Review Article
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Spinal anesthesia, puncture position and local anesthetic solutions. Better understanding for better indication.

Abstract

Two schools teach spinal anesthesia, one prefers the lateral decubitus position and the other the sitting position. The vast majority of anesthesiologists worldwide use routinely the hyperbaric solution of bupivacaine for almost all types of surgery, mainly performed in a sitting position. There is renewed interest in understanding spinal anesthesia about puncture position, the various solutions used, and the position of the operating table during the surgical procedure. Understanding the vertebral column, of the anterior and posterior roots, allows the different puncture positions, and the hyperbaric, isobaric, and hypobaric solutions to offer better quality of these techniques and will be shown in this article. The application of the three solutions in different puncture positions, and the position of the surgical table during the procedure, will be shown in seven items in 14 tables, and 6 figures, for the complete understanding of spinal anesthesia. The possibility of performing hemi-spinal anesthesia (unilateral and posterior), and the possibility of performing completely sensory spinal anesthesia without any degree of motor block are discussed. The explanations in this article with the different puncture positions and the three local anesthetic solutions are applied both in the lumbar region and in the thoracic region.

Keywords: Regional anesthesia, Understanding spinal anesthesia, Hyperbaric, isobaric, hypobaric local anesthetic, Position of puncture

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Introduction

When I became an anesthetist in the 1975, there were only two types of local anesthetics available for spinal anesthesia: 5% hyperbaric lidocaine and tetracaine (hyperbaric, isobaric, and hypobaric), it is prepared by the (pharmacy) of Rio de Janeiro and São Paulo, Brazil (procaine, bupivacaine and mepivacaine were also used for spinal anesthesia at that time). The first trials with bupivacaine in 1966, proved to be effective and with almost all the desirable characteristics of an anesthetic for use in spinal anesthesia.[1] In an excellent editorial published in 1984, the author describes all bupivacaine solutions in comparison with existing drugs at the time, showing an excellent result.[2] Hyperbaric solutions containing glucose were tested in concentrations of 0.5%, 0.75% and 1%. However, the greatest interest was aroused by the isobaric solution, particularly for surgeries lower limbs and perineal,[2] although there was no lack of people who tried their job in abdominal surgeries,[3] and in cesarean sections with cardiocirculatory stability without hypotension and without the use of vasopressors in all patients.[4]

Recently our group wrote an article showing that spinal anesthesia is much more than a single shot injection of hyperbaric anesthetic.[5] Having been listed seven possibilities of lack of knowledge of other possibilities of using spinal anesthesia. In a recent editorial, I defended that for the good use of ultrasound (US) in spinal anesthesia, other puncture positions should be studied with this new method, since most books and publications focus on the sitting position.[6]

Changes in the concept of spinal anesthesia

In 2001, when I was submitted to a surgery, I was able to evaluate the entire installation and regression of the use of 0.5% isobaric bupivacaine solution and fentanyl.[7] Four hours later all sensory had disappeared, and motor block had disappeared after five hours later (With this technique, the motor block disappears before the sensory block.). When I had my first spontaneous void after walking from bed to the bathroom. A surgical procedure lasting 1 hour did not justify maintaining a motor blockade of the lower limbs for 5 hours. In this way, we started to change the criteria of cardiocirculatory stability for patient satisfaction. It is very important to be on the other side of the needle to see if what we are doing as an anesthetic technique is perceived by the patient as quality and satisfaction with the procedure.[7]

This technique with isobaric bupivacaine allowed for a long-lasting motor block, which lasted longer than the sensory block. At that time, we concluded that the motor block was not a quality of spinal anesthesia, but rather a necessity when surgery required it. This new concept of the difference between sensory and motor block led us to deeply study the understanding of spinal anesthesia, initially a concept published as a letter to the editor.[8] (Motor block with spinal bupivacaine is ALWAYS shorter than sensory block).

After this initial explanation, we tried to perform spinal anesthesia according to the surgical need, with a study of spinal hemianesthesia (unilateral and posterior), low doses of local anesthetics according to the surgical need and according to the surgeon (prior knowledge of them), resulting in several studies. And some articles explaining all the possibilities of various spinal anesthesia techniques.[5,6,9-16]

Local anesthetic solutions and puncture position

A recent editorial demonstrated the different positions used for accessing the neuraxial and performing spinal anesthesia.[6] However, it was discussed previously that most anesthesiologists prefer to use the sitting position and 0.5% hyperbaric bupivacaine, demonstrating that spinal anesthesia is much more than the use of this position and this solution.[5] In this article it was demonstrated that the new approach with US in all books and articles prefer the sitting position for the neuraxial approach and spinal anesthesia.[5] This fact demonstrates that the use of US also needs to evolve to perform spinal anesthesia in

different puncture positions and different local anesthetic solutions (hyperbaric, isobaric, and hypobaric).[5] Likewise, anesthesiologists need to understand the safety of thoracic spinal anesthesia and its puncture positions, and the local anesthetic solutions used, to increase your possibilities for performing spinal anesthesia safely.[17] Conventional spinal anesthesia may be undesirable for such procedures due to prolonged lower limb motor block with consequent patient dissatisfaction.[7] Therefore, we must use spinal anesthesia judiciously, using the three solutions (hypobaric, isobaric, and hyperbaric), and knowing the type of surgery and the quality of the surgeon.

Baricity of local bupivacaine solutions and adjuvants

In 2017, we wrote an article trying to explain all the possibilities for a complete understanding of spinal anesthesia.[12] In an experimental study, using a modern densimeter (DMA 450), all the densities of the different anesthetics used in spinal anesthesia and all adjuvants were evaluated.[18] The three bupivacaine solutions at 37oC in the study showed that the average obtained was 0.99510 for 0.15% hypobaric bupivacaine, 0.99930 for 0.5% isobaric bupivacaine, and 1.02360 for 0.5% hyperbaric bupivacaine. Thus, bupivacaine solution with density greater than 1.02360 are hyperbaric, with densities under 0.99510 are hypobaric, and with densities between 0.99510 and 1.02360 are called isobaric. Adjuvants such as morphine, fentanyl, sufentanyl, clonidine used in daily clinical practice are hypobaric, and mixing them in the same syringe modifies the baricity of the final solution.[14]

The use of hyperbaric, isobaric, or hypobaric solutions of the various local anesthetics in the subarachnoid space has shown that each solution has its own private onset time, spread and motor block duration, and the result is that the dispersion of these solutions will depend on the puncture position. Various adjuvants are added to local anesthetic solutions for spinal anesthesia. This may change the final density of the local anesthetic mixture.[18] The association in the same syringe, in addition to never having used it, I am radically against it, as this mixture greatly modifies the density of this new solution injected into the subarachnoid space. In view of the change in baricity of local anesthetics, this article did not evaluate mixing local anesthetics with any adjuvant.

Puncture position for spinal anesthesia

Worldwide, there are two schools teaching neuraxial anesthesia (spinal and epidural), one prefers to teach in the lateral decubitus position and the other in the sitting position. The school that teaches only in the sitting position is not familiar with the use of hemianesthesia (unilateral and posterior). However, the school that teaches in the lateral decubitus position also teaches the use of unilateral spinal anesthesia. Posterior spinal anesthesia (ventral decubitus) is taught only by anesthesiologists who are familiar with this position.

Lumbar puncture is the most used worldwide, but thoracic puncture has been advocated and used in recent decade.[11,17] Therefore, the concepts emitted by the various solutions apply to both lumbar puncture and thoracic puncture.

Hyperbaric solutions

When dextrose is added to the local anesthetic solution to make it hyperbaric, and the glucose concentration used are 0.33%, 0.83%, 1%, 5%, an 8%, the most common being the 8% solution.[19,20] Comparing concentrations below 1% (0.33%, and 0.83%) with 8% glucose, showed that the rate onset and the extent of blockade was significantly higher with the 8% glucose solution.[19] However, comparing the 1% solution with 5% glucose, the results were similar, concluding that the addition of glucose does not necessarily need to be the usual 8% solution.[20]

A. Position of puncture in sitting for hyperbaric local anesthetic

For a better understanding of spinal anesthesia, the hyperbaric solution will be punctured in the sitting position and immediately after the puncture, the patient will be placed in the different positions of the surgical table, such as horizontal dorsal decubitus, ventral decubitus and/or lateral decubitus, showing the various studied parameters (Table 1-4).

Table 1 Hyperbaric Local Anesthetic, Position of Puncture in Sitting, and Surgical Table in Dorsal Decubitus

Local Anesthetic	Hyperbaric Solution
Position Puncture	Sitting
Surgery	Dorsal Decubitus
Concentration Local Anesthetic	> Posterior of the Body < Anterior of the Body
Blocking Privileging Fibers	Fibers Posterior (Sensitive)
1st Start Latency	Sensitive Fibers
2nd Start Latency	Motor Fibers
Duration of Blocks	Block Sensitive > Block Motor

Table 2 Hyperbaric Local Anesthetic, Position of Puncture in Sitting, and Surgical Table in Ventral Decubitus

Local Anesthetic	Hyperbaric Solution
Position Puncture	Sitting
Surgery	Ventral Decubitus
Concentration Local Anesthetic	> Anterior of the Body < Posterior of the Body
Blocking Privileging Fibers	Fibers Anterior (Motor)
1st Start Latency	Motor Fibers
2nd Start Latency	Sensitive Fibers
Duration of Blocks	Block Motor > Block Sensitive

Table 3 Hyperbaric Local Anesthetic, Position of Puncture in Sitting, and Surgical Table in Left Lateral Decubitus

Local Anesthetic	Hyperbaric Solution
Position Puncture	Sitting
Surgery	Left Lateral Decubitus
Concentration Local Anesthetic	> Left Part of the Body < Right Part of the Body
Blocking Privileging Fibers	Both Fibers Left Side
1st Start Latency	Sensitive and Motor Fibers Left Side
2nd Start Latency	Sensitive and Motor Fibers Right Side
Duration of Blocks	Block Sensitive-Motor Left Side > Right

Table 4 Hyperbaric Local Anesthetic, Position of Puncture in Sitting, and Surgical Table in Right Lateral Decubitus

Local Anesthetic	Hyperbaric Solution
Position Puncture	Sitting
Surgery	Right Lateral Decubitus
Concentration Local Anesthetic	> Right Part of the Body < Left Part of the Body
Blocking Privileging Fibers	Both Fibers Right Side
1st Start Latency	Sensitive and Motor Fibers Right Side
2nd Start Latency	Sensitive and Motor Fibers Left Side
Duration of Blocks	Block Sensitive-Motor Right Side > Left

B. Position of puncture in lateral decubitus for hyperbaric local anesthetic

For a better understanding of spinal anesthesia, the hyperbaric solution will be in the lateral position and immediately after the puncture, the patient will be placed in the different positions of the surgical table, such as horizontal dorsal decubitus, ventral decubitus and/or lateral decubitus, showing the various studied parameters. The purpose of choosing left lateral decubitus is mainly because majority of the anesthetists are much more comfortable and better orientated with the left lateral decubitus position, mainly in obstetrics (Table 5-7).

Table 5 Hyperbaric Local Anesthetic, Position of Puncture in Left Lateral Decubitus, and Surgical Table in Dorsal Decubitus

Local Anesthetic	Hyperbaric Solution
Position Puncture	Left Lateral Decubitus
Surgery	Dorsal Decubitus
Concentration Local Anesthetic	> Left Part of the Body < Right Part of the Body
Blocking Privileging Fibers	Fibers Sensitive
1st Start Latency	Sensitive Fibers
2nd Start Latency	Motor Fibers
Duration of Blocks	Block Sensitive > Block Motor

Table 6 Hyperbaric Local Anesthetic, Position of Puncture in Left Lateral Decubitus, and Surgical Table in Ventral Decubitus

Local Anesthetic	Hyperbaric Solution
Position Puncture	Left Lateral Decubitus
Surgery	Ventral Decubitus
Concentration Local Anesthetic	> Anterior of the Body < Posterior of the Body
Blocking Privileging Fibers	Fibers Motor
1st Start Latency	Motor Fibers
2nd Start Latency	Sensitive Fibers
Duration of Blocks	Block Motor > Block Sensitive

Isobaric solutions

The ratio of the density of local anesthetics and cerebrospinal fluid (CSF), which is known as local anesthetic baricity, is one key determinant of local anesthetic distribution within the subarachnoid space. Solutions that have a baricity approaching 1.00000 are referred to as isobaric. Cerebrospinal fluid at 37°C had density of 1.000646±0.000086 g/ml.[21] In fact, many authors prefer to call isobaric solutions plain, because they can be slightly hypobaric at 37°C. Isobaric solutions used for spinal anesthesia include 2% lidocaine, 0.5% bupivacaine, 0.5% tetracaine, ropivacaine and levobupivacaine in 0.5% and 0.75% concentrations.

A. Position of puncture in sitting for isobaric local anesthetic

Isobaric 0.5% bupivacaine was not recommended for spinal anesthesia in obstetrics, when the puncture was performed in the sitting position, especially if associated with opioids that are extremely hypobaric.[18] The effect of the sitting position (0, 2.5, 5.0 or 7.5 minutes), during and after the injection of 3 ml of 0.5% isobaric bupivacaine, on the cephalad spread of anesthesia, showed the spread of analgesia was significantly greater in those who sat for 2.5 min or more compared to those who were immediately placed in a supine position.[22] Comparing a fixed dose of 0.5% isobaric bupivacaine punctured in the lateral decubitus and sitting position, it showed greater dispersion in the sitting position and a higher incidence of arterial hypotension (Table 7 & 8). [23]

Table 7 Isobaric Local Anesthetic, Position of Puncture in Sitting, and Surgical Table Dorsal Decubitus

Local Anesthetic	Isobaric Solution
Position Puncture	Sitting
Surgery	Dorsal Decubitus
Concentration Local Anesthetic	> Anterior of the Body < Posterior of the Body
Blocking Privileging Fibers	Fibers Motor
1st Start Latency	Motor Fibers
2nd Start Latency	Sensitive Fibers
Duration of Blocks	Block Motor > Block Sensitive

Table 8 Isobaric Local Anesthetic, Position of Puncture in Sitting, and Surgical Table Ventral Decubitus

Local Anesthetic	Isobaric Solution
Position Puncture	Sitting
Surgery	Ventral Decubitus
Concentration Local Anesthetic	> Posterior of the Body < Anterior of the Body
Blocking Privileging Fibers	Fibers Sensitive
1st Start Latency	Sensitive Fibers
2nd Start Latency	Motor Fibers
Duration of Blocks	Block Sensitive > Block Motor

B. Position of puncture in lateral decubitus for isobaric local anesthetic

Due to the isobaric bupivacaine when in lateral decubitus, and immediately placed on the table in dorsal decubitus, it alters little the cephalic dispersion of analgesia (Table 9 & 10).

Table 9 Isobaric Local Anesthetic, Position of Puncture in Left Lateral Decubitus, and Surgical Table in Dorsal Decubitus

Local Anesthetic	Isobaric Solution
Position Puncture	Left Lateral Decubitus
Surgery	Dorsal Decubitus
Concentration Local Anesthetic	> Right Part of the Body < Left Part of the Body
Blocking Privileging Fibers	Both Fibers Right Side
1st Start Latency	Sensitive and Motor Fibers Right Side
2nd Start Latency	Sensitive and Motor Fibers Left Side
Duration of Blocks	Block Sensitive-Motor Right Side > Left

Table 10 Isobaric Local Anesthetic, Position of Puncture in Left Lateral Decubitus, and Surgical Table in Ventral Decubitus

Local Anesthetic	Isobaric Solution
Position Puncture	Left Lateral Decubitus
Surgery	Ventral Decubitus
Concentration Local Anesthetic	> Posterior of the Body < Anterior of the Body
Blocking Privileging Fibers	Both Fibers Posterior
1st Start Latency	Sensitive and Motor Fibers Posterior
2nd Start Latency	Sensitive and Motor Fibers Anterior
Duration of Blocks	Block Sensitive-Motor Posterior > Anterior

Hypobaric solutions

The injection of a non-isobaric (hyperbaric or hypobaric) local anesthetic should induce a unilateral spinal anesthesia in patients in

a lateral decubitus position.[9] Unfortunately, most anesthesiologists do not use hypobaric solutions of local anesthetics. Thus, laboratories producing local anesthetics do not manufacture this hypobaric solution. The hypobaric solution of any anesthetic can be obtained by adding water to the isobaric (plain) solution.

The prone position is used for a variety of procedures ranging from short duration procedures to major surgeries such as orthopedic, anorectal and plastic surgery.[15] Hypobaric solutions can be made from isobaric solutions of 2%, lidocaine, 0.5% bupivacaine, and 0.5% levobupivacaine (S75:R25?????) by adding distilled water, thereby providing 0.6% hypobaric lidocaine, 0.15% and 0.1% hypobaric bupivacaine and levobupivacaine.[9] A laboratory study showed that 0.1% hypobaric bupivacaine solution is significantly more hypobaric than 0.15% bupivacaine solution.[24] This 0.1% hypobaric bupivacaine solution allows achievement of analgesia without any degree of motor blockade.[24]

A. Position of puncture in sitting for hypobaric local anesthetic

Like hypobaric solutions they have an upward movement from where they are injected. Thus, if we puncture in the sitting position and immediately place it in the ventral position for surgery, only motor block will occur, with practically no analgesia (Table 11). However, if the patient is punctured in the sitting position and is immediately placed in dorsal decubitus for the surgery, the blockade will favor the sensory ones, providing a sensory blockade without virtually any motor blockade (Table 12).

Table 11 Hypobaric Local Anesthetic, Position of Puncture in Sitting, and Surgical Table in Dorsal Decubitus

Local Anesthetic	Hypobaric Solution
Position Puncture	Sitting
Surgery	Dorsal Decubitus
Concentration Local Anesthetic	Anterior Part of the Body
Blocking Privileging Fibers	Fibers Motor
1st Start Latency	Motor Fibers
2nd Start Latency	No Sensitive Fibers
Duration of Blocks	Block Motor

Table 12 Hypobaric Local Anesthetic, Position of Puncture in Sitting, and Surgical Table in Ventral Decubitus

Local Anesthetic	Hypobaric Solution
Position Puncture	Sitting
Surgery	Ventral Decubitus
Concentration Local Anesthetic	Posterior Part of the Body
Blocking Privileging Fibers	Fibers Sensitive
1st Start Latency	Sensitive Fibers
2nd Start Latency	No Motor Fibers
Duration of Blocks	Block Sensitive

B. Position of puncture in lateral decubitus for hypobaric local anesthetic

As we previously reported, in Brazil there was only 5% hyperbaric lidocaine and 1% tetracaine produced by laboratories with little scientific rigor. Thus, the first experience with the attempt to perform unilateral spinal anesthesia was with 0.1% hypobaric tetracaine, obtained with the dilution of distilled water. The 0.1% tetracaine solution in distilled water, positioned in lateral decubitus with the side to be blocked facing up.[25] Subsequently, with the launch of 0.5% isobaric bupivacaine, a new study was published with 0.15% hypobaric bupivacaine (Table 13).[26]

Table 13 Hypobaric Local Anesthetic, Position of Puncture in Left Lateral Decubitus, and Surgical Table in Dorsal Decubitus

Local Anesthetic	Hypobaric Solution
Position Puncture	Left Lateral Decubitus
Surgery	Dorsal Decubitus
Concentration Local Anesthetic	Right Part of the Body
Blocking Privileging Fibers	Fibers Sensitive and Motor
1st Start Latency	Sensitive Fibers
2nd Start Latency	Motor Fibers
Duration of Blocks	Block Sensitive = Block Motor

C. Position of puncture in ventral decubitus for hypobaric local anesthetic

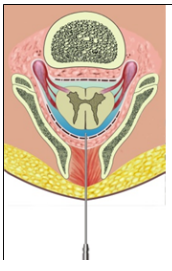
Because most anesthesiologists use the sitting position for puncture and the hyperbaric solution, they are familiar with the saddle block to performing anorectal or perineal surgery. This technique induces sensory and motor block of lumbar and sacral roots. To facilitate performing the lumbar puncture with patients in the prone position, a pillow should be placed under the abdomen to correct lordosis and increase the interspinal space. In this position, the CSF appears spontaneously, but if there is difficulty, just ask the patient to cough, or aspirate the needle with a 1 or 3 ml syringe. And afterwards to inject local anesthetic hypobaric solution (Table 14).

Table 14 Hypobaric Local Anesthetic, Position of Puncture in Ventral Decubitus, and Surgical Table in Ventral Decubitus

Local Anesthetic	Hypobaric Solution
Position Puncture	Ventral Decubitus
Surgery	Ventral Decubitus
Concentration Local Anesthetic	Posterior Part of the Body
Blocking Privileging Fibers	Fibers Sensitive
1st Start Latency	Only Sensitive Fibers
2nd Start Latency	No Motor Fibers
Duration of Blocks	Only Block Sensitive

Distribution of the different solutions

Figures 1 to 6 show in drawing form the dispersions and preferential blocks of the anterior and posterior roots injected in a sitting or lateral decubitus position, and the preference of the unilateral blocks when using the hyperbaric or hypobaric solution. Several puncture positions have been shown previously and correlating with hypobaric, isobaric, and hyperbaric solutions of local anesthetics. When performing lumbar spinal anesthesia with the patient sitting down, after the injection of the hyperbaric anesthetic solution, the blockade is installed from the injection point to the sacral region. If the patient is kept in this position, the solution will migrate to the bottom of the dural sac where it will be fixed in the sacral roots. The same hyperbaric solution, if injected into the patient in the lateral decubitus position and returned to the supine position, will tend to be distributed posteriorly along the dural sac, both caudally and cephalad.



Hyperbaric solution distribution in the subarachnoid space of the patient in the supine position

Figure 1 Hyperbaric solution, supine position.

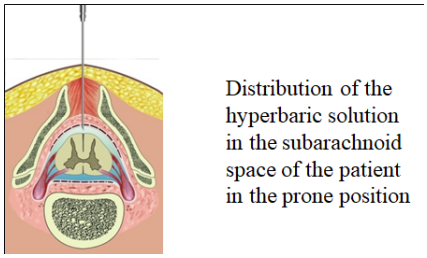


Figure 2 Hyperbaric solution, prone position.

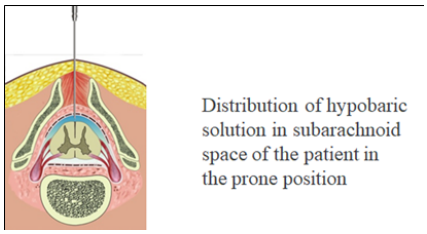


Figure 3 Hypobaric solution, prone position.

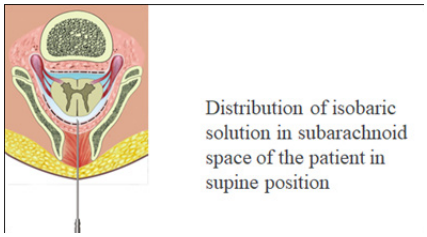


Figure 4 Isobaric solution, supine position.

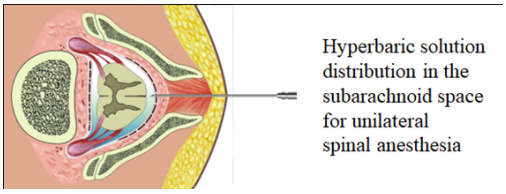


Figure 5 Hyperbaric solution for unilateral spinal anesthesia.

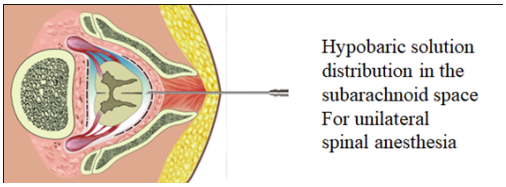


Figure 6 Hypobaric solution for unilateral spinal anesthesia.

In fact, there is no local anesthetic in an isobaric solution. After blocking the patient in lateral decubitus and placing him/her in dorsal decubitus, the isobaric solution will tend to float in the CSF and assume an anterior position, concentrating on the radicles and motor roots, promoting a prolonged motor block. This is the explanation for the longer motor blockade time of the isobaric solution. If the block is performed with the patient in a sitting position, the tendency of the solution is to ascend and provide a chest-level block. Diluted solutions can also be used with the aim of selectively blocking the sensory radicles, offering the patient the comfort of analgesia without motor blockade. It is a technique as old as spinal anesthesia itself. With less common indications and low use, there is still no commercially available hypobaric solution. This solution is useful for posterior blocks (related to the posterior radicles) or pure sensory blocks, performed with the patient in ventral decubitus, for surgeries in this position, or that can be started in this position. This solution is also extremely useful in unilateral spinal anesthesia for one of the limbs.

Discussion

Spinal anesthesia is the technic of choice for a variety of surgical procedures. Spinal anesthesia has always seduced us, and it is recognized for its simplicity, what seems simple is performing the subarachnoid puncture. The complete understanding of spinal anesthesia in its different solutions and puncture position, shows that the technique is much more than the simple puncture of the subarachnoid space. There are two schools that teach spinal anesthesia. The one that teaches and practices in the sitting position and the one that teaches and practices in the lateral position.

Knowing the anatomy of the vertebral column and spinal cord, the different types of local anesthetics, their baricity providing hyperbaric, isobaric, hypobaric local anesthetics, injection speed, different doses used, different types of punctures (sitting, lateral decubitus, jackknife position), the puncture sites (lumbar and thoracic) and the association with adjuvants, can provide a way to know the best technique for each patient and for the type of surgery. All anesthesiologists have the patient, the surgeon, and the institution as clients. And our decisions influenced performance and the outcomes for all three clients. This way, the knowledge of all the possibilities of spinal anesthesia will allow us to obtain an excellent result. Our philosophy of understanding spinal anesthesia it means treating each patient individually, applying knowledge about the technique and using all its possibilities.[5]

The vast majority of anesthesiologists do not understand the reason why isobaric solutions are used when the patient is in the supine position for the surgery, regardless of whether they are administered in the sitting or lateral decubitus position, providing a motor blockade of longer duration than the sensory blockade.[7] The rapidity of the wonderful meeting of the local anesthetic with the CSF gives no time for thoughts, no chance for the mind of searching for a word to define it. The experience of being subjected to spinal anesthesia with an isobaric solution of 0.5% bupivacaine, I asked to be completely lucid to understand what happens with this encounter.[7] The slow onset of anesthesia by the tingling in the toes, and which gradually rose to the buttocks. At the same time, I noticed the loss of movement in the limbs, even with the attempt to move them. The sensory block lasted 4 hours and the motor block lasted 5 hours. Only patients who suffer this prolonged motor block can understand how extremely unpleasant it is, especially if there is no need for the proposed surgery. A fact that occurred in this case since the surgery lasted only 1 hour. This was the reason I tried to explain all these mechanisms through the various tables in this article.

Understanding the anatomy of the spinal cord is critical, as the anterior roots are the motor fibers and the posterior roots are the sensory fibers of the anterolateral and posterolateral sulci of the cord, respectively. Thus, knowing this anatomy, it is possible to privilege the sensitive roots, providing surgical analgesia, and if there is no need, avoid blocking the motor roots, which is responsible for the motor block, mainly in the lower limbs.[8,9,12,13] For it to spread cranially the volume must be increased, change the site of puncture for a higher one, modify the level of the table or understand the behavior of the different solutions such as hyperbaric, isobaric, and hypobaric.

Hyperbaric solutions are the most used and are preferred worldwide. It can be used in the two main puncture techniques: sitting and lateral decubitus. It is still widely used to perform unilateral spinal anesthesia, requiring injection in lateral decubitus and the limb that remains down will be anesthetized. In some articles the plain solutions are also called isobaric solutions. After the block in the lateral position or sitting position and the patient will be placed in the recumbent

position, which will allow the solution to float anteriorly, promoting an intense motor block lasting longer than the sensory block.

Hypobaric solutions of local anesthetics are not produced by laboratories. In this way, we can prepare hypobaric solutions from isobaric solutions of local anesthetics by dilution with water.[9,15] These solutions are special for unilateral block for lower limb surgery, the puncture must be performed in lateral decubitus and the limb to be anesthetized will be the one that is on top. Similarly, the hypobaric solution is fundamental for anesthesia performed with a puncture in the prone position, resulting in sensory-only anesthesia without motor blockade of the lower limbs.

Conclusion

My initiation into anesthesia coincided with the epidural being the technique of choice for the neuraxis. Thin needles did not exist, and local anesthetics were not the ones we have today. With the advent of fine needles and bupivacaine, I rediscovered spinal anesthesia, having changed my life, changed my thoughts, tastes, research projects, I could say that intelligence is the art of reducing the most complex to the simplest, and spinal anesthesia fits perfectly in this concept.

Most anesthesiologists always use spinal anesthesia in the lumbar region, with different needles and mainly with a hyperbaric solution. Few anesthesiologists understand that the puncture can also be performed in the thoracic region with anatomical protection, which allows for the safety of this technique.[11,17] In this way, the concepts presented here are understood both in lumbar puncture and in thoracic puncture. More important than the rediscovery of spinal anesthesia was being operated on with this technique, which made me deepen my studies to understand spinal anesthesia, looking for the quality and satisfaction of my patients with this wonderful technique.

Acknowledgments

None.

Conflicts of Interest

None.

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