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Comparison of the Effects of General and Spinal Anesthesia on Ureteric Dilatation during Ureteroscopy

Mohamed Mahmoud Zaza[1], Ahmed Nabil Elsayed Esmaiel Elshaer[1], Tarek Abd Elmageed salem[1], Ossama Hamdy Salman[2], Mohamed Hassan Ali[1]

[1]*Urology Department, Helwan University, Egypt*

[2]*Anaesthesia Department, Helwan University, Egypt*

Abstract

Based on factors including age, sex, race, and geography, the prevalence of urolithiasis—which is defined as a history of stone disease—is estimated to be between 1 and 15%. In the latter part of the 20th century, this frequency rose for both men and women of diverse racial backgrounds. The primary surgical method for treating ureteral stones is ureteroscopy. To compare the effects of general and spinal anesthesia on ureteric dilatation during ureteroscopy. This this prospective randomized comparative study included forty patients with lower ureteric stone were recruited in this study. After taking history, clinical examination and evaluation of irritative symptoms, pelvi-abdominal sonography and computed tomography urinary tract. Then Patients divided into 2 groups (spinal and general anesthesia groups). The age ranged from 36 to 56 years, with a mean of 49.25 ± 9.07 years. In those instances, the average stone size was 12.0 ± 3.16 mm, with a range of 9 mm to 16 mm. regarding ureteral dilatation, there are notable distinctions between spinal and general anesthesia. In the spinal and general anesthesia groups, the mean dilatation time was 5.70± 0.80 minutes and 3.20± 0.77 minutes, respectively. The group under general anesthesia experienced a considerably shorter dilatation time ($p<0.001$) than the group under spinal anesthesia Conclusions: spinal anesthesia offers benefits such as reduced postoperative discomfort and improved postoperative results for ureterorenoscopy. On the other hand, early ureter dilatation and stone access are made easier by general anesthesia. If there are no contraindications, this research advises ureterorenoscopy under general anesthesia.

Keywords: General and Spinal Anesthesia; Ureteric Dilatation; Ureteroscopy

Full length article **Corresponding Author*, e-mail: *ahmed_nabil@med.helwan.edu.eg*

1. Introduction

Based on factors including age, sex, race, and geography, the prevalence of urolithiasis—which is defined as a history of stone disease—is estimated to be between 1 and 15%. For both men and women of diverse racial backgrounds, this incidence has grown in the latter part of the 20th century [1]. There is a rise in prevalence of urinary calculi diseases worldwide compared to last several decades, this may be related to rise in detection of asymptomatic calculi through increased use of radiological imaging especially computed tomography (CT) [2]. When medication expulsive treatment is not an option for treating ureteral stones, ureteroscopy recommended surgical approach [3]. According to studies, ureteral access is necessary for successful ureteroscopy outcomes [4]. Anesthesia technique affects ureteral entry through surgical success and affects ureteral access, according to prospective randomized trials. Thus, purpose of this study was to investigate how spinal and general anesthesia affected ureteric dilatation during ureteroscopy [5].

2. Methods

Prospective randomized comparative study enlisted 40 patients with ureteric stone, collected from Helwan university hospitals and carried out between December 2022 and June 2023.

Inclusion criteria**:** Adult patient with distal ureteric stone / stones. No contra indication for general or spinal anaesthesia

Exclusion criteria**:** Patients with ureteric stricture, history of surgery in ureter, active urinary tract infection, and coagulopathy.

2.1. Sampling technique

Probability sampling (simple random sampling) was carried out, and all the patients who fulfilled the inclusion and the exclusion criteria were selected and divided into two groups:

(1) Group 1 (n=20) have spinal anesthesia during ureteroscopy.

(2) Group 2 (n=20) have general anesthesia during ureteroscopy.

Sample size justification: (according to rule of thumb) 40 patients with ureteric stone will be selected from the outpatient clinic of Helwan University Hospitals.

2.2. Methodology

At first, before the treatment, diagnosis of ureteric stone by:

- History taking.
- Clinical examination and evaluation of irritative symptoms.
- Pelvi-abdominal sonography.

Half of the patients had spinal anesthesia while the other half had general anesthesia and results were interpreted according to inclusion criteria, then we compared between the effects of general and spinal anesthesia on ureteric dilatation during Ureteroscopy.

2.3. General anesthesia

Prior to the procedure, patients received 100% oxygen for a duration of 4 to 5 minutes in the operating room. The administration included a total of 2 µG/kg of fentanyl, 2 to 3 mg/kg of propofol, and 0.5 mg/kg of rocuronium. Following the induction of muscle relaxation, endotracheal intubation was carried out using an endotracheal tube. In cases requiring artificial respiration, controlled ventilation was maintained with a tidal volume of 8 to 10 mL/kg and a respiratory rate of 10 to 12 breaths per minute. Anesthesia was sustained with a mixture of 50% oxygen and 50% nitrous oxide, along with 1% of the minimum alveolar concentration of sevoflurane.

2.4. Spinal anesthesia

Patients were administered 500 mL of a balanced electrolyte solution for hydration 30 minutes prior to the operation. After disinfecting the skin with alcohol, a spinal needle was inserted at the L3–4 or L4–5 intervertebral space using a midline approach. Upon the observation of clear cerebrospinal fluid, 2 mL of bupivacaine was injected slowly. The sensory block levels were assessed using the pinprick test. The surgical procedure commenced once the anaesthetized dermatome reached the T8-T6 level. Ureteral dilatation technique**:** Ureteral dilatation time was measured by minutes from the beginning of the introduction of first Teflon dilator (6 fr) till the introduction of the Teflon dilator (14 fr). Dilatation failure was reported as failed introduction of teflon dilator (14 fr) and patients were excluded. Three surgeons participated in study, Karl Storz rigid ureteroscopy and serial Teflon dilators [6-14] (6-14 fr) were used.

Anesthetic and ureteroscopic complications**:** Hematuria / Nausea / Vomiting / Infection / ureteric avulsion and need for hospital stay were reported.

Primary outcome: Time taken to reach ureteric dilatation 14 fr.

Secondary outcome: Occurrence of Intraoperative / postoperative complications.

Some patients were recorded for dilatation failure for both general and spinal anesthesia.

The sample size calculation was done by G*Power 3.1.9.2 (Universitat Kiel, Germany). According to a previous study (21), the mean ± SD of dilatation time of patients (the primary outcome) was 104.01 ± 12.77 sec/patient with GA group and 130.55 ± 22.53 sec/patient with SA. The sample size was based on the following considerations: 1.449 effect size, 95% confidence limit, 95% power of the study, group ratio 1:1 and six cases were added to each group to overcome dropout. Therefore, we will recruit 20 patients in each group. Statistical analysis was conducted by inputting data into a computer and utilizing the IBM SPSS software package, version 20.0 (Armonk, NY: IBM Corp) for analysis. Qualitative data were represented through numerical values and percentages. The Shapiro-Wilk test was employed to assess the normality of the distribution. Quantitative data were characterized by their range (minimum and maximum), mean, standard deviation, and median. The significance of the results obtained was evaluated at the 5% level**.**

3. Results and discussion

3.1. Results

Out of 40 cases, six (15%) had dilatation failure; two instances were in the general anesthesia group and four cases were in the spinal anesthesia group. Regarding dilatation failure, there was no statistically significant difference between the two groups under study ($p>0.05$) (Table I). In the spinal and general anesthesia groups, the mean dilatation time was 5.70± 0.80 minutes and 3.20± 0.77 minutes, respectively. The group under general anesthesia experienced a considerably shorter dilatation time ($p<0.001$) than the group under spinal anesthesia. (Table II). Regarding postoperative complications, two cases in spinal anesthesia group had hematuria, one case had nausea and vomiting, and one case had postoperative pain. While in general anesthesia group, four cases had hematuria, six cases had nausea and vomiting, two cases had postoperative infection and seven cases had postoperative pain. The group under spinal anesthesia experienced considerably less postoperative pain than the group under general anesthesia ($p=0.048$). Table 3 and Figure 1 demonstrate that there was no statistically significant difference ($p>0.05$) in the two groups' experiences of haematuria, nausea & vomiting, and infection. The group under spinal anesthesia spent an average of 1.33±0.48 days in the hospital, whereas the group under general anesthesia spent an average of 1.43±0.73 days there. Regarding hospital stay, there was no statistically significant difference between the two groups ($p>0.05$) (Figure 2).

3.2. Discussion

The procedure is conventionally conducted under general anesthesia accompanied by muscle paralysis to mitigate the risk of potential ureteral injuries that may arise from sudden and unanticipated movements by the patient. Nevertheless, numerous independent trials have demonstrated that spinal and epidural anesthesia can also be equally safe [10-12]. The success of a ureteroscopic procedure is contingent upon the specific underlying condition and whether a diagnostic or therapeutic endoscopy was carried out[1]. This study indicates that the choice of anesthesia method impacts ureteral access and affects the ureteral entrance. According to the findings, general anesthesia for ureterorenoscopy can reduce both the dilatation time and the time taken to reach the stone when compared to spinal anesthesia. Our findings align with those of Shaikh et al. [13], who reported that the average stone size was 0.79 cm in the general anesthesia group (A) versus 1.14 cm in the spinal anesthesia group (B). Despite the larger stone size in group B, there were no complications such as ureteral avulsion or perforation, and all stones successfully extracted.

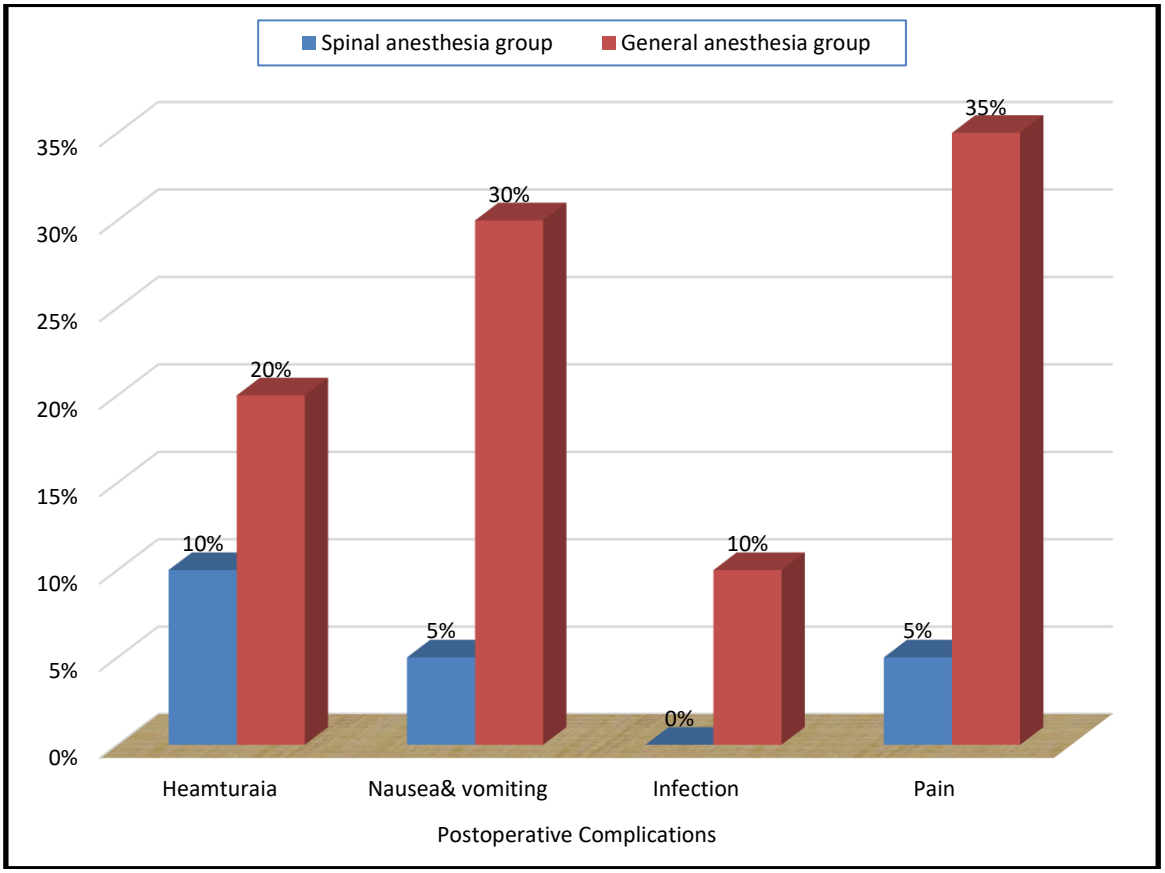

Figure (1): Comparison between the studied groups regarding postoperative complications

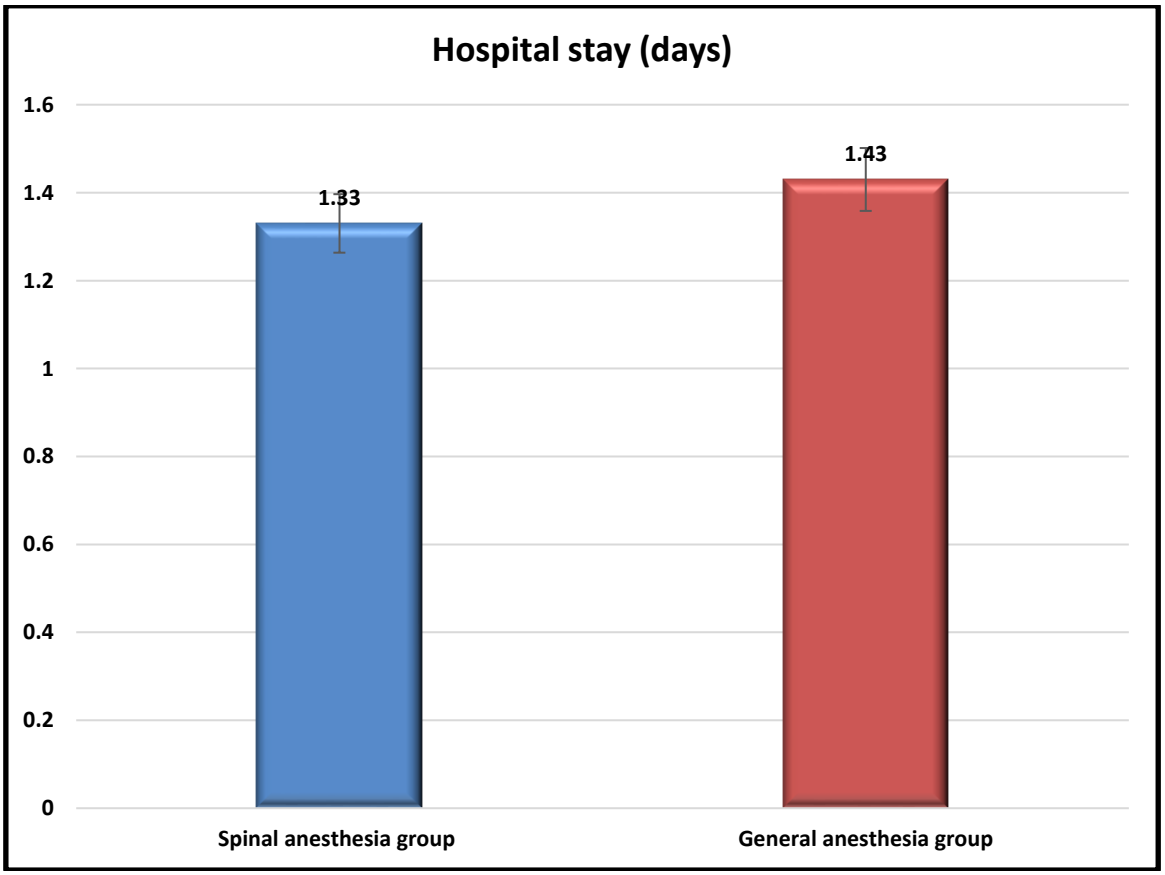

Figure (2): Comparison between the studied groups regarding postoperative hospital stay.

Table (1): Comparison between the studied groups regarding dilatation failure

		Spinal anesthesia group		General anesthesia group		Chi- Square test	
		N	%	N	%	Test value	P-value
Dilatation failure	Yes	4	20.0%	2	10.0%	X^2= 0.196	0.661
	No	16	80.0%	18	90.0%		

Table (2): Dilatation time among the studied groups

		Spinal anesthesia group	General anesthesia group	Test value	P-value
Dilatation time (min.)	Mean±SD	5.70± 0.80	3.20± 0.77	^{Z}MWU= 5.403	**<0.001**
	Median	6.0	3.0		
	Range	4.0- 7.0	2.0- 4.0		

Table (3): Comparison between the studied groups regarding postoperative complications

Variable		Spinal anesthesia group		General anesthesia group		Chi-Square Test	
		No.	%	No.	%	Test value (X^2)	P-value
Postoperative Complications	Heamturaia	2	10.0%	4	20.0%	0.196	0.661^{FET}
	Nausea& vomiting	1	5.0%	6	30.0%	2.771	0.096^{FET}
	Infection	0	0.0%	2	10.0%	0.526	0.468^{FET}
	Pain	1	5.0%	7	35.0%	2.294	

Conversely, Harmon et al. [14] proposed general anesthesia is preferable when a longer procedure is expected. Patients who underwent general anesthesia experienced improved postoperative outcomes, including reduced pain, nausea, and vomiting. It appears that type of anesthesia does not significantly influence duration of hospital stay. Our findings are consistent with another published research [15-16]. Additionally, our results corroborate those of Cai et al. [9], who found that dilatation time for patients in general anesthesia (GA) group was shorter than that of spinal anesthesia (SA) group (104.01 ± 12.77 sec/patient vs.130.55 ± 22.53 sec/patient, $p < .0001$, $q = 17.0350$). The intraoperative and postoperative characteristics observed in this study are in agreement with those reported in prospective randomized studies by Oztekin et al. [17], Parikh et al. [18], Tangpaitoon et al. [19], and Zeng et al. [20].

4. Conclusions

Spinal anesthesia offers benefits such as reduced postoperative pain and improved outcomes following ureterorenoscopy. Conversely, general anesthesia allows for prompt dilation of the ureters and easier access to the stone. This study recommends the use of general anesthesia for ureterorenoscopy in the absence of contraindications.

Conflict of interest: Authors report no conflicts of interest.

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Author contribution: Authors contributed equally to study.

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