

The Trendelenburg position increases the spread and accelerates the onset of epidural anesthesia for Cesarean section

[La position de Trendelenburg permet une plus grande distribution de l'anesthésie épidurale et en accélère le début d'action lors de la césarienne]

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Objectif : L'effet de la position sur la distribution de l'anesthésie épidurale et sur le délai d'installation n'ont pas été bien documentés. La présente étude est entreprise pour évaluer l'effet de la position de Trendelenburg modifiée sur la distribution de l'anesthésie épidurale pendant la césarienne.

Méthodes : Sept cent trente-neuf parturientes ont reçu une anesthésie épidurale pour une césarienne élective ou urgente. Divisées en deux groupes, dans une étude randomisée et contrôlée, toutes les patientes ont reçu 20 mL de lidocaïne à 2 % administrée avec une aiguille épidurale 19G, la technique standard dans notre établissement. Le premier groupe a été placé en position de Trendelenburg à 15°, la tête élevée à 10° et le deuxième en position horizontale. Le délai d'installation et le niveau de l'anesthésie, les signes vitaux de la mère, l'indice d'Apgar ont été évalués dans les deux groupes.

Résultats : La pression artérielle, la fréquence cardiaque, la saturation du sang artériel en oxygène, et l'indice d'Apgar n'ont pas présenté de différence significative intergroupe selon les positions de Trendelenburg modifiée ou horizontale. Les résultats montrent des différences significatives de délai d'installation (environ quatre minutes plus rapide dans le groupe en position de Trendelenburg modifiée) ($P < 0,001$) et d'atteinte d'un bloc sensoriel au niveau T5 entre les groupes dans les positions Trendelenburg modifiée et horizontale (97,5 % contre 42,8 % respectivement).

Conclusion : Cette étude démontre que la position de Trendelenburg modifiée a un effet significatif sur l'étendue de l'anesthésie épidurale et qu'elle peut être utilisée sans risque chez les parturientes à terme, candidates à la césarienne urgente ou élective.

Purpose: The effect of position on the spread and the onset time of epidural anesthesia has not been well documented. This study was undertaken to assess the effect of modified Trendelenburg position on the spread of epidural anesthesia for Cesarean section.

Methods: Seven hundred thirty-nine parturients underwent epidural anesthesia for elective or emergent Cesarean section. Patients were divided into two groups in a randomized-controlled study. All patients received 20 mL of 2% lidocaine injected through a 19G epidural needle, a standard technique in our institution. During induction of epidural anesthesia, the first group was placed in 15° Trendelenburg with 10° head-up position and the second in the horizontal position. The onset time and the level of anesthesia, patients' vital signs, and Apgar score were recorded in both groups.

Results: There were no significant differences in vital signs, oxygen saturation and Apgar score between the two groups. The results show significant differences in the time of onset (on average four minutes faster in the modified Trendelenburg position group) ($P < 0.001$), and in achieving T5 level sensory blockade (97.5% vs 42.8%) between the modified Trendelenburg and horizontally positioned pregnant women.

Conclusion: This study demonstrates that the modified Trendelenburg position has a significant effect on the spread and the onset time of single shot epidural anesthesia, and can be used safely in term parturients for emergency or elective Cesarean section.

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EPIDURAL anesthesia is a common and safe technique for Cesarean section. One of the major problems with this technique is the time needed to achieve the desirable level of anesthesia in an emergency situation. There are several reports on the effect of position on the spread of epidural anesthesia. Apostolou and Grundy showed that the position has a significant effect on the spread of epidural anesthesia.^{1,2} In contrast, Norris and Merry did not obtain the same results.^{3,4} In this study we compared the onset and the spread of epidural blockade between a modified Trendelenburg and horizontally positioned pregnant women during induction of epidural anesthesia for Cesarean section.

Materials and methods

Over a ten-month period (May 1999–February 2000), we studied term parturients, admitted to Akbarabadi Obstetrics and Gynecology Hospital (Tehran, Iran). Pregnant women requiring Cesarean section for delivery participated in this study after giving written consent to the investigation. Women with morbid obesity, underlying disease, and intra uterine fetal death were not included. The cases were divided into two groups based on a simple random allocation.

Epidural anesthesia was performed in the sitting position. A 19 gauge Tuohy needle, was introduced into the epidural space, using a midline approach at the L3–L4 interspace with loss of resistance to air technique. A test dose (lidocaine 2% 3 mL and 15 µg epinephrine) was injected and after observing no signs of intravascular or intrathecal injection, 20 mL 2% lidocaine with 2 mL 7.5% bicarbonate was injected incrementally through the needle at a rate of approximately 1 mL·sec⁻¹. After induction of epidural anesthesia, patients in group I were placed in 15° Trendelenburg with 10° head-up position (modified Trendelenburg, Figure 1), and group II in a horizontal position. Both groups were positioned with left uterine displacement.

Monitoring devices in the operating room included an electrocardiograph, a noninvasive automated blood pressure device and a pulse oximeter. Epidural technique, volume and concentration of drugs were the same in both groups, the only difference being the position of patients after epidural anesthesia. All patients were given one litre of lactated Ringer's solution before the administration of epidural anesthesia, then as needed.

Loss of sensation to pinprick was assessed at 30-sec intervals. The highest level of anesthesia was defined as T5 or the level of anesthesia that remained fixed for three minutes. After achieving the T5 level or a fixed

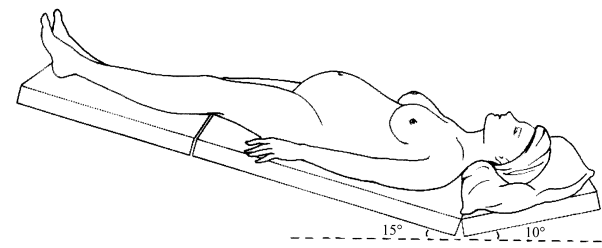


FIGURE 1 Modified Trendelenburg position.

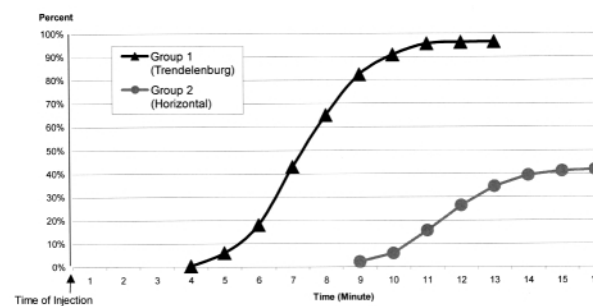


FIGURE 2 Percentage of subjects in each group achieving T5 sensory block over time.

level of anesthesia, patients in group I were placed in the horizontal position. After delivery, all patients received midazolam and oxytocin. Evaluation of the newborn was performed using Apgar score at one and five minutes. Data were analyzed by the appropriate statistical tests (means difference test and nonparametric difference tests) using SPSS for Windows package.

Results

Seven hundred thirty-nine patients were studied; 363 were in group I and 364 were in group II. Twelve patients were excluded from the study because of technical failure. There were no differences in maternal age, weight, parity, and Apgar score between the groups (Table). Ninety-seven percent of patients in group I had an adequate level of sensory block (T5); 31.7% of patients achieved this level in less than six minutes, 77.4% in less than eight minutes and 97.4% in less than ten minutes (Figure 2). In group II only 47.4% achieved an acceptable sensory block (T5–T6) in less than ten minutes (between eight and ten minutes) ($P < 0.001$ vs group I). Globally, 42.8% achieved a T5 sen-

TABLE Brief comparison of selected variables between subjects in each group

	<i>Age (yr)</i> <i>(mean ± SD)</i>	<i>Weight</i> <i>(kg)</i> <i>(mean ± SD)</i>	<i>Parity</i> <i>Primi</i> <i>(%)</i>	<i>Multi</i> <i>(%)</i>	<i>Emergent</i> <i>%</i>	<i>Elective</i> <i>%</i>	<i>Apgar score</i> <i>≥ 7 in</i> <i>1st min</i> <i>(%)</i>	<i>≥ 9 in</i> <i>5th min</i> <i>(%)</i>
Group I (Trendelenburg position)	26.6 ± 5.6	76.5 ± 7.5	116 (32)	247 (68)	287 (79)	76 (21)	97.5	97
Group II (Horizontal position)	26.7 ± 6.1	77.0 ± 6.8	123 (34)	241 (66)	265 (73)	79 (27)	95.6	97.8

sory block, 40.8% a T6 sensory block while the remainder had an upper level of sensory block between T6 and T8. A decrease in blood pressure requiring treatment with ephedrine occurred in 5% of mothers.

Discussion

The Akbarabadi Obstetrics and Gynecology Center performs more than 2800 Cesarean sections annually and the usual anesthetic technique for Cesarean section is epidural injection of anesthetic solution through a Tuohy needle. Although slow and incremental injection of local anesthetic through a catheter is generally accepted and safer, we use a single dose technique for Cesarean sections because, in our center, there are not enough epidural catheters available. The major problems with this technique are hypotension and a delay in achieving adequate sensory block level in an emergency situation. Several investigations have assessed the effects of posture on the spread of epidural anesthesia in the lateral and head-up position but their results are conflicting. In two different studies Grundy *et al.* compared the effect of pregnancy and lateral position on the spread of epidural anesthesia and found no difference on the spread of epidural anesthesia in pregnant and non-pregnant women,⁵ but showed that the lateral position has a significant effect.² This latter finding was subsequently confirmed by Husmeyer and White, and Apostolou.^{1,6} Ponhold showed head-up position not only decreases the maximum cephalad spread of local anesthetic but also provides better anesthesia in lower segments during epidural anesthesia.⁷ In contrast, Norris studied term pregnant women and reported that gravity does not augment the spread of epidural anesthesia for Cesarean section.^{3,8} In these studies, Norris used 3% chlorprocaine, a local anesthetic drug with rapid onset and anesthetic levels were checked every five minutes. This may influence the conclusion of his results. Whalley *et al.* observed no significant difference in the final level of cephalad spread and the degree of motor block, but found that the time to maximum cephalad spread was shorter in the sitting position,

implying that the local anesthetic spreads faster against the gravity.⁹ In 1999, White mentioned the possibility of cephalad spread of the epidural block.¹⁰ In our study, we used a modified Trendelenburg position, which has not been evaluated before, and found significant differences in the time of onset and to achieve a T5 level of sensory blockade when compared to the horizontal position. Theoretically, the Trendelenburg position can increase the possibility of regurgitation, although this was not a problem clinically. In this study the maximum cephalad spread of epidural blockade was not measured. However, on average, the upper level of anesthesia in group I was higher than in group II.

Our results indicate that the patient's position not only has a significant effect on the time of onset, but also augments the spread of anesthesia in term pregnant women who receive a single injection of local anesthetic solution in the epidural space for Cesarean section.

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