Comparison of vasovagal shock incidence during spinal anesthesia in sitting and lateral position

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Abstract

Introduction & aim of the study: Spinal anesthesia was the first regional anesthetic technique to be employed, the conventional procedure (sitting position) and the lateral position are two of the most well-known methods for administering spinal anesthesia. Vasovagal shock (syncope) (VVS) is a type of reflex syncope that can be induced by a variety of factors, including pain, the injection of neuraxial anesthesia, emotional or orthostatic stress and other factors. So in this study, we attempt to compare the incidence of vasovagal shock (VVS) during spinal anesthesia in sitting and lateral position.

Material and method: The patients in this study were blinded to how they received the spinal anesthesia using various approaches because the trial was carried out using a randomized single-blinded study design, following that, they were divided into two groups non-randomly based on their position during spinal anesthesia administration, and the dural puncture performed by spinal needle 25 GA, 12-15 mg (2.5-3 ml) of hyperbaric bupivacaine and slow speed of injection was 1 ml/30s for both groups.

Result: The mean age of participants in this study, which included 60 patients, was 29.4 ± 4.5 years. The incidence of vasovagal response was 4-5 % in the previous study population. Our findings revealed that among all participants, 6.7 % of vasovagal shock incidence with spinal anesthesia occurred in these situations, and it was divided by 5% (3 patients) when spinal anesthesia is given in the sitting position and 1.7% (just 1 patient) when it is given in the lateral position, ($p<0.05$) that's mean there is high significant difference between these two techniques.

Conclusion: Regarding that vasovagal shock occurring to a smaller number of participants when administering spinal anesthesia in the lateral position, the results clearly preference administering spinal anesthesia in the lateral position over the sitting position in terms of the number of samples that had this condition (VVS) in each group when it compared according most variables like age, gender, other complications and cardiopulmonary changes. Also, in term of the presence of other side effects (hypotension, headache, shivering, sweating, nausea, and others) which were limited and less severity than those with the sitting position, it's also indicated the advantage for the lateral spinal anesthesia technique.

Keywords: vasovagal shock, incidence, during spinal anesthesia, sitting position, lateral position.

Introduction

Spinal anesthesia was the first regional anesthetic technique to be employed, and August Bier of Germany performed the first operation while under spinal anesthetic in 1898. In reality, the development of regional anesthesia began with the isolation of local anesthetics, the first of which was cocaine (the only naturally occurring local anesthetic). Before this, topical eye anaesthetic and infiltration anesthesia were the only options for local anesthesia. Currently, in the majority of countries around the world, operations below the umbilical region are performed while the patient is under spinal anesthesia. Neuraxial anesthesia is the practice of using local anesthetics to prevent the central nervous system (CNS) from conduction of nerve impulses in response to painful stimuli through surgical wounds (1). The spinal cord is considered to be the primary site of action for neuraxial blockers, and spinal anesthesia is a neuraxial anesthesia technique in which local anesthetic is given directly into the intrathecal region (subarachnoid space) (2,3).

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Additionally, there are particular procedures for spinal anesthesia, one of which is lateral spinal anesthesia. This approach is quick and cost-effective, and it also prevents needless paralysis on the side that wasn't operated on (4, 5). Contrary to the second type, which is the conventional method known as a sitting (bilateral) spinal anesthesia as in this study, lateral spinal anaesthetic aims to limiting the distribution of spinal block solely to the operated side for all surgeries involving the under-umbilical region. A lateral spinal injection also has another benefit related to use as an alternative in case of challenging spinal anesthesia injection in sitting position. An exclusively lateral block only affects the sensory, motor, and sympathetic functions on one side of the body and provides the benefits of a spinal block without the usual negative side effects seen with a sitting (bilateral) block (6, 7). The incidence of vasovagal syncope (shock) in two positions (sitting and lateral), for various surgical procedures under the umbilical region, in particular ASA classes (I, II), and in a constant age range of 18 - 55 years is what we are looking for and attempting to explain in this study. Vasovagal shock (syncope) (VVS) is a type of reflex syncope that can be brought on by a variety of factors, including the injection of spinal anesthesia and emotional or orthostatic stress. It is typically preceded by a prodromal of autonomic activation, and it can refer to a reflex that causes cardiovascular depression that results in loss of consciousness along with bradycardia, extreme vasodilation (hypotension) and sweating, this response is commonly occurs during spinal anesthesia injection or after that in short time (8,9). The main goals of this study are to evaluate and compare the incidence of vasovagal shock changes in patients who are admitted for below-the-umbilical surgeries while under lateral and sitting spinal anesthesia, as well as to show which one of these spinal anesthesia techniques is superior to the other in terms of increasing success rates or lowering rates of complications that are related to vasovagal shock incidence. This study's aimto examine the prevalence of vasovagal shock during spinal anesthesia in the sitting and the lateral position in order to determine which technique is optimum in this approach.

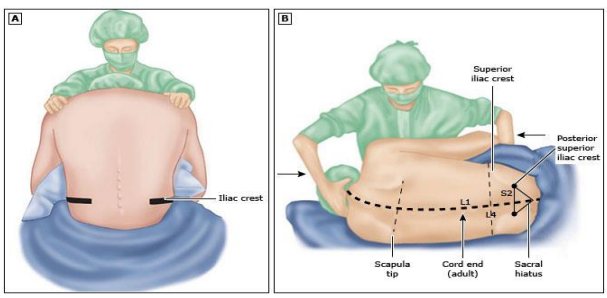

Figure 1: A- Spinal anesthesia injection during sitting position.
B- Spinal anesthesia injection during lateral position.

Material and method

Setting of this study

It is important to note that from October 2022 to December 2022, 60 patients were included in this study, which was conducted in the orthopedic theater and the general surgery theater at the Imam Hussein teaching hospital. Before anything else, the patients verbally agreed to participate in the trial, and the responsible anesthesiologist at the "Imam Hussein Teaching Hospital" first assessed each patient's anesthesia risk.

Data collection & sample size

This cross-sectional study could proceed once the ethics committee of Tehran University of Medical Sciences provided its authorization. We searched in MEDLINE, Google Scholar, EMBASE, PubMed, and Cochrane Evidence Based Medicine Reviews to identify the most recent studies. In addition to manual searches of recent neuraxial anesthesia-related articles and citation reviews. Because the patients in this trial were blinded to the various neuraxial anesthetic delivery methods, the investigation was conducted using a randomized single-blinded study design, following that, they were divided into two groups non-randomly based on where they were when the spinal anesthetic was administered. In order to conduct this cross-sectional study, the patient was first prepared, his medical history was obtained, and all the preparatory steps that are taken during general anesthesia, such as fasting and re-examination by the anesthesiologist, were followed. After obtaining consent, the spinal anesthetic medication was then administered in a variety of positions (lateral and setting), depending on the site of the surgery, but at same doses. Furthermore, the patient must meet the ASA I, II, and uncomplicated case requirements (RTA, vascular surgery, injuries from a gunshot or stab, etc.). Additionally, we depend on the constant age range of 18 - 55 years. The intraoperative vasovagal shock alterations must be carefully observed and documented in the final stage. The participants were chosen at random from the population. All patients whose records contained a considerable amount of missing information were excluded from the experiment, and new participants were then randomly selected once each participant's inclusion and exclusion criteria had been evaluated. After the patient was admitted, we spoke with and gave him a general idea about the spinal anesthesia technique that would be used. Once we had his consent, we began closely monitoring the patient's blood pressure, heart rate, and any other changes that might indicate the occurrence of vasovagal shock. Next, we should divide the patients into two groups based on how they were positioned while spinal anesthesia was being administered:

GROUP A (those gets spinal anesthesia in sitting position).

GROUP B (those gets spinal anesthesia in lateral position).

$$n = \frac{\left(z_{1-\frac{\alpha}{2}}\right)^2 \times pq}{d^2}$$

Formula 1: sample size calculation

Study design

In group A: There are 30 participants in this group, they were randomly selected where 19 male patients and the other 11 are females exactly as they collected. Furthermore and before anything the patient should be placed on the operating bed in supine position and started with cardiopulmonary monitoring (heart rate, blood pressure, respiratory rate and Spo2) and placed IV cannula, then start by crystalloid fluid loading (hydration) and after that, when all thing is normal we prepare the patient for spinal anesthetic injection by putting him/her in sitting position and prepare set of spinal anesthesia and sterilizing the site of injection(as it done in all neuraxial anesthesia cases) and start injection of spinal anesthetic drug such as we used the bupivacaine in dose 12 - 15mg (2.5-3 ml), after injection the patient must be placed on supine position immediately and low degree of head elevation and start hemodynamic monitoring (HR , BP) to determine vasovagal shock if it happened and also other signs like sweating, nausea and mental status changes must be monitored. The close monitoring for this signs must be continuous through the surgery and recording any changes if it happened.

In group B: Also there are 30 participants in this group as that's in group A, and also they were selected in random manner, where 18 male patients and the remaining 12 are females. So we started by placed a cardiopulmonary monitoring and start hydration by crystalloid fluid, as that's explained in group A, then the patient placed on lateral position (lateral decubitus position) it targets the same side of the operation and the dural puncture performed by spinal needle 25 GA, 12 – 15 mg (2.5-3 ml) of hyperbaric bupivacaine and slow speed of injection was 1 ml/30s, then the patient must stay on the lateral side in same side of operation site for 15-20 min with close monitoring of vasovagal stimulation changes like heart rate, blood pressure, sweating and mental changes, after all that the patient turn to supine position after 10-20m from spinal anesthetic administration, after that we must check the sensory block on the targeted side before giving the permission to start the surgery by the attending anesthesiologist.

Statistical analysis

The statistical analysis was carried out using Excel 2010 for Windows 7 and the Statistical Package for the Social Sciences SPSS) (version 26). The percentages, averages, and standard deviations of all research components were extracted and compared in order to find statistically significant differences. For the chi-square test, an independent P-value of 0.05 was used to establish statistical significance. ANOVA analysis was also used to compare the heart rate, blood pressure, respiratory rate, and blood oxygen saturation. All data were compared in order to ascertain the effect of the injection method on the important parameters for each subject in this experiment.

Results

The mean age of participants in this study, which included 60 patients, was 29.4 ± 4.5 years. The incidence of vasovagal shock (VVS) response was 6.7% in the study population.

In table 1, we noted the frequency of vasovagal shock incidence according to the position during spinal anesthesia administration, there are 3 cases of VVS incidence from 30 patients in sitting position and that's represent 5% of all samples in this study. Also noted the frequency of VVS incidence in lateral position it's just 1 case from 30 patients in lateral position which represent 1.7% of all samples.

*P.value < 0.05: high Significant/that's mean there is significant difference between two groups in incidence of VVS according to the position of spinal anesthesia injection.

- This comparison clearly shows the preference of giving spinal anesthesia in the lateral position over giving it in the sitting position in terms of the number of cases that this condition (VVS) occurred to.

Table1: Explain the incidence of vasovagal shock according to position of injection

Vasovagal ShockType of injection	Positive		Negative		Total	
	NO.	%	NO.	%	NO.	%
Sitting	3.00	5.00	27.0	45.0	30.0	50.0
Lateral	1.00	1.70	29.0	48.3	30.0	50.0
Total	4.00	6.70	56.0	93.3	60.0	100
Pearson Chi-SquareSignificance	1.0710.031				df:1	

In table 2: the P. value< 0.05: Highly significant/ There are high variations between the two groups (sitting, lateral) in the duration of vasovagal shock (VVS), there is no patients from sitting position group from out 3 cases under duration of 35 second but there is just 1 patient in the lateral position involved in this time and it represented 25% from all cases that have this condition (VVS), but on the other duration time of VVS 35-45 second there is 2 patient divided as one from each group and each one represent 25% from all cases that have incidence of VVS, Then in the last class of time that's > 45 sec, there are 2 patients both them from sitting position group and they represent 50% from all cases that have VVS.

- Here, shown a clear preference appears in terms of the short duration of the vasovagal shock (VVS) when it occurred with the samples during the administration of spinal anesthesia in the lateral position, while we note the long duration of this condition(VVS) while it occurs during the administration of spinal anesthesia in the sitting position.

Table 2: Tests for the duration of VVS according to each position of spinal anesthesia injection.								
Time of ShockType of injection	< 35 sec.		35-45 sec.		> 45 sec.		Total	
	NO.	%	NO.	%	NO.	%	NO.	%
Sitting	0.00	0.00	1.00	25.0	2.00	50.0	3.00	75.0
Lateral	1.00	0.25	0.00	0.00	0.00	0.00	1.00	25.0
Total	1.00	25.0	1.00	25.0	2.00	50.0	4.00	100
Pearson Chi-SquareSignificance	100.000< 0.001						df:2	

In this table 3: the P.value < 0.05: High significant / there is high significant variation in occurring the VVS attack according the gender and position of spinal anesthesia injection: There is 1 male sample in the sitting position, which represent 25% of the total number of samples that had VVS attack. While no male sample had this attack in the lateral position of spinal injection. In other side there are 2 samples of females in the sitting position, who had VVS attack and they represent 50% of the total samples that had this condition, while only 1 sample of females had this condition in the lateral position and it represent 25% of samples that had VVS attack. As a summary to this table, there are 3 samples that had this condition in sitting position, just one of them is men and the other two are females, and they represent 75% from the total number of cases that had this condition (VVS), while there is one case of the females who had this condition in the lateral position of spinal injection and it make up 25% from all cases that had VVS attack. According to this comparison, which depends on the patient's gender and the position of spinal anesthesia administration, a clear preference appears for giving spinal anesthesia in the lateral position over the sitting position, as most of the cases in which these complications occurred were when spinal anesthesia was given in the sitting position and in the females patients.

Table 3: test of positive VVS samples according to gender& position of injection.						
GenderType of injection	Male		Female		Total	
	NO.	%	NO.	%	NO.	%
Sitting	1.00	25.0	2.00	50.0	3.00	75.0
Lateral	0.00	0.00	1.00	25.0	1.00	25.0
Total	1.00	25.0	3.00	75.0	4.00	100
Pearson Chi-SquareSignificance	11.111<0.001				df:1	

In table 4: **the P.value> 0.05**: non-significant, there is no significant difference between the two groups (sitting & lateral) according to age in this study, which means that there is no age group that is related to the occurrence of this condition (VVS) in specific position more than other age groups. All samples to which this condition (VVS) occurred were in the second age group that extend from 20-39 years old, 3 of which were in the sitting position and only 1 sample in the lateral position, both them represent 100% of all samples that had VVS, which means that all cases occurred in one age group, so there is no clear significant difference between the two groups in terms of age groups. In this comparison, it was proven that all cases that have VVS occurred to that were at the same average of age (young period) and This is completely consistent with what is found in published studies that prove the occurrence of this condition in a high percentage in young people , thus did not show a preference for one of the two methods over the other in terms of the average of age for which this case occurred, but inside the same average of age(20 -39) there is a clear preference in terms of the lack of occurrence of this condition (VVS) with the lateral position compared to the sitting position.

Table 4: Chi-Square Tests of Positive VVS SamplesAccording to Age & Position of Injection.								
Age GroupsType of injection	< 20years		20-39 years		> 39years		Total	
	NO.	%	NO.	%	NO.	%	NO.	%
Sitting	0.00	0.00	3.00	75.0	0.00	00.0	3.00	75.0
Lateral	0.00	0.00	1.00	25.0	0.00	0.00	1.00	25.0
Total	0.00	00.0	4.00	100	0.00	00.0	4.00	100
Pearson Chi-SquareSignificance	0.7450.689						df:2	

Discussion

In this cross-sectional study there is an attempt to choose which technique is more dependable and appropriate for the patient, as well as to compare the effectiveness of VVS management in below-umbilical surgeries in place of this study, the goal of this study was to evaluate the prevalence of vasovagal shock incidence with spinal anesthesia in sitting and lateral position. The average age of the 60 patients who participated part in this trial was 29.4 ± 4.5 years. Since many of these kinds of surgeries were performed at the "Imam Hussein teaching hospital" in numerous operating rooms, including theaters for orthopedic and general surgery, for this study, the generalizability, reliability and power of the results

are acceptable. The lateral spinal anesthetic approach offers a higher level of analgesia and an adequate sensory and motor block when compared to the standard spinal technique(sitting position), according to study by Seyyed Mostafa Moosavi Tekye and Mohammad Alipour at Mashhad University of Medical Sciences in 2013 (10). Another investigation on the prevalence of VVS under spinal anesthesia by E. J. Watkins, M. Dresner, and C. E. Calow (2000) revealed that the combination of sympathetic block and vagal over-activity resulted in significant hypotension that endangered the patient's life while it applied in sitting position (11). According to a study by McConachie, injected spinal anesthesia in sitting position and lack of adequate anxiolytic premedication may both enhance the incidence of vasovagal syncope (1991) (12). It is necessary to mention that the average of this condition (VVS) incidence of in the previous studies above is 4-5% during applied the neuraxial anesthesia.

All the results that emerged from this study proved the preference for giving spinal anesthesia in the lateral position than in sitting position, so we will explain its preference according to the comparisons made in this study: First, when they were compared in terms of the number of cases of vasovagal shock (VVS) that occurred in each position, it was found that giving spinal anesthesia in the sitting position (Group A) causes an increase in VVS incidence, and thus the lateral position is safer, as it was found that the number of samples that showed symptoms of VVS is 3 out of 30 samples In the sitting position and this is comparable to the percentages mentioned in the research above, while when spinal anesthesia was given in the lateral position (Group B), it was found that the number of samples that appeared to have this condition is only 1 sample out of 30 samples. Also, when the two methods were compared on the basis of the patient's age, it was also found that giving spinal anesthesia in the sitting position caused more incidence of VVS than giving it in the lateral position but same range of age (20 – 39 years) and this is consistent with previous studies and researches that showed that the elderly have lower sympathetic tone, which may explain why this illness is more common in young people. but there is no preference appeared for one group over the other in terms of the average age that this condition occurs in both positions and this may be due to the limited range of age that was adopted in this study(18 -55 years) and also limited samples number . In the last, it is necessary to mention that there is no previous study that discussed the incidence of this condition (VVS) during lateral spinal anesthesia, therefore, this study is considered the first to discuss the occurrence of this condition with this type of spinal anesthesia.

Conclusion

Our results showed that one of the significant problems that occurred after below umbilical surgeries that were performed while under spinal anesthesia in the sitting and lateral positions was vasovagal shock (VVS) but in significant variation ($P<0.05$) between the two techniques. This cross-sectional study shown that, as compared to spinal anesthesia in the lateral position, spinal anesthesia in the sitting position significantly increased the incidence of vasovagal shock (VVS) and other adverse effects (hypotension, headache, nausea, shivering, sweating, and others). Therefore, we advise the healthcare centers to adopt the lateral spinal anesthesia procedure in all situations when it is indicated. And as a recommendations, this condition can be avoided by taking precautions such being properly hydrated before anesthesia, keeping the patient close monitoring and being mindful of any prior attacks.

Ethical approval

The ethical committee at Tehran University of Medical Sciences approved the study ethical permission (IR.TUMS.SPH.REC.1401.191). Group data were published for all the information that was gathered (rather than individually). A name, ID number, country code, or any other identity data is missing from the required data.

Conflicting interests

The authors say they have no competing interests

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