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IN LOWER LIMB ORTHOPAEDIC PROCEDURES, REVERSE TRENDELENBURG POSITIONING FOLLOWING SPINAL ANAESTHESIA EXTENDED THE TIME OF SENSORY AND MOTOR BLOCKAGE.

Anaesthesiology

Dr Abhinav Chauhan	MS, Department of Surgery, Postgraduate Institute of Medical Education and Research, Chandigarh.
Dr Brijender*	MD, Department of Anesthesia, Dr Rajendra Prasad Govt. Medical College and Hospital, Kangra at Tanda. *Corresponding Author
Dr Anu	MD, Department of Anesthesia, Indra Gandhi Govt. Medical College and Hospital, Shimla.

ABSTRACT

Background: The initial option for lower limb procedures is spinal anaesthesia, and the patient's position during spinal anaesthesia administration is a crucial factor in achieving effective neural blocking. After spinal anaesthesia is administered, the supine posture is commonly used for lower limb procedures. **Objective:** In contrast to the supine posture, we suggested that a ten-degree reverse Trendelenburg positioning following spinal anaesthesia could extend the duration of sensory and motor blockage. **Methods:** There are two groups of the 60 patients who were recruited for the study. After receiving spinal anaesthesia, participants in the supine group were placed in the supine position, while those in the Trendelenburg group were placed in a ten-degree reverse Trendelenburg position. The duration of analgesia, motor block, and sensory block were compared between the two groups. In addition, the two groups were compared in terms of heart rate, blood pressure, mean arterial pressure, and hypotension. **Results:** Patients in the Trendelenburg group experienced sensory block, motor block, and analgesia for a much longer period of time than those in the supine group. The Trendelenburg group's blood pressure and heart rate stayed within the physiological range, but the supine group's were noticeably higher. Hypotension, which affects 33% of patients in the supine group, was not seen in the Trendelenburg group. **Conclusion:** Immediately following spinal anaesthesia, a ten-degree reverse Trendelenburg posture can be more advantageous, particularly for elderly patients and other high-risk patients undergoing lower limb procedures, as it greatly reduces the degree of sensory block and improves haemodynamic stability.

KEYWORDS

Supine, Trendelenburg, Anaesthesia, Hypotension, Spinal.

INTRODUCTION

In spinal procedures, achieving a successful sensory and motor block is the main goal of anaesthesia. The amount and length of sensory block are known to be influenced by a number of parameters, including the patient's age, height, weight, local anaesthetics, location after the aesthetic drug is administered, dosage, injection technique, patient-specific symptoms, and needle level orientation (1). Spinal anaesthesia is still the preferred option for lower limb orthopaedic procedures because it offers a rapid, efficient neural block. Additionally, it provides good analgesia with minimal side effects, such as bradycardia, hypotension, vascular retention, headaches from post-dural punctures, and acute or long-term neurological consequences (2). There have been reports of a high frequency of bradycardia and hypotension during spinal anaesthesia, which can be dangerous, particularly in older patients with weakened cardiopulmonary reserves (3).

Patient posture is one of the most important determining elements among the many parameters that affect the diffusion of local anaesthetic solutions in the cerebrospinal fluid. During spinal anaesthesia, vascular absorption and diffusion across the arachnoidal and dural membranes remove local anaesthetics from the subarachnoid area (4). Higher levels of spinal blockage result in a larger surface area for absorption and diffusion. This causes a greater amount of local anaesthetic to be eliminated per unit of time than at lower levels, which shortens the duration of anaesthesia (5). With the same dosage of hyperbaric bupivacaine, spinal blocking will last longer if the local anesthetic's spread is limited. The patient's position influences both the spread and the length of the spinal blockage while using hyperbaric solutions (6).

Inadequate patient positioning increases the risk of nerve injury from repeated spinal needle insertions, back pain, headaches from post-dural punctures, and epidural haematomas. When low lumbar and sacral levels of sensory anaesthesia are needed for the surgical process, patients undergoing spinal anaesthesia are frequently put in the sitting posture (7). Different head-down tilts are used by anaesthesiologists to guarantee that the right amount of block is obtained. These are frequently done at the operator's discretion because the majority of operating room tables do not have a mechanism to determine the exact tilt degree. Studies demonstrating the impact of Trendelenburg location on subarachnoid block height are scarce. In order to determine the impact of the tilt of the operating table during the lumbar puncture on the height of the subarachnoid block, the current investigation was conducted. We suggested that prolonging spinal blocking following spinal anaesthesia administration may be achieved by keeping the patient in a 10-degree reverse Trendelenburg position.

MATERIAL AND METHODS

The study included 60 patients of either sex, aged 20–65, who were scheduled for spinal anaesthesia for lower limb procedures. The study included patients with ASA physical status I and II, but excluded patients with haemodynamic instability and those with ASA physical status grade > II. The study also excluded patients with a history of neurological or psychiatric disorders, epilepsy, a history of cardiovascular, renal, hepatic, respiratory, endocrine, or neuromuscular disorders, bleeding or coagulation disorders, a history of local spinal deformity or infection, or a known allergy to local anaesthetics.

The current investigation was cross-sectional, prospective, single-blind, single-centric, randomised, and interventional. Using block randomisation, the 60 patients that were recruited were split into two groups of 30 patients each. After receiving spinal anaesthesia, participants in the supine group were placed in the supine position, while those in the Trendelenburg group were placed in a ten-degree reverse Trendelenburg position. The two groups' durations of analgesia, motor block, and sensory block were compared. In addition, the two groups were compared in terms of heart rate, blood pressure, mean arterial pressure, and hypotension.

The patients were moved to the operating table, and an 18 G cannula was used to secure the intravenous line in the forearm on the other side of the surgery. Lactated ringer (10 ml/kg) was used for co-loading. A standard monitor was connected. Attached were non-invasive blood pressure (NIBP) monitoring (systolic, diastolic, and mean), five lead electrocardiography (ECG), and oxyhaemoglobin saturation (SpO_2). Prior to administering a subarachnoid block, all of the previously listed parameters (baseline) were noted. Using an 18 G Tuohy's needle while seated, an epidural catheter was placed in the L2-3 intervertebral space while all aseptic measures were taken. After inserting the catheter, which was 5 cm long, into the epidural space, it was secured. A test dosage of 2% lignocaine and 3cc of adrenaline was administered. utilising a 26-gauge Quincke BD dura cutting spinal needle (0.45mm x 90mm) in the L3-4 intervertebral gap, a subarachnoid puncture was carried out utilising a midline lumbar approach while the patient was seated. The drug was administered intrathecally gradually at a rate of 0.2 millilitres per second. The spinal needle's bevel end was held downward. After that, the patient was placed in a supine position with a 10-degree tilt in reverse Trendelenburg position, which was maintained for the duration of the procedure or supine position based on the groups. Using common mathematical computations, a 10-degree reverse Trendelenburg position was attained. As usual, intraoperative fluid management was carried out.

The onset of sensory block was defined as the moment a medication was injected into the subarachnoid space until bilateral T12 (anterior superior iliac spine) analgesia was achieved. Every 30 seconds until the beginning of sensory block, and then every 15 minutes until regression to two segments below maximal level, bilateral sensory block was assessed in the mid-clavicular line using the pin prick method for touch and pain. After 20 minutes, the maximum amount of sensory block is determined. The time required to regression a block to two segments below the maximum block level was measured as two segment regression time. The time it took to regress to T12 was used to determine the duration of the sensory block. The request for the first dose of analgesic was used to define the duration of analgesia.

The modified Bromage scale was used to test the motor block: 1-Inability to raise the extended leg but still be able to move the knee and feet, 2-Inability to raise the extended leg and move the knee but still be able to move the feet, 3-Complete motor block and 0-No motor loss. Every 30 seconds until the motor block started, and then every 15 minutes until it resolved (which was not done during surgery), the motor block was evaluated. The time from intrathecal injection to modified Bromage score 3 was used to measure the start of the motor block, and the time it took for the motor block to regress from modified Bromage score 3 to 0 was used to measure its duration.

Any negative side effects, such as bradycardia, hypotension, or respiratory depression, were recorded, monitored, and treated appropriately: Systolic blood pressure < 90 mm Hg or mean blood pressure < 20% of baseline were considered hypotension. Ephedrine 6 mg intravenously was used to alleviate hypotension, and this procedure was repeated as needed. A heart rate of less than 45 beats per minute was considered bradycardia. An intravenous injection of atropine 0.6 mg was used to treat bradycardia. A respiratory rate of less than 8 beats per minute was considered respiratory depression.

RESULTS

The average age of the participants in this study was 42.76 ± 12.35 years for the Supine group and 44.06 ± 12.51 years for the Trendelenburg group. There were nine females and twenty-one males in each group. The average height of the Trendelenburg group was 158.86 ± 3.52 cm, slightly lower than the average height of the Supine group, which was 160.56 ± 6.53 cm. The Trendelenburg group's mean weight was 58.43 ± 5.31 kg, whereas the Supine group's was 59.20 ± 5.92 kg. The Trendelenburg group's average body mass index (BMI) was 23.24 ± 2.57 kg/m², while the Supine group's was 22.97 ± 1.67 kg/m². The Trendelenburg group's participants all had an American Society of Anaesthesiologists (ASA) grade of I, whereas the Supine group included 28 patients with a grade I and two patients with a grade II. The Supine group's average surgery time was 77.10 ± 16.50 minutes, while the Trendelenburg group's was 76.63 ± 19.17 minutes, suggesting that the two groups' surgical times were quite comparable (Table 1).

Table 1: Table Showing The Sociodemographic And Clinical Determinants Of Recruited Patients.

Variables	Supine group (n=30)	Trendelenburg group (n=30)
Age (years)	42.76±12.35	44.06±12.51
Sex [Male: Female], N	21:9	21:9
Height (cm)	160.56±6.53	158.86±3.52
Weight (Kg)	59.20±5.92	58.43±5.31
BMI (Kg/m2)	22.97±1.67	23.24±2.57
ASA grade [I: II], N	28:2	30:0
Duration of surgery (Min)	77.10±16.50	76.63±19.17

The Supine and Trendelenburg groups were compared on a number of characteristics in this study. With a p-value of 0.044, the Supine group had sensory block onset much faster (127.33 ± 47.55 seconds) than the Trendelenburg group (150.60 ± 39.77 seconds). There was a highly significant difference (p < 0.0001) in the maximal sensory block level between the groups; more participants in the Trendelenburg group reached lower levels, like T9 and T10, while the Supine group achieved higher levels at T6 and T7. With a p-value < 0.0001, the Supine group's average segment blocked above T-12 was considerably higher (5.10 ± 1.06) than the Trendelenburg group's (3.96 ± 0.99). With a p-value of less than 0.01, the Supine group's two-segment regression time was 72.50 ± 7.96 minutes, while the Trendelenburg group's was 85.20 ± 18.90 minutes. The time it took for the motor block to start was not significantly different between the groups (Supine group: 274.00 ± 52.10 seconds vs. Trendelenburg group: 282.33 ± 66.47 seconds; p = 0.591). However, with a p-value of less than 0.01, the Supine group's sensory block length until T12 was considerably shorter (122.33 ± 12.98 minutes) than the Trendelenburg group's (146.16 ± 16.54 minutes). Similarly, with a p-value of 0.009, the Supine group's motor block duration until T12 was shorter (97.00 ± 10.79 minutes) than the Trendelenburg group's (104.00 ± 9.13 minutes). Lastly, with a highly significant p-value of < 0.0001, the Supine group experienced analgesia for a substantially shorter period of time (165.36 ± 6.83 minutes) than the Trendelenburg group (180.46 ± 8.19 minutes). (Table 2).

Variable	Supine group (n=30) Mean ± SD or N	Trendelenburg group (n=30) Mean ± SD or N	P Value
Onset of sensory block (Sec)	127.33±47.55	150.60±39.77	0.044
Maximum Sensory Block Level			<0.0001
T4	0	0	
T5	2	0	
T6	12	3	
T7	12	5	
T8	4	10	
T9	0	11	
T10	0	1	
Segment blocked above T-12	5.10±1.06	3.96±0.99	<0.0001
Two segment regression time (Min)	72.50±7.96	85.20±18.90	<0.01
Onset of Motor Block (Sec)	274.00±52.10	282.33±66.47	0.591
Duration of Sensory block till T12 (min)	122.33±12.98	146.16±16.54	<0.01
Duration of Motor Block till T12 (Min)	97.00±10.79	104.00±9.13	0.009
Duration of analgesia	165.36±6.83	180.46±8.19	<0.0001

The Supine and Trendelenburg groups' baseline heart rates, blood pressures, and mean arterial pressures were comparable. The Trendelenburg group's heart rate tended to drop more than the Supine group's across the course of the research, with significant drops occurring at 5, 10, and 15 minutes. At 5 and 25 minutes, the Trendelenburg group's blood pressure rose more sharply, but the Supine group's trend remained steadier. At earlier time points, the Trendelenburg group's mean arterial pressure was normally higher; however, by 60 minutes, it was more comparable to that of the Supine group. These measures changed significantly in both groups, although the Trendelenburg group's blood pressure and heart rate fluctuated more, especially within the first half hour (Table 3).

Table 3: Table Depecting The Heart Rate, Blood Presure And Mean Atrial Pressure During The Surgery.

	Heart Rate		Blood Pressure		Mean Atrial Pressure	
Time Points	**Supine group (n=30) Mean ± SD**	**Trendelenburg group (n=30) Mean ± SD**	**Supine group (n=30) Mean ± SD**	**Trendelenburg group (n=30) Mean ± SD**	**Supine group (n=30) Mean ± SD**	**Trendelenburg group (n=30) Mean ± SD**
Baseline	83.63±14.22	84.56±9.58	123.33±10.51	125.00±13.76	95.63±7.86	96.26±9.41
5 min	83.53±11.37	80.56±18.06	126.76±14.21	133.00±18.05	92.32±8.71	96.03±11.14
10 min	83.56±11.12	79.83±14.19	125.36±11.97	125.36±20.93	91.60±8.55	95.06±11.59

15 min	79.90±13.07	74.80±14.86	125.00±14.11	121.13±17.21	89.84±12.30	94.43±10.18
20 min	81.76±9.37	72.83±12.56	125.96±10.27	124.33±12.53	92.38±10.91	94.50±10.55
25 min	79.90±6.71	77.23±8.58	118.63±9.76	127.63±13.28	90.50±13.40	92.63±7.50
30 min	77.96±8.09	78.96±11.96	128.33±19.40	122.63±8.96	98.00±17.45	94.13±7.59
60 min	76.26±7.67	76.03±9.18	123.20±11.94	121.30±9.87	93.16±10.46	90.33±5.43

DISCUSSION

The patient's position may have a significant impact on the final degrees of motor and sensory inhibition. Chang et al. previously used isobaric bupivacaine to compare the spinal anaesthesia for supine and prone position procedures, and they found no discernible differences in the level of sensory and motor block (8). When Toptas et al. examined the haemodynamic and heart rate variability of hyperbaric and isobaric bupivacaine for spinal anaesthesia, they found that the former had much lower haemodynamic instability and heart rate variability (9). In the current investigation, the Trendelenburg group's mean time to establish T12 sensory block was noticeably longer than that of the Supine group. Since the beginning, we have employed hyperbaric medication and maintained a 10-degree reverse-Trendelenburg tilt. The Trendelenburg group may have experienced a delayed onset of sensory block as a result of the slower ascent of hyperbaric bupivacaine. However, since a delayed onset of 20 to 30 seconds is unlikely to affect our clinical goal, it might not have any clinical significance. However, the Trendelenburg group's more steady haemodynamic and relatively modest spinal block levels may be explained by this later onset.

The current study supports that of Poredos and Novak, who found that the high spinal group had a considerably higher degree of sensory block than the low spinal group (10). In the Infante et al. investigation, the horizontal group's maximum cephalad distribution of sensory block was noticeably greater than that of the group whose torso elevation was 30 degrees (6). According to the current study, the Trendelenburg group had a considerably lower average number of segments blocked above T12 than the supine group. Therefore, we may draw the conclusion that spinal anaesthesia in the 10˚ reverse-Trendelenburg position can aid in regulating the degree of sensory block. In this study, we discovered that the Trendelenburg group's two-segment regression time was noticeably slower than that of the supine group. Consequently, we deduce that providing a 10˚ reverse-Trendelenburg position may cause the Trendelenburg group's two-segment regression time to be longer than the Supine group's. Similar outcomes in a caesarean delivery were found in one such trial conducted by Lee et al. employing a head-up posture (11). The current study's findings are corroborated by a study by Infante et al. that found that the horizontal group's two-segment regression time was noticeably faster than that of the group with a 30-degree thoracic elevation (6).

In the current study, we discovered that the Trendelenburg group experienced a sensory block for a substantially longer period of time than the supine group. However, no research comparing the duration of sensory block during spinal anaesthesia for lower limb procedures using the reverse Trendelenburg posture was reported in the literature. We therefore draw the conclusion that implementing the reverse Trendelenburg position during surgery can help to reduce the block levels while also extending the duration of the sensory block. In this study, we discovered that the Trendelenburg group's motor block duration was noticeably longer than that of the supine group. This suggests that a longer length of motor block may result from the reverse Trendelenburg position. However, it might not be clinically relevant. Infante et al.'s study, which found that the horizontal group's duration to complete motor block recovery was much shorter than that of the group with thoracic elevation of 30 degrees, supports the current findings (6).

The Trendelenburg group had longer analgesia than the supine group in this study. Infante et al. found that pain appeared faster in the horizontal group than in the 30 degree torso elevation group (6). Poredos and Novak found 35% hypotension in high spinal group and 10% in low spinal group (10). These findings were consistent with the present investigation, which found clinically meaningful hypotension in 33% of supine patients and none in Trendelenburg patients. Our study may reduce spinal anesthesia-induced hypotension, haemodynamic deterioration, and peak block level for the scheduled procedure by altering the patient posture. Few studies have employed reverse Trendelenburg posture to modulate spinal block height with hyperbaric medicines. No research have compared reverse Trendelenburg and supine spinal anaesthesia.

CONCLUSION

The study found that maintaining a patient in 10˚ reverse Trendelenburg position immediately after spinal anaesthesia reduces sensory block and improves haemodynamic stability. Geriatric and other high-risk patients for lower limb procedures where levels beyond T10 are rarely needed may benefit more. Patient posture also affected spinal blockade duration. After spinal anaesthesia, reverse Trendelenburg prolonged sensory and motor blockage. We need larger clinical trials to prove our hypothesis. We urge future investigations employing reverse Trendelenburg posture in geriatric and other high-risk groups to discover a solution to what has not been ideal since spinal anaesthesia was introduced a century ago.

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