Post-Operative Urinary Retention Beyond Spinal Anesthesia

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Abstract

Introduction: Spinal anesthesia is commonly used in various surgical procedures, including hernia repair, different types of hysterectomy, cesarean section, prostate surgery, and urological bladder surgeries. **Aim of the study**: Our study aimed to assess urinary retention post-operative due to spinal anesthesia. **Patients and methods**: This prospective study was conducted at Imam Al-Hijjah Charitable Hospital, Karbala /Iraq from 5 January 2022 to 5 March 2022. Under the supervision of the Department of Anesthesia Technologies at Al-Mustaqbal University College – in Babil. After obtaining local ethics committee approval and written consent, 40 male patients only, aged 22–70 years, American Society Anesthesiologist – physical status I and II were divided into two types of anesthesia spinal (20) cases and general (20) cases undergoing surgery. **Statistical Analysis**: demographic data, including age, gender, type of surgery, time of surgery, type of anesthesia, drug anesthesia, and time of obstruction collected information were recorded using a checklist. Data were analyzed using IBM SPSS statistic version 20.0. Results of descriptive statistics were illustrated through frequency distribution tables and charts. **Results**: a decision is made to reject the null hypothesis and accept the alternative hypothesis Which proves that there is a significant difference with statistical significance between general and spinal at the time of obstruction this difference is due to the data with the higher average, as shown in the tables and graphs above. **Discussion**: the main finding in the present study is that postoperative urinary retention is common complication after general or spinal anesthesia. The incidence of postoperative urinary retention is affected by anesthetic technique. The bladder is composed of detrusor muscle and internal and external urethral sphincters. **Conclusion**: General anesthetics cause bladder atony by acting as smooth muscle relaxants and by interfering with autonomic regulation of detrusor tone. The patients were monitored after the operation for 2 - 2 and a half hours for elements of urinary tract obstruction. **Recommendation**: Based on the study, the following recommendations are suggested: A health education program about risk factors and complications of spinal anesthesia and ongoing research about how to decrease urinary retention after spinal anesthesia.

Keywords: Urinary, Spinal, Patients, Urinary Retention, Anesthesia, Bladder.

Introduction

Spinal anesthesia is commonly used in various surgical procedures, including hernia repair, different types of hysterectomy, cesarean section, prostate surgery, and urological bladder surgeries. Spinal anesthesia is a technique widely used for its efficacy and safety, and it is also known as spinal, subarachnoid, intradural, or intrathecal anesthesia. It is characterized by the administration of an anesthetic in the subarachnoid space that is located between the pia mater and arachnoid meninges to generate a sequential block in the nerve fibers **(Abo El Nour & Abdelzaher, 2024).**

The neurological complications of spinal anesthesia are of great importance in anesthesiology because some can be serious and be due to multiple previous patients, and pharmacological, and genetic factors that can intervene in the complications, as it is a technique widely used in surgery and anesthesiology. When it is necessary to perform a surgical intervention, whose objective is to interrupt the connection between the peripheral nervous system and the brain, spinal anesthesia is used to block painful stimuli **(Doelakeh, & Chandak, 2023).**

Post-operative urinary retention (POUR) is defined as the inability to void with a full bladder following surgery **(Baldini et al., 2009)**. Complications include delirium, pain, prolonged hospital admission, and long-term altered bladder contractility **(Stephenson et al., 2020).** POUR is readily managed with catheterization, but this can be emotionally traumatic and is associated with morbidity including urinary tract infection, trauma, and blockage **(Johansson et al., 2013).** This procedure may be difficult in patients with underlying urological pathology, who are at increased baseline risk of POUR **(Toyonaga et al.,2006)**.

Post-operative urinary retention (POUR) can cause significant discomfort and distress to the patient. Apart from the negative impact on patient satisfaction, it may cause acute or long-term motility abnormalities of the

bladder, delayed discharge, and increased cost of patient care due to catheterization, treatment of urinary tract infection, and prolonged hospital stay**(Sidash & Ranganath, 2023).** Estimates of retention rates after incontinence and prolapse surgery range from 2.5%–24% and are as high as 43% after tension-free transvaginal mesh sling placement **(Partoll, 2002).** Onset can be sudden or gradual. When the onset is sudden, symptoms include an inability to urinate and lower abdominal pain. When of gradual onset, symptoms may include loss of bladder control, mild lower abdominal pain, and a weak urine stream. Those with long-term problems are at risk of urinary tract infections. Causes of UR: Bladder (Detrusor sphincter dyssynergia, neurogenic bladder, and damage to the bladder) and Prostate (Benign prostatic hyperplasia, Prostate cancer, and other pelvic malignancies, prostatitis, circumcision, congenital urethral valves, and chronic urinary retention).

Chronic urinary retention is due to bladder blockage which can either be as a result of muscle damage or neurological damage. If the retention is due to neurological damage, there is a disconnect between the brain to muscle communication, which can make it impossible to empty the bladder. If the retention is due to muscle damage, it is likely that the muscles are not able to contract enough to empty the bladder **(Stoffel, 2017).**

For surgical repair of pelvic organ prolapse without an incontinence procedure, the rate of any postoperative retention has been quoted at 29%. In many cases, women undergo a combination of procedures to treat both incontinence and prolapse, which likely increases their probability of experiencing postoperative urinary retention **(Hakvoort et al., 2009).** Spinal anesthetics bupivacaine and tetracaine delay the return of bladder function beyond the resolution of sensory anesthesia and may lead to distention of the bladder beyond its normal functioning capacity. This may cause urinary retention, or possibly even bladder damage **(Haleem et al., 2020).**

Ultrasound has been used as a diagnostic tool for postoperative urinary retention as well as an imaging modality to evaluate bladder function. In the postoperative period, urinary retention has two main causes. The first is mechanical obstruction of the urinary outflow tract, and the second is altered neural control of the bladder and detrusor mechanism, most commonly due to analgesic drugs **(Lingaraj et al., 2007).** The use of alpha-blockers can provide relief of urinary retention following de-catheterization for both men and women. In case, if catheter can't be negotiated, a suprapubic puncture can be done with lumbar puncture needle **(Fisher et al., 2014)**.

Methodology and Participants

Ethics

This prospective study was carried out at at Imam Al-Hijjah Charitable Hospital, Karbala /Iraq from 5 January 2022 to 5 March 2022. Under the supervision of the Department of anesthesia technologies at Al-Mustaqbal University College – in Babil.

After obtaining local ethics committee approval and written consent, 40 male patients only, aged 22–70 years, American Society Anesthesiologist – physical status I and II were divided into two types from anesthesia spinal cases and general (20) cases undergoing surgery. In spinal anesthesia anesthetized by spinal anesthesia, was divided into two groups bupivacaine in 10 patients, who were taken heavy plain bupivacaine and xylocaine 10 patients who were taken plain xylocaine while 20 patients were anesthetized by general anesthesia.

Patients with anesthesia

Patients were allowed to drink water up to 2 h before induction of anesthesia. All patients voided before transfer to the operating area. After the application of routine monitoring equipment (ECG, oscillometer arterial pressure cuff, pulse oximetry), an intravenous infusion with ringer's lactate fixed volume (1000 ml) for all cases was commenced and an initial bladder ultrasonography scan was performed to measure bladder content before and after spinal anesthesia or general anesthesia. The patients received antacid as prophylaxis 150mg ranitidine orally 2hr before surgery and 10mg metoclopramide 2hr. The cannula was put at the site of one of either, intravenous ringer lactate infusion as crystalloid solution was given, monitoring of the patients with pulse rate, pulse oximeter, non-invasive blood pressure, and ECG.

General anesthesia method

The patients lie on the couch with the left. Lateral till with a pillow behind their buttock, the patients received 100% oxygen for 5 min then induction was done with 2mg/kg propofol as an induction agent, 0.5mg/kg ketamine as analgesic, 0.6mg/kg rocuronium as muscle relaxant. The patients were intubated with proper endotracheal cuffed tube size ventilated with 100% oxygen and maintained with 0.7% MAC isoflurane. The patients were reversed by giving neostigmine 2-5mg with atropine 1mg to reverse the effect of muscle relaxant and then awake extubating was done. Postoperative pain was measured on a numeric rating scale (0–10). Ketorolac 30 mg i.m. was used as a bolus dose if required. Ultrasound scans of the bladder were performed hourly after surgery until spontaneous micturition or catheterization occurs. It should be noted that ultrasound bladder scans were used to diagnose urinary retention. Urinary retention was

defined as a bladder volume ⩾ of 500 ml together with the inability to micturate or post residual volume > 500 ml. Patients were catheterized when these criteria were met.

2.2 Spinal anesthesia method

In the lateral or setting position, the subarachnoid space was punctured with a 25 G Whitacre needle at L3/4 or L4/5 using a median or paramedian approach until there was free backflow of cerebrospinal fluid, and 3 ml of hyperbaric bupivacaine 0.5% and 3 ml from xylocaine 2% were administered. After 30 sec-1 min, the patients lie in the supine position. Perioperatively, ephedrine, midazolam, or both were administered intravenously if required. Exclusion criteria include prostate hyperplasia or urogenital pathologies (incontinence, cysto-ureteric reflux, known bladder retention, and patients with renal impairment), intraoperative blood loss of 200 ml or more, and alcohol or drug abuse. According to the study questionnaire, we collected an (age, gender, type of surgery, time of surgery, type of anesthesia, drug anesthesia, and time of obstruction.

Device used in this study

1- Anesthetic machine
2- Monitors
3- Laryngoscope
4- Endotracheal Tube
5- Non-invasive blood pressure
6- Pulse oximeter
7- foley catheter
8- Section device
9- Electrocardiogram ECG
10- Ultrasound scans

Table 1. Number of surgeries.

Surgery	Frequency
ankle fixation	3
Bowel obstruction	3
Femoral fracture	11
Gastrectomy	3
Knee replacement	2
Laparoscopic gallbladder	7
pelvic fracture	4
Vertebral fixation	7
Total	40

Statistical Analysis

Demographic data, including age, gender, type of surgery, time of surgery, type of anesthesia, drug anesthesia, and time of obstruction collected information were recorded using a checklist. Data were analyzed using IBM SPSS statistic version 20.0. Results of descriptive statistics were illustrated through frequency distribution tables and charts.

Results

The data was analyzed using the statistical program IBM SPSS Statistic 20 the results attached below were obtained based on the following hypotheses and aim of this study (our study aimed to assess the urinary retention in post-operative due to spinal Anesthesia).

The null hypothesis

There is no significant difference between general and spinal anesthesia at a significant level of 0.05:

M2≠: M1 H0

The alternative hypothesis

There is a significant difference between general and spinal anesthesia at a significant level of 0.05

M2=: M1 H1

To verify the above hypotheses, we conducted a test T-test independent samples the results were as follows:

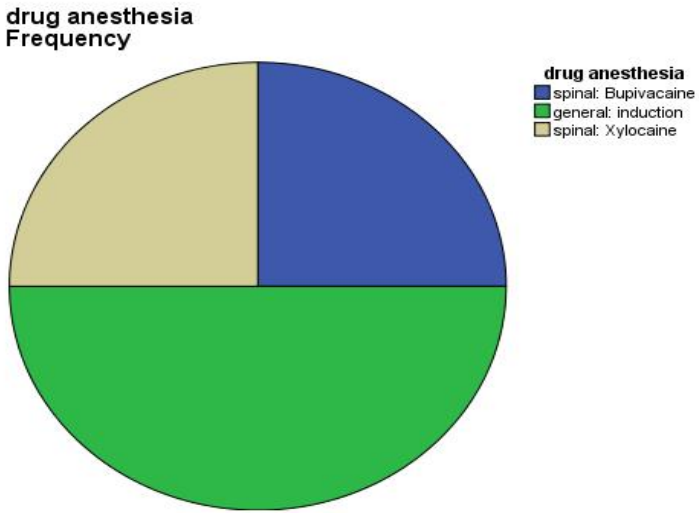

Figure1. Distribution of type of anesthesia.

In the figure (1), we note that the distribution of type of anesthesia under study and there are:

1) General anesthesia (50%).
2) Bupivacaine in spinal anesthesia (25%).
3) Xylocaine in spinal anesthesia (25%).

In the figure (2), we report the distribution of type of surgery in the study.

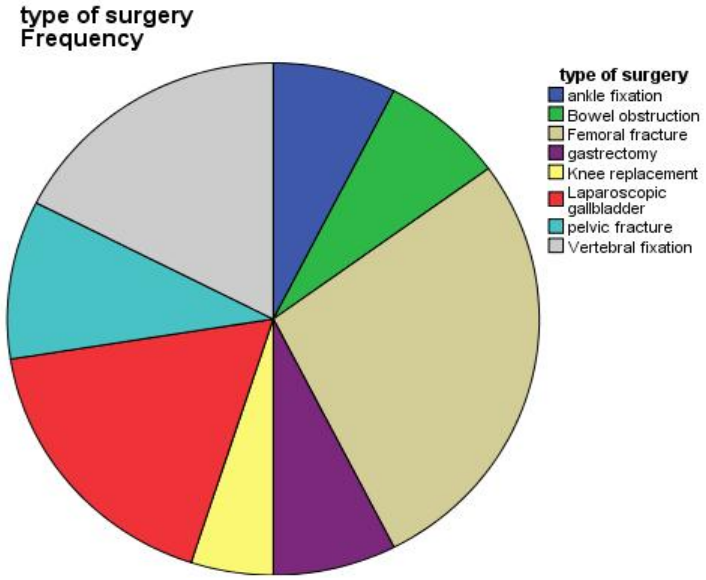

Figure 2: Distribution of type of surgery in the study.

Table 2: crosstabulation between age and gender.

age * gender Crosstabulation

			Gender	Total
			Male	
Age	<25	Count	4	4
		% Within gender	10.0%	10.0%
	25-50	Count	21	21
		% Within gender	52.5%	52.5%
	>50	Count	15	15
		% Within gender	37.5%	37.5%
Total		Count	40	40
		% Within gender	100.0%	100.0%

In Table (2), we note the crosstabulation between age and gender in the study and we calculate only male patients under

three types of age such as the following:

1) Age (<25) There were 4 males.
2) Age (25-50) There were 21 males.
3) Age (>50) There were 15 males.

In Table (3) we have shown the mean and St. Deviation in this study for (age, type of surgery, time of surgery, time of obstruction, type of anesthesia, and drug anesthesia) according to the type of anesthesia used by the patients (general and spinal {bupivacaine and xylocaine}).

Table 3. Mean ±St. Deviation for each data variable.

Case Processing Summary

	Cases		
	General anesthesia	Spinal (xylocaine)	Spinal (bupivacaine)
	Mean ± St. Deviation	Mean ± St. Deviation	Mean ± St. Deviation
Age	49.05 ± 13.264	36.80 ± 13.943	49.30 ± 16.439
type of surgery	3.75 ± 1.943	1.80 ± 0.632	1.90 ± 0.994
time of surgery	2.55 ± 0.887	1.10 ± 0.316	1.50 ± 0.850
time of obstruction	2.70 ± 1.174	1.90 ± 0.316	1 ± 0
type of anesthesia	1.00 ± 0	1.00 ± 0	1 ± 0
drug anesthesia	1.00 ± 0	1.00 ± 0	1 ± 0

Time of obstruction according to anesthesia

Table 4. Distribution of drug anesthesia to time of obstruction.

Drug anesthesia * time of obstruction							
		time of obstruction					
		one hour	one hour and a half	two hours	three hours	without obstruction	Total
drug anesthesia	Bupivacaine	0	0	0	0	10	10
	Induction	8	3	8	1	0	20
	Xylocaine	1	0	0	0	9	10
Total		9	3	8	1	19	40

p-value 0.001 HS (p-value<0.05), HS: high significant

In Table (4) we show the relation between drug anesthesia used by the patients (induction in general anesthesia and bupivacaine, xylocaine in spinal anesthesia) and the time of obstruction occurs in five groups (one, one hour and a half, two, three hours and without obstruction. We noted that there was no obstruction in spinal anesthesia when we used (bupivacaine) but there was only one obstruction in (xylocaine) in one hour only. There was an obstruction in the general anesthesia group we can see it in the time that occurs following (8,3,8,1). With a p-value (0.001) this means a highly significant data variable.

Table 5. Statistical T-test results for the difference between the mean of general and spinal according to time of obstruction.

From the table (5), we note that the mean for spinal is 4.85 with std. Deviation 0.671 which is less std. deviation for general 1.174 that has a mean is 2.70 with a high significant data variable in 0.001 for p-value in the general and a significant data variable of 0.02 for spinal.

Group Statistics					
	type of anesthesia	N	Mean	Std. Deviation	p-value
time of obstruction	General	20	2.70	1.174	0.001 HS
	Spinal	20	4.85	0.671	0.02 S

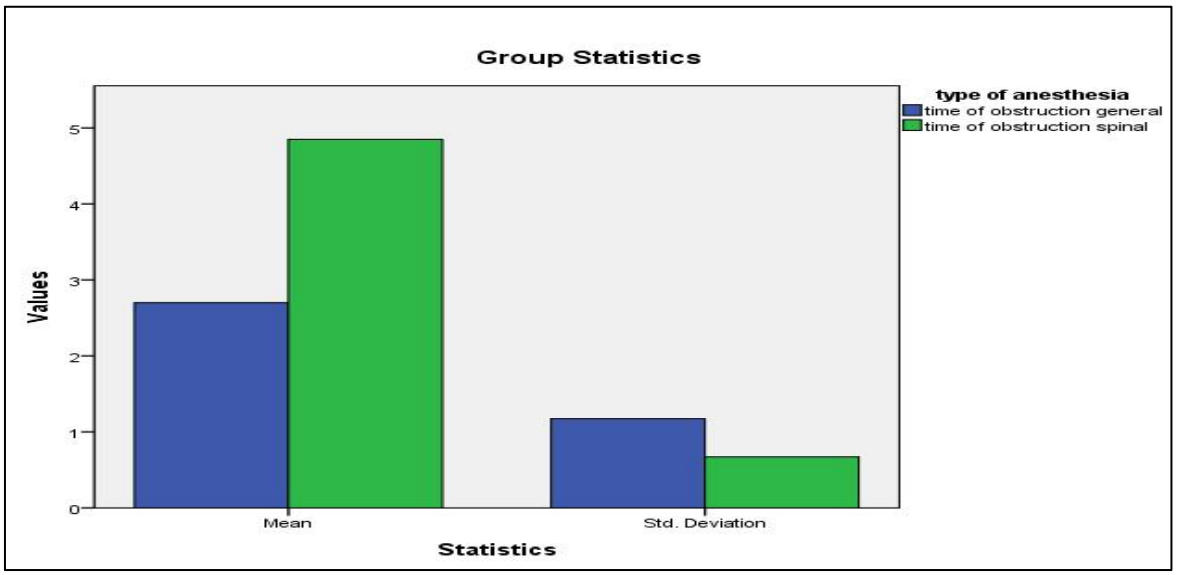

Figure 3. shows the spread of data in type of anesthesia.

From the results above in Figure (3), a decision is made to reject the null hypothesis and accept the alternative hypothesis Which proves that there is a significant difference with statistical significance between general and spinal at the time of obstruction this difference is due to the data with the higher average, as shown in the tables and graphs above.

Discussion

The main finding in the present study is that postoperative urinary retention is a common complication after general or spinal anesthesia. The incidence of postoperative urinary retention is affected by anesthetic technique. The bladder is composed of detrusor muscle and internal and external urethral sphincters. It has a capacity of 400–600 ml and is innervated by efferent somatic, sympathetic, and parasympathetic fibers. The parasympathetic fibers cause contraction of the detrusor and relaxation of the sphincter, permitting micturition. The sympathetic fibers produce detrusor relaxation and internal urethral sphincter closure. The two systems are governed by spinal reflexes and two pontine brain stem

centers. The voluntary control of the bladder involves the coordination between the frontal cortex and the pontine centers. At a bladder volume of 150 ml, when the voiding threshold is reached, the first urge is felt and at 300 ml sense of fullness is created **(Baldini et al., 2009).**

General anesthetics cause bladder atony by acting as smooth muscle relaxants and by interfering with autonomic regulation of detrusor tone. In vitro work, clinical doses of halothane and thiopentone decrease bladder response to stimulation **(Steffey et al.,2024).** Volatile anesthetics and Sedative-hypnotics inhibit the pontine micturition center and voluntary cortical control of the bladder, suppressing detrusor contraction and the micturition reflex. Other drugs given with general anesthesia may produce postoperative urinary retention. Anticholinergic agents such as atropine used for premedication or reversal of neuromuscular blockade may impair detrusor contractility and facilitate passive overfilling of the bladder by acting at cholinergic receptor sites in the smooth muscle of the bladder and urethra **(DeFalco & Buol, 2022).**

Intrathecal injection of bupivacaine will block the afferent and efferent neural transmission from and to spinal segments S2–S4. But, on maximal filling of the bladder, the feelings of tension are present. So, bladder analgesia is due to the blocking transmission of the afferent nerve fibers from the bladder to the micturition center in the brain. After 30–60 s of spinal anesthetic injection, the sensation of urgency to void disappears, 2–5 min the detrusor contraction is completely abolished and its recovery depends on the duration of the sensory block above S2 and S3 sacral segments, which is 7–8 h. Complete normalization of detrusor strength occurs 1–3.5 h after ambulation. With the use of longer-acting local anesthetics, the duration of detrusor blockade allows the bladder volume to significantly exceed preoperative bladder capacity **(Slaven et al., 2023).**

Patients experience increased rates of POUR when intrathecal local anesthetics are administered with opioids. The addition of fentanyl to spinal anesthesia and the choice of spinal over epidural anesthesia were found to significantly increase the time to discharge ambulatory surgical patients **(Shui et al., 2023).**

Conclusion

General anesthetics cause bladder atony by acting as smooth muscle relaxants and by interfering with autonomic regulation of detrusor tone. A study on the effect of general and spinal anesthesia on post-operative urinary retention, the study was conducted and patients monitored after the operation for 40 patients at Imam Al-Hijjah Charitable Hospital, where: 20 of the patients underwent the operation under general anesthesia, where 20 of the patients underwent the operation under the influence of spinal anesthesia (Xylocaine 2%,), an injection of the substance in the back, and the patients were monitored after the operation for 2 - 2 and a half hours for element of urinary tract obstruction.

Recommendation

Based on the study, the following recommendations are suggested:

1) Health education program about risk factors and complications of spinal anesthesia.
2) Ongoing research about how to decrease urinary retention after spinal anesthesia.

Conflict of Interest

The authors declare no conflict of interest.

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