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RESEARCH ARTICLE

Hyperbaric Lidocaine 1.5% for Spinal Anesthesia in Short Duration Surgeries. Retrospective Study

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Abstract

Background: Solutions lower than 5% lidocaine have been recommended for spinal anesthesia. Thus, several solutions ranging from 0.5% to 3% lidocaine in glucose have been used. We designed this retrospective study in patients operated on in gynecological, general and urological surgery in the supine position with 60 mg of 1.5% lidocaine in glucose.

Methods: A total of 210 patients were retrospectively evaluated after receiving a fixed dose of 60 mg of 1.5% hyperbaric lidocaine. Patients were examined for latency of analgesia, cephalad spread, sensory block, motor block, duration of surgery, block duration, and cardiocirculatory and neurological complications.

Results: The baricity of 1.5% lidocaine glucose is hyperbaric. All patients were successfully operated on in the horizontal dorsal position, and there were no anesthesia failures. The cephalad spread mode of analgesia was between T10 at 5 minutes, T9 at 10 minutes and T8 at 15 minutes, every 5 minutes the cephalic spread increased by one level of sensory blockade. Complete motor block (grade 3) occurred in 70% of patients at 15 minutes. Eight (3.8%) patients presented bradycardia, and 19 (9%) patients presented hypotension. The transient neurological symptoms no were reported by telephone after discharge until the 3rd postoperative day.

Conclusion: This study showed that 60 mg of 1.5% lidocaine hyperbaric solution for spinal anesthesia for gynecological, inguinal and umbilical hernia repair, urological short-term surgery with subarachnoid puncture in left lateral decubitus and surgery was performed in horizontal dorsal decubitus, facilitates discharge of outpatients within a few hours while decreasing recovery room time and nursing care.

Keywords: Local, Lidocaine, Transient Neurologic Symptoms, Spinal Block.

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Key Points

- Spinal anaesthesia can provide many of the desired properties of the ideal technique for ambulatory anaesthesia.
- Lidocaine hyperbaric 5% became available for intrathecal use in 1954.
- Lidocaine in concentrations less than 5% for spinal anesthesia may be advocated.
- Various solutions with or without glucose have been used, such as 0.5%, 1%, 2% and 3%, for different surgical procedures.
- Most of the anesthesiologists' preference for the sitting position and hyperbaric solution.
- Few schools of anesthesiology apply the lateral decubitus position for neuraxial anesthesia.
- Lidocaine 1.5% hyperbaric can be used in outpatient surgery.
- With the spinal technique used and the lidocaine solution, no TNS was observed

1. Introduction

Lidocaine was synthesized in 1943 under the name xylocaine by Swedish chemist Nils Lofgren [1]. His colleague Bengt Lundqvist performed the first injection anesthesia experiments on himself [2]. The use of lidocaine for spinal anesthesia was first published in1949, using 2 mL of 2% solution in 10% glucose for urological operations produced a rapid and satisfactory anesthesia [3]. In 1954 lidocaine was used at a concentration of 5% with glucose [4].

In 1991, four cases of cauda equina syndrome were reported, three of which involved the use of high doses of 5% lidocaine with glucose in a 28G microcatheter and one involving the use of 1% tetracaine with 5% glucose and a 20G catheter for epidural use [5]. Therefore, these four cases have a methodological error because two local anesthetics and a microcatheter and epidural catheter were used.

The reason for using 5% lidocaine with glucose for spinal anesthesia is unclear and this concentration. After reports of complications with this solution, there was a search for the use of various solutions of lidocaine with glucose for spinal anesthesia. Thus, several concentrations were researched so that hyperbaric lidocaine could continue to be used: 0.5% [6], 1.5% and 2% [7], 1% and 3% [8], all these concentrations showed similar results to 5% hyperbaric lidocaine, with rapid onset of action and short duration of action.

The purpose of the retrospective study was to evaluate fixed dose of 60 mg (4 mL) of 1.5% hyperbaric lidocaine for spinal anesthesia punctured in left lateral decubitus, and operated in the prone position, to determine their characteristic particularly with respect to latency, sensory and motor block, quality of surgical conditions, duration of sensory block, subsequent recovery, complications and patient satisfaction, undergoing spinal anesthesia for gynecological, general and urological surgeries in the supine position.

2. Methods

The study was registered in the Brazil Platform (CAAE:09061312.1.0000.5179). The Ethics Research Committee approved the study protocol (Number: 171,924) and was a retrospective study carried out in several hospitals. All spinal anesthesia with lidocaine for orthopedic surgery were recorded in an Excel spreadsheet for further study [9], and 210 spinal anesthesia with 1.5% lidocaine hyperbaric, according to the consort flowchart (Figure 1). Because the study was retrospective, the Free and Informed Consent Term was released.

The density (g/ml) of 1.5% hyperbaric lidocaine at 37ºC was measured using a DMA 450 densimeter. Two hundred and ten ASA I and II patients of both genders, aged between 20 and 60 years, weighing between 50 and 80 kg, height between 150 and 180 cm, scheduled for gynecological, inguinal and umbilical hernia repair, urological short-term surgery, basis were recruited in this retrospective study. Exclusion criteria were neurological or neuromuscular diseases, infection at the spinal puncture site, hypersensitivity to local anesthetics of the amide group, refusal of the proposed method, and lack of data in the spreadsheet.

All patients received a pre-anesthetic visit by the anesthesiologist and the entire procedure was informed, but no pre-anesthetic medication was administered. Upon arrival at the surgical center, patients were monitored, and a vein was punctured on the back of the left hand with a 20G venous catheter and hydration was started with Ringer's Lactate, prehydration was not used before spinal anesthesia. The monitoring used was ECG continuously in the CM5 lead, non-invasive blood pressure, oxygen saturation and expired CO2 through the capnograph placed in the nose, and all data were recorded at 5-minute intervals until the incision and afterwards every 10 minutes.

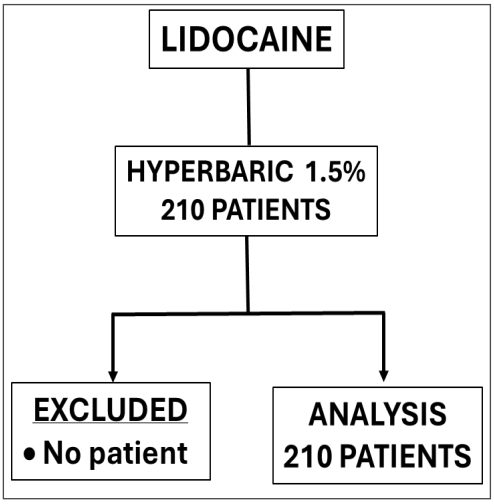

Figure 1. *Consort flowchart with 210 spinal anesthesia with 1.5% hyperbaric lidocaine, performed between 1998 to 2018.*

Each patient received 50 µg of fentanyl and 1 mg of midazolam intravenously approximately 10 minutes before being placed in the left lateral position for the blockade (Figure 2). After cleaning the skin with 70% alcohol or alcoholic chlorhexidine, the subarachnoid puncture was performed, and after anesthetic infiltration of the skin and deep tissues with 1% lidocaine solution, the subarachnoid space was approached via the paramedian route between the L3-L4 apophyses using a 27G gauge needle with a Quincke tip without the use of an introducer. After the appearance of CSF in the needle hub, 4 mL of 1.5% hyperbaric lidocaine were injected at a rate of 1 mL in 10 seconds.

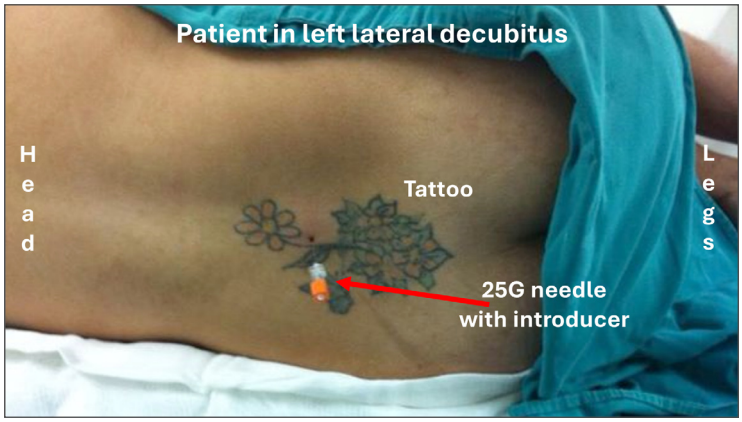

Figure 2. *Patients in left lateral decubitus com insertion paramediana.*

The patient was placed in the supine position to assess the time for the onset of blockade assessed by the loss of sensitivity to the touch of the needle stylet. The cephalic spread of analgesia was assessed by lightly touching a cotton ball soaked in alcohol along the bilateral midaxillary line, starting on the lateral side of the thigh, at 5, 10 and 15 minutes. At the same time of 5, 10 and 15 minutes, motor block was tested by asking the patient to identify the movements made of both feet. The motor blockade of the lower limbs was performed at 15 minutes using the modified Bromage table with degrees of 0 absence and 3 maximum degrees.

The duration of surgery was defined as the time after release for surgery and the end of surgery. The duration of the blockade was defined as the time between the puncture and injection of hyperbaric lidocaine and the recovery of perineal sensitivity, when the needle stylet touched the buttocks, assessed after the end of the surgery every 15 minutes until full recovery. Hemodynamic parameters were assessed every five minutes for the first 15 minutes and every 10 minutes until the end of the surgery. Hypotension was defined as a reduction in systolic pressure greater than 30% of the baseline value and bradycardia was defined as a reduction in heart rate below 50 beats per minute. All patients received oxygen (2 l/min) via Hudson mask or oxygen catheter. During the surgical procedure, patients received midazolam (0.5 to 1 mg) for sedation, and fentanyl (50 µg) was administered if there was a complaint of pain.

At the end of surgery, postoperative analgesia was performed with surgical wound blockade with 0.25% enantiomeric excess levobupivacaine (S75:R25) at a dose of 20 ml, and 40 mg/kg of dipyrone in 100 ml of serum. After surgery, patients were transferred to the post-anesthesia care unit (PACU) for continuous monitoring of vital signs until complete regression of

the blockade. Before being discharged from the clinic, the anesthesiology recorded the patient's satisfaction with the technique, which was classified as good, satisfactory or bad. Discharge was only permitted for patients who were awake, able to walk without assistance and with stable vital signs for at least one hour. Home follow-up was maintained, using a telephone questionnaire, with questions about post-dural puncture headache or transient neurological symptoms (TNS) up to the 3rd day after surgery. When evaluating the surgical procedure, the surgeon was asked about any neurological complications.

2.1 Statistical Analysis

An exploratory data analysis was performed to understand the behavior of the variables involved in the study. Descriptive measures such as means and standard deviations were applied for continuous variables, while absolute and relative frequencies were calculated for categorical variables.

3. Results

The demographic data of the 210 patients are in Table I. All patients were successfully operated on in the horizontal dorsal position with 60 mg of 1.5% hyperbaric lidocaine. None complained of discomfort, and no rescue dose of fentanyl was required. Hydration during surgery was always below 700 mL.

Table 1. *Patient demographics data*

Data	Lido 1.5% = 210
Age (yr)	41.86 ± 10.85
Weight (kg)	70.60 ± 10.39
Height (cm)	169.12 ± 7.77
Gender: M / F	130 / 80

The density values at 37ºC obtained were 1.02520±0.00000 g/ml for 1.5% hyperbaric lidocaine. The mean block latency was around 1 minute. The mean duration of surgery was 36 minutes, and the mean duration of sensory block was 89 minutes, and motor block was 81 minutes. There were no anesthesia failures with the 60 mg dose of 1.5% hyperbaric lidocaine and there was sufficient time for all procedures [Table II].

Table 2. *Assessment of blocks in 1.5% hyperbaric lidocaine*

Data	Lido 1.5% = 210
Latency (min)	1:03 ± 0:44
Surgery duration (min)	36:02 ± 7:02
Sensory block duration (min)	89 ± 6
Motor block duration (min)	81 ± 5
Anesthesia failure	Zero

The cephalad spread mode of analgesia was between T10 at 5 minutes, T9 at 10 minutes and T8 at 15 minutes (Table III, Figure 3). Every 5 minutes the cephalic spread increased by one level of sensory blockade. The average onset of motor block at 5, 10 and 15 minutes is shown in Table III. Complete motor block (grade 3) occurred in 70% of patients at 15 minutes. All patients were satisfied with the short duration of spinal anesthesia, mainly because the motor blockade lasted less than the analgesia (Table III).

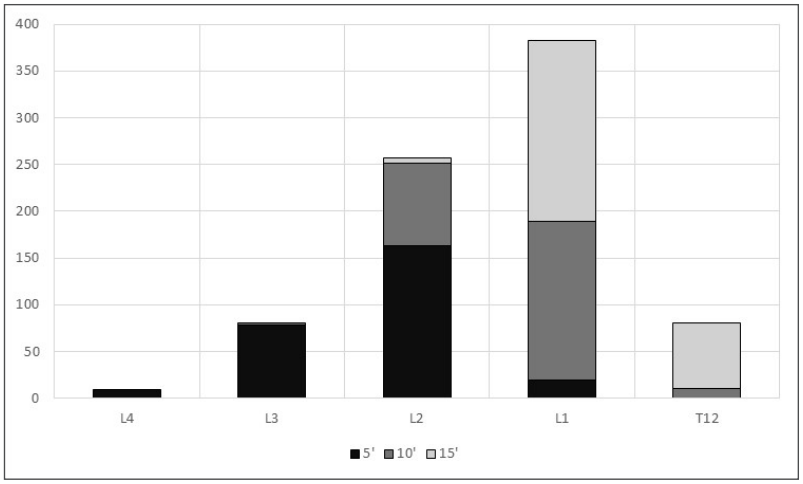

Figure 3. *Cephalic spread of analgesia to the 5, 10 and 15 minutes.*

Table 3. *Assessment of dispersion cephalic analgesia, time of installation of degrees motor blocks, and satisfaction*

Data	Lido 1.5% = 210
Dispersion cephalic: Mode	
5 min	T10
10 min	T9
15 min	T8
Time degrees motor block:	
5 min	1:00 ± 0:46
10 min	2:79 ± 1:25
15 min	4:85 ± 0:94
Degrees motor block:	
5 min	BM 1 = 210
10 min	BM 2 = 210
15 min	BM 3 = 148
Satisfaction	
Good	210
Satisfactory	0
Bad	0

Eight (3.8%) patients presented bradycardia, and 19 (9%) patients presented hypotension treated with atropine and ephedrine. No patient presented pain during the surgical procedure.

In the postoperative interview, one patient complained of headache after dural puncture. The transient neurological symptoms no were reported by telephone after discharge until the 3rd postoperative day. During the surgical control evaluated by the surgeon, there were no reports of neurological complications.

4. Discussion

Two-hundred and ten patients received spinal anesthesia with 60 mg of 1.5% hyperbaric lidocaine, for gynecological, inguinal and umbilical hernia repair, urological short-term surgery with subarachnoid puncture in left lateral decubitus and surgery was performed in horizontal dorsal decubitus. The density was shown to be hyperbaric due to the addition of glucose. The mean block latency was around 1 minute, the mean duration of surgery was 36 minutes, and the mean duration of sensory block was 89 minutes, and motor block was 81 minutes. There were no anesthesia failures with the 60 mg dose of 1.5% hyperbaric lidocaine and there was sufficient time for all procedures. In the post-operative telephone interview, no TNS were observed in all patients.

The sensory level after injection of local anesthetic into the subarachnoid space depends on numerous factors, baricity being one of the most important. The baricity found showed that 1.5% lidocaine with glucose is hyperbaric in relation to CSF. Thus, performing the injection of 60 mg (4 mL) of 1.5% hyperbaric lidocaine in the left lateral decubitus position and immediately placing the patient in the horizontal dorsal decubitus position, showed through mode a higher dispersion of one segment every 5 minutes (T10, T9, T8).

The use of lidocaine in concentrations less than 5% for spinal anesthesia may be advantageous, and there are several studies evaluating these different concentrations with glucose and dextrose-free lidocaine, have been published worldwide, for different types of surgical procedures. Comparing 30 mg of 0.5% with 5% hyperbaric lidocaine with 7.5% glucose for continuous spinal anesthesia showed that was sufficient to achieve surgical anesthesia for 50 minutes, with hemodynamic effects of two hyperbaric lidocaine solutions were comparable [6].

A total of 100 patients were randomized to receive either 30 mg of 1.5% lidocaine in 8% glucose or the same dose of 2% lidocaine in 8% glucose for spinal anesthesia in lithotomy position and outpatient surgery, examined for latency, spread, sensory block motor block, and block duration [7]. The result of the study showed that the latency and spread of analgesia was the same with both hyperbaric solutions of lidocaine, motor block was incomplete in all patients in both groups. In the postoperative interviews no complaints of TNS after discharge were offered. In this study with 210 patients who underwent gynecological, herniorrhaphy and urology surgery in the horizontal dorsal decubitus position, no patient presented TNS.

In a study with 65 patients evaluating a fixed dose of 30 mg of 3% lidocaine in 8.2% dextrose compared with 1% lidocaine in 7.8% dextrose, the spread, duration, regression of sensory and motor block, and side effects were examined [8]. The result of the study showed that 3 mL of 1% hyperbaric lidocaine

solution resulted in shorter times for recovery from motor block and to urination than did 1 mL of 3% hyperbaric lidocaine solution whereas levels of sensory block were similar. Hyperbaric 1% lidocaine spinal anesthesia may be more suitable for day-care surgery compared with hyperbaric 3% lidocaine.

Six hundred patients were randomly divided in two groups receiving the same dose of 60 mg of 2% lidocaine isobaric and 2% lidocaine hyperbaric for orthopedic surgery and were observed: onset of analgesia, motor block, effect duration, level of cephalic spread of analgesia, cardiovascular changes and TNS [9]. The result showed that spread of analgesia was significantly higher with 2% hyperbaric lidocaine, and the sensory block was significantly longer lasting than the motor block. With the isobaric lidocaine, the sensory block was significantly shorter lasting than the motor block, and bradycardia and hypotension were significantly lower. TNS occurred in 14 (2.3%) patients with both solutions without significant difference and all related to knee arthroscopic surgery. In this study with 210 patients anesthetized in the left lateral decubitus position and operated in the horizontal dorsal decubitus position with 60 mg of 1.5% hyperbaric lidocaine, cephalic dispersion varied from T10 to T4, at 15 minutes, with the sensory block lasting longer than the motor block, and no case of TNS was observed.

Studying eight volunteers who had previously received 5% lidocaine with dextrose, in randomized, double blind, cross-over fashion. lidocaine 50 mg (1.5% with dextrose and 1.5% dextrose-free) and concluded the use of different solutions of lidocaine for spinal anesthesia results in significant differences in sensory and motor block and time until recovery of micturition [10]. In the present study, 1.5% dextrose-free lidocaine was not evaluated.

A Cochrane systematic review published in 2009 found that TNS occurs after one in seven spinal anesthetics with lidocaine [11]. In a previous study of 40 patients undergoing spinal anesthesia with the same dose of 1.5% hyperbaric lidocaine in various types of surgery, no cases of TNS were observed [12]. Unlike the 2009 Cochrane review, in this retrospective study of 210 patients undergoing various types of surgery operated in the supine position, no cases of TNS were observed.

5. Conclusion

Lidocaine is an amide local anesthetic with a rapid onset and fast recovery of sensory and motor block, making it well suited for ambulatory surgery. The use of lidocaine in concentrations less than 5% for spinal anesthesia may be advantageous. Various solutions with or without glucose have been used, such as 0.5%, 1%, 1.5%, 2% and 3%, for different surgical procedures. This study showed that 60 mg of 1.5% lidocaine hyperbaric solution for spinal anesthesia for gynecological, inguinal and umbilical hernia repair, urological short-term surgery with subarachnoid puncture in left lateral decubitus and surgery was performed in horizontal dorsal decubitus, facilitates discharge of outpatients within a few hours while decreasing recovery room time and nursing care.

Study Carried out in Several Hospitals.

Financial Support: No

Conflict of Interest: No

Contribution: No

IRB: No

This paper has not been presented.

This article was written without any financial support, being an opinion formed over 50 years of studying neuraxial blocks. Because I am a retired Professor and continue to teach anesthesiology residents, I do not have any additional salary.

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