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Effect of Spinal Anesthesia by Prilocaine 2% versus Lidocaine 2% and Bupivacaine 0.5% in Day-Case Lower Abdominal Surgery Outcome

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Abstract

Background: Ambulatory anesthesia and surgery have attracted growing interest in the past few years, and consequently the number of drugs available for outpatient spinal anesthesia has increased. Therefore, a rapid improvement from anesthesia, resulting in an early release, and fast resumption of on daily basis activities, could be of great benefit to patients, surgeons, and hospital stay **[1]**.

Aim of Study: The main objective of the present study is to examine the outcome of intrathecal anesthesia with 2% prilocaine against intrathecal anesthesia with bupivacaine 0.5% and 2% lidocaine for lower abdominal day-case surgery.

Patients and Method: Sixty-six (66) patients were assigned to spinal anesthesia and randomly divided into three groups with either 2% prilocaine (P group), 0.5% bupivacaine (B group), and 2% lidocaine (L group). The primary outcome as onset of the block, sensory level and motor recovery (Bromage score), voiding time, time to ambulation, time of home readiness. The secondary outcome as discharge scoring system (White fast and Aldrete discharge score), complications and side effects such as vomiting, nausea, urinary difficulties, as well as (TNS) transient neurological symptoms were monitored prior tohospital discharge and followed-up by telephone for up to one week.

Results: In all groups, onset of sensory block, time to return of motor and sensory functions, and ambulation time were significantly shorter in prilocaine (P group), and lidocaine (L group) than in bupivacaine (B group) (p-value <0.05). Moreover, shorter time to spontaneous voiding has been detected after prilocaine, and lidocaine than bupivacaine $p<$ 0.001.

Conclusion: A faster recovery time has been found with prilocaine and lidocaine groups, making anesthesia a good alternative for lower abdominal surgery as day case surgery and patient outcome after discharge from the hospital. However, TNS limits the use of lidocaine.

Key Words: *Spinal anesthesia – Prilocaine – Lidocaine – Bupivacaine – day-case surgery.*

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Introduction

AMBULATORY anesthesia and surgery have attracted growing interest in the past few years, and consequently the number of drugs available for outpatient spinal anesthesia has increased. Therefore, a rapid improvement from anesthesia, resulting in an early release, and fast resumption of on daily basis activities, could be of great benefit to patients, surgeons, and hospital stay **[1]**.

The optimal intrathecal anesthesia would provide fast block, regression, and fewer side effects. These effects are induced by lidocaine; nevertheless, TNS are mild to severe pain in the buttocks and legs that can last for dayshad unfavorable effect in patients after intrathecal injection **[2]**. Bupivacaine is along acting local anesthetic belonging to the amide group that is more stable and less likely to cause allergic reactions, unlike lidocaine. Bupivacaine used for intrathecal anesthesia in ambulatory surgery that may be delayhospital discharge. Prilocaine is a local anesthetic belonging to the amide group with rapid onset, intermediate potency, and action. Besides, it has less TNS. Prilocaine has been used as another option for lidocaine intrathecal anesthesia for short procedures as lower abdominal surgery **[3]**. The main aim of this study was to evaluate spinal anesthesia with prilocaine 2%, lidocaine 2%, and bupivacaine 0.5% to highlight the efficacy and the safety for their short-term uses of day-case surgeries and ambulatory anesthesia **[4]**.

Exclusion criteria:

ASA physical status more than II, presence of coagulopathy, sever pulmonary pathology, anemia, Methemoglobinemia, preexisting neuropathology in the lower limbs, infection in the injection site,

sever mitral or aortic stenosis, local anesthetic allergy.

Patients and Methods

The revised clinical protocol agreed after approval of Ethical Committee at Al-Zahra Hospital within a period from January 2021-September 2021. The study included 66 patients ASA I, II, between (21-59) years of age, undergoing lower abdominal surgery andwere divided by simple random samplinginto three groups; (B group) 22 patients who received intrathecal anesthesia with bupivacaine 0.5%; (P group) 22 patients who received intrathecal anesthesia with prilocaine 2%; and (L group) 22 patients who received intrathecal anesthesia with lidocaine 2%. Two hours before surgery, pure liquids allowed. Immediately prior to surgery, patients were asked to pour out their urinary bladder. Wide bore cannula 18 gauge inserted into anon-dominant hand and Patients received midazolam IV 0.02mg/kg as premedication, fluid solution Ringer's lactate infused of 20ml/kg/h as a preload. Monitoring devices such as ECG, pulse oximetry, and non-invasive arterial blood procedure were utilized. Then, a spinal puncture was performed after sterilization of the back and complete aseptic condition by the midline approach at the L 3-4 or L 4-5 interspaces with the patient in seated position using a 23G-25G needle pencil-point type. Local anesthetic at room temperature was injected gradually over a period of 16s., and according to height of the patients dose ranges between 40mg-50mg prilocaine + 25µg fentanyl in (p group) compared to adose between 40mg-50 mg lidocaine + 25µg fentanyl in (L group), and 10-12.5mg bupivacaine + 25µg fentanyl (B group) all used drugs are preservative-free. Immediately, following injection, a small pad was placed under the patients' head and shoulder. Evaluation of onset and sensory levelof the block carried out by pin-prick test at 3, 6, 9, 12, and at 15min after local anesthetic intrathecal injection and 10min intervals later until maximum sensory level T6 and then time cessation of sensory block to L1 and S3. The modified Bromage scale; was tested at 3, 6, 9, 15, 60, and 120min from the onset of the maximum motor block.

Grade	Criteria	Degree of block
I	- Free legs and feet movement	- No (0%)
II	- Able to flex knees with free movement of feet	- Partial (33%)
III	- Unable to flex knees, but with free movement of feet	- Almost complete (66%)
IV	- Unable to move legs or feet	- Complete (100%)

After recovery of the motor blockade assessed every 10min until (Bromage grade 0) full regaining of motor power. Time to stand unassisted, voiding time, discharge time from the hospital. The secondary outcome as postoperative discharge score (White fast track in operating room (OR) and modified Aldrete discharge score in PACU) and complications as nausea, shivering, vomiting, and transient neurological symptomsas pain in the buttocks and legs observed prior to hospital discharge and followed-up for one week after discharge by telephone.

Statistical analysis:

Recorded data were analyzed using the statistical package for social sciences, version 23.0 (SPSS Inc., Chicago, Illinois, USA). The quantitative data were presented as mean ± standard deviation and ranges. Also qualitative variables were presented as number and percentages. The following tests were done: A one-way analysis of variance (ANOVA) when comparing between more than two means. Post Hoc test: Tukey's test was used for multiple comparisons between different variables. Chi-square (x^2) test of significance was used in order to compare proportions between qualitative parameters. The confidence interval was set to 95% and the margin of error accepted was set to 5%. So, the *p*-value was considered significant as the following: *p*-value <0.05 was considered significant; *p*-value <0.001 was considered as highly significant; *p*-value >0.05 was considered insignificant.

Results

No statistically significant difference was found between groups according to demographic data regarding Age (years), Sex, BMI (wt./ht^2) ASA physical status, and duration of surgery (min), with a *p*-value ($p>0.05$), as shown in Table (1). No statistically significant difference was detected between groups according to the type of operation as demonstrated in Table (2). There were no significant differences between the hemodynamic as heart rate, MABP, and oxygen saturation during operation as shown in Fig. (1). Fig. (2) shows a statistically significant higher onset in the B group compared to the L group, and the P group according to their sensory block with respect to onset (6.85±0.76min) in the B group (3.10±0.36min) in the L group, and (3.30±0.47min) in the P group with a *p*-value <0.001. With regard time to reach sensory block level T6, it was (15.91±1.41min) in B group, (13.30±0.82 min) in P group, and (7.20± 0.32min) in L group with a *p*-value <0.001. Cessation of sensory block L1 was (201.30±19.69

min) in the B group,(135.81±12.81min) in P group, and (120.33±10.2min) in L group with a *p*-value (*p*<0.001). Cessation of sensory block to S3 was (60.90±4.49min) in B group, (46.35±4.56 min) in P group, and (50.3±8.2min) in L group, with a p-value (*p*<0.001), as shown in Table (3). Fig. (3) shows a statistically significant difference between B group compared to the P group and L group, according to the Bromage scale at the 1^{st} and 2^{nd} hour. Fig. (4) demonstrates a significantly higher time to stand unassisted in B group (191.12±27.4 min) compared to P group (145.70±17.17min), and L group (142.7±15.85min) with a *p*-value <0.00. Regarding time to void (urine), it was found to be (183.61±30.29min) in B group (162.21±27.05min) in P group, and (145.8±16.2min) in L group and a *p*-value <0.001. Whereas time to home readiness was (231.39±25.61min) in B group, (186.43±30.75 min) in the P group, and (180.2±28.9min) in L group, with a *p*-value <0.001. As regards the white fast-track score, there is a highly significant fast recovery from the operating room and a p-value <0.001 and a significant modified Aldrete discharge score with a *p*-value <0.000 in P and L groups, than B group as shown in (Table 4). Concerning postoperative complication there is no significant difference in the three groups, as shown in (Table 5).

Table (1): Demographic data between three groups.

Demographic data	Prilocaine Group (n=22)	Lidocaine Group (n=22)	Bupivacaine Group (n=22)	*p*-value
Age (years)	42.48±12.21	43.02±9.40	44.04±8.5	0.875
Sex: Male	10 (45.5%)	17 (77.3%)	13 (59.1%)	0.096
Sex: Female	12 (54.5%)	5 (22.7%)	9 (40.9%)	
BMI [wt./ (ht)^2]	22.74±2.45	23.77±1.9	22.70±1.9	0.168
ASA I	18 (81.8%)	12 (54.5%)	17 (77.3%)	0.101
ASA II	4 (18.2%)	10 (45.5%)	5 (22.7%)	0.634
Duration of surgery (min)	36.13±7.66	35.14±5.82	34.22±6.2	

Table (2): Comparison type of operation between three groups.

Type of operation	Prilocaine Group (n=22)	Lidocaine Group (n=22)	Bupivacaine Group (n=22)	*p*-value
Ano-rectal surgery	9 (39.1%)	6 (26.1%)	10 (43.5%)	0.240
Inguinal hernioplasty	6 (26.1%)	2 (8.7%)	2 (8.7%)	
Cesarean section	7 (31.8%)	14 (63.6%)	10 (43.5%)	

p-value >0.05 Non-significant.

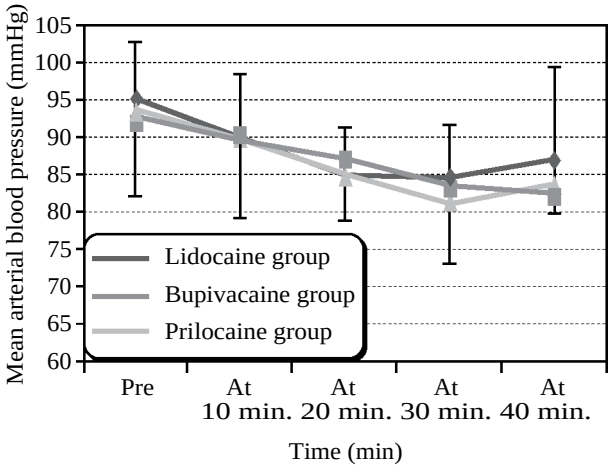

Fig. (1): MBP mmHg between three groups.

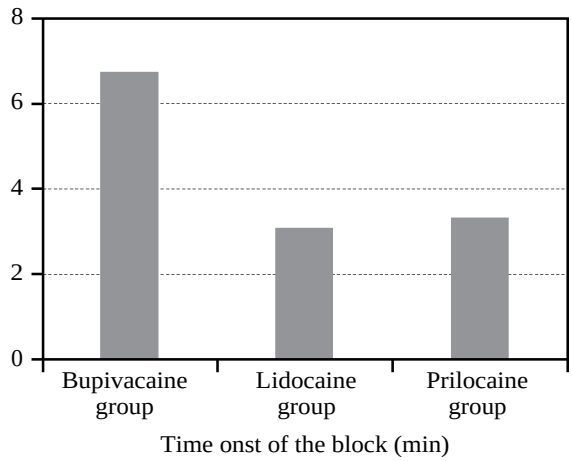

Fig. (2): Comparison of the onset of block (min) between groups.

Table (3): The level of the sensory block (min) between groups.

Levels of sensory block (Min)	Prilocaine Group (n=22)	Lidocaine Group (n=22)	Bupivacaine Group (n=22)	*p*-value
Maximum sensory block T6 (min)	15.91±1.41A	13.30±0.82B	7.20±0.32C	<0.001
Cessation of sensory block to L1 (min)	201.30±19.69A	135.81±12.81B	120.33±10.2C	<0.001
Cessation of the sensory block to S3 (min)	60.90±4.49A	46.35±4.56AC	50.3±8.2C	<0.001

p-value <0.001 highly significant.

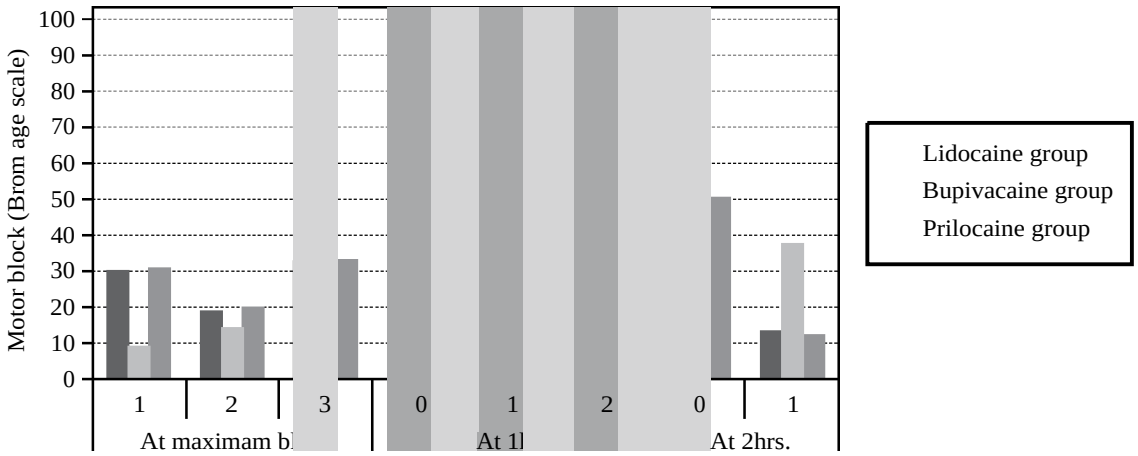

Fig. (3): Comparison between groups according to Bromage scale *p*-value <0.001** HS.

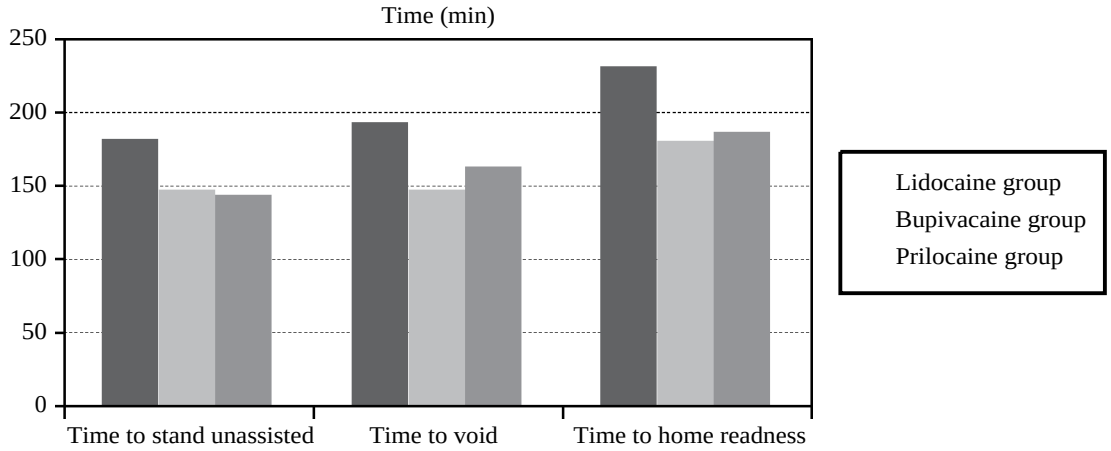

Fig. (4): Comparison of Time to stand unassisted (min), Time to void and Time to home readiness.

Table (4): Postoperative discharge score.

	Prilocaine Group (n=22)	Lidocaine Group (n=22)	Bupivacaine Group (n=22)	*p*-value
White fast track score (OR)	3.06±0.67A	2.19±0.40B	3.06±0.67A	<0.001
Aldrete discharge score (PACU)	9.42±3.14B	12.11±3.46A	11.33±3.7AB	0.034

***p*<0.001 HS, and significant *p*<0.05.

Table (5): Postoperative complications.

Complications postoperative	Prilocaine Group (n=22)	Lidocaine Group (n=22)	Bupivacaine Group (n=22)	*p*-value
Nausea	2 (9.1%)	2 (9.1%)	4 (18.2%)	0.566
Shivering	2 (9.1%)	1 (4.5%)	4 (18.2%)	0.327
Vomiting	1 (4.5%)	1 (4.5%)	3 (13.6%)	0.421
TNS	0 (0.0%)	2 (9.1%)	1 (4.5%)	0.351

NS: Non-significant.

Discussion

This study was conducted to examine the effects of spinal anesthesia by bupivacaine 0.5% versus prilocaine 2%, and lidocaine 2% for day-case lower abdominal surgery at Al-Zahra hospital within a period from January until September 2021 in terms of hemodynamic (MABP) duration of anesthetic recovery with the onset of sensory and resolution of the block, time of hospital discharge, and complications such as nausea, shivering, vomiting in PACU, and the efficacy of TNS postoperatively for day-case spinal anesthesia. Regarding demographic data including sex, duration of operation, and BMI in all groups, were found to be similar. Concerning the hemodynamic (MABP) change no statistically significant difference was in MABP in the studies groups postoperatively in the PACU.

With respect to the onset of block, the study of Teunkens et al. **[5]**, demonstrated judgment of prilocaine, lidocaine, and bupivacaine worn for spinal (intrathecal) anesthesia on 63 patients each undergoing ambulatory knee arthroscopic surgeries **[6,7]**. Patients were categorized into 3 groups. Onset of sensory block achievement, time to falling off, and first urination were significantly shorter in the lidocaine and prilocaine groups versus the bupivacaine group, while the reported rate of TNS was significantly lower in the prilocaine and bupivacaine groups compared to the lidocaine group **[8]**.

In concurrence with the results of the current study, Manassero et al. **[9]**, that day-case intrathecal anesthesia with 35mg prilocaine + fentanyl 25µg for anorectal surgery provides quick onset of the block, declaration of the block, and hospital discharge compared to 10mg of bupivacaine + 25µg fentanyl **[10]**.

The findings of the current study are in agreement with Saporito et al. **[11]** who illustrated that when compared to prilocaine, lidocaine is safe and effective with low-dose bupivacaine and shows that the moment for T10 block and the furthermost block was shorter for prilocaine and lidocaine than in bupivacaine.

In consistence with our study, a study by Ali Hassan et al. **[12]**, on arthroscopic knee surgery showed a fast-track outcome when comparing bupivacaine and lidocaine. It was also demonstrated in an earlier instance of ambulation in lidocaine 120min relative to the low dose of bupivacaine 159min. The moment in time to fulfill discharge also was more rapid in the lidocaine group (152min) versus the low-dose of bupivacaine (185min) **[13,14]**.

Mohta et al. **[15]**, conducted a study on fifty patients who all underwent spinal intrathecal anesthesia for elective cesarean section. The first group received intrathecal hyperbaric 55mg prilocaine, whereas the second group (B) received 12.5 mg intrathecal hyperbaric bupivacaine **[16]**. Equal 3µg sufentanil and 0.1mg morphine were mixed into the anesthetic drug in both groups which enhanced the onset and improved the quality of the block, reducing staff workload, in addition to reducing intra-operative hypotension, maternal postoperative pain, and patient satisfaction **[17,18]**.

In contrast to our results, a study by Camponovo et al. **[19]**, to compare the effectiveness of 60mg hyperbaric prilocaine 2% versus 60mg plain prilocaine 2% for spinal anesthesia, showed that the hyperbaric prilocaine had hemodynamic stability, shorter onset of sensory and motor blockade, decay of motor blockade, and quicker voiding of urine than the plain formulation **[20-23]**.

The study performed by Hampl et al. **[24]**,to assess whether TNS symptoms associated with increased osmolarity and hyper baricity as in lidocaine 5%. They compared three studied drugs; hyperbaric lidocaine 5% in 7% glucose; hyperbaric bupivacaine 0.5% in glucose 8%; and lidocaine 5% in 2.6% glucose **[25,26]**. They detected no change in symptoms between the 2 different lidocaine osmolarity and 0% of TNS in the hyperbaric bupivacaine. TNS symptoms persist within two to five days postoperatively **[27]**.

Zaric et al. **[28]**, demonstrated that TNS symptoms are extensively higher with lidocaine compared to different agents such as prilocaine, mepivacaine, bupivacaine, ropivacaine, levobupivacaine, and procaine despite baricity.

Conclusions:

Spinal anesthesia with prilocaine and lidocaine results in an earlier recovery of sensory and motor blockade, leading to faster sanatorium release, reduced workload of medical staff, and better patient outcome compared to bupivacaine, despite reported TN symptoms with lidocaine that limit its use.

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تقييم التخدير النخاعى باستخدام بريلوكايين ٢٪، ليدوكايين ٢٪، البيبفا كين ٠.٥٪ لتسليط الضوء على الفعالية والسلامة لاستخداماتهم قصيرة المدى فى جراحات اليوم الواحد والتخدير المتنقل

أصبحت علميات اليوم الواحد والجراحات تحت التخدير النصفى السريع تحتل أهتماماً متزايداً فى السنوات القليلة الماضية. وبالتالى زاد عدد الأدوية المتاحة للتخدير النخاعى. مما أدى إلى التحسين السريع من التخدير مما يؤدى إلى الخروج المبكر من المستشفى واستئناف الأنشطة اليومية بشكل أسرع.

مما أفاد المرضى والجراحين وقلل زمن الإقامة فى المستشفى. ومن أنواع الأدوية السريعة التى يتم استخدامها الآن الليدوكايين ٢٪ ومع أنه له أثار جانبية مثل TNS وهى الآم شديدة فى الأرداف والساقين والتى يمكن أن تستمر لعدة أيام مهما قلل استخدامه كتخدير نصفى. والبيبفاكين ٠.٥٪ يستخدم أيضاً بجرعة قليلة ومع ذلك طول مدة التخدير النصفى يقلل استخدامه. لذلك البريلوكايين ٢٪ له تأثير وقتى أقل ومضاعفات أقل كخيار أفضل للتخدير النصفى للجراحات القصيرة لأسفل البطن.

كان الهدف الرئيسى من هذه الدراسة هو تقييم التخدير النخاعى باستخدام بريلوكايين ٢٪، ليدوكايين ٢٪، البيبفاكين ٠.٥٪ لتسليط الضوء على الفعالية والسلامة لاستخداماتهم قصيرة المدى فى جراحات اليوم الواحد والتخدير المتنقل.