quality, and longer length of the scope.

In this study, the VAS pain score experienced by the patients during the ureteral stent removal was significantly higher in the rigid cystoscopy group as compared to the rigid ureteroscopy group (3.65±1.9 vs 2.60±0.7, p<0.001). The patient, whose stent was removed by rigid cystoscopy, also reported more pain (1.91±1.2) at first post-procedure void than rigid ureteroscope (1.24±0.8), which was statistically significant (p=0.002). In a study by Neeli et al. involving 64 patients, the stent retrieval by rigid cystoscopy group experienced significantly higher pain and discomfort than the rigid ureteroscopy group during the procedure (7.05±1.21 vs 2.57±1.04; p<0.0001) and at first void (6.58±1.27 vs 3.03±0.96; p<0001).[21] Söylemez et al. reported that the mean operative pain scores were significantly higher in patients undergoing stent retrieval using a rigid cystoscope (5.4±1.4) than the rigid ureteroscope (1.7±1.2) group (p<0.01).[20] However, in our study, the pain score at 24 hours post-stent removal was comparable between the two groups (p=0.131), which could be due to the resolution of transient inflammation and edema of the urethra that occurred during the procedure.

Most of the patients, especially males, complained of some degree of lower urinary tract symptoms during the first void after DJ stent removal. The patients in the rigid cystoscopy group experienced significantly higher

irritative lower urinary tract symptoms (measured by IPSS score) as compared to the ureteroscopy group (p=0.001). However, these symptoms decreased in all patients and were comparable between the two groups at 24 hours. Other studies, such as Söylemez et al., [20] Neeli et al.,[21] and Li et al.[22] also showed that rigid ureteroscopy induces a significantly lower degree of lower urinary tract symptoms. Another important complication after ureteral removal is hematuria. Our study showed that the incidence of hematuria was higher in rigid cystoscopy group but that was not statistically significant. The hematuria was of mild degree and mostly subsided by the next day. However, study by Li et al.[22] and Söylemez et al.[20] reported significantly greater incidence of hematuria in rigid cystoscopy group than rigid ureteroscopy. None of the patients in the present study had urinary retention, fever, or urinary tract infection after DJ stent removal.

There were many studies that compared pain and discomfort in patients undergoing ureteral stent retrieval using rigid ureteroscope and flexible cystoscope and found that pain, hematuria, and voiding symptom scores were comparable between the two groups.[19,22,23] However, a rigid ureteroscope is much cheaper than a flexible cystoscope, making it a reliable option in the developing world. The authors analyzed whether there is a difference between male and female patients regarding pain and discomfort (Table 3). The analysis showed that the VAS pain score during the procedure and at first void, as well as urinary symptoms score after the procedure, were significantly higher in males as compared to female patients (p=0.003; p=0.005 and p=0.013). This could be attributed to the shorter urethra in females, while the longer urethra and the presence of the prostate in males.

Among the male patients, we compared the parameters between the cystoscopy and ureteroscopy groups. (Table 4) The VAS pain score during procedure and at first void, and IPSS score after stent removal were significantly lower in patients in whom a ureteroscope was used as compared to the cystoscopy group (p=0.003; p=0.013 & p=0.009). However, at 24 hours post-procedure, there was no difference in the incidence of pain, lower urinary tract symptoms, and other complications in both groups. Similar results were reported by Söylemez et al., with a higher incidence of pain and irritative voiding symptoms in male patients than in females ($p<0.05$).[20] Among the female patients, however, the pain and urinary symptoms during the procedure, during first void, and at 24 hours, as well as hematuria and other complications, were similar in the cystoscopy and ureteroscopy groups ($p>0.05$) in our study.

In the present study, the pain and discomfort during stent removal and at first void, and lower urinary tract symptoms were significantly higher in the rigid cystoscope group as compared to the rigid ureteroscope. However, the pain and urinary symptoms at 24 hours, the demographic parameters, and the incidence of hematuria were comparable between the two groups.

This study has some limitations. The sample size was relatively small, and this is a single-center study, which may have an unavoidable inherent bias. The DJ stents were not removed by a single urologist, as it is a teaching institute. Future multi-centric randomized studies with a larger sample size will give better results.

CONCLUSIONS

In conclusion, pain and lower urinary symptoms during and after ureteral stent removal under local anesthesia were significantly higher using a rigid cystoscope than a rigid ureteroscope. The rigid ureteroscope is available in most hospitals, familiar to all urologists, and is highly patient-tolerable. Thus, the use of a rigid ureteroscope is safe, less painful, and an effective method for ureteral stent removal.

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AUTHORS' CONTRIBUTIONS

HBKC designed the research, searched the literature, collected the data, performed statistical analysis, and prepared the first draft of the manuscript. GBA did the literature search, data interpretation, and manuscript editing. All the authors have read and approved the final draft.

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