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Correlation Between the Abdominal Circumference and the Incidence of Hypotension in Parturients Undergoing Cesarean Section Under Spinal Anesthesia

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KEYWORDS
Abdominal circumference, cesarean section, hypotension, spinal anaesthesia.

ABSTRACT:

Introduction:Hypotension during cesarean section under spinal anesthesia is a common complication that can affect outcomes. Abdominal circumference, reflecting uterine and fetal size, may impact the risk of hypotension. This study investigates the correlation between abdominal circumference and hypotension incidence in parturients undergoing cesarean delivery to identify potential predictive markers for better management.

Objectives: The objective of this study is to investigate the correlation between abdominal circumference and the incidence of hypotension in parturients undergoing cesarean section under spinal anesthesia.

Methods: After obtaining informed written consent, a total of 60 women were enrolled in the study. Participants were divided into two groups based on abdominal circumference measurements: those with a circumference of 100 cm or less and those with a circumference greater than 100 cm. The study focused on examining the relationship between abdominal circumference and the incidence of hypotension during cesarean section under spinal anesthesia.

Results: Participants were divided into two abdominal circumference groups: "Larger" (52%) and "Smaller" (48%). Baseline mean arterial pressure (MAP) for the smaller circumference group was most common in the 80-90 mmHg range (55%), while for the larger circumference group, it was also most frequent in the 80-90 mmHg range (42%). After spinal anesthesia, 52% of those with a smaller circumference experienced hypotension (MAP decrease >20%), compared to 65% in the larger circumference group. This indicates a higher prevalence of significant hypotension in individuals with larger abdominal circumference, reflecting the increased risk associated with larger abdominal girth following spinal anesthesia

Conclusions: Pregnancy-related increases in abdominal circumference are associated with significant decreases in mean arterial pressure from baseline. However, the incidence of hypotension did not show a significant difference between groups with larger and smaller abdominal circumferences. This suggests that while abdominal circumference affects mean arterial pressure, it may not be a definitive predictor of hypotension risk in parturients undergoing cesarean section under spinal anesthesia.

1. Introduction

Hypotension is a common and clinically significant complication during cesarean sections performed under spinal anesthesia. It is characterized by a substantial decrease in mean arterial pressure (MAP) following the administration of the anesthetic, which can lead to adverse outcomes for both the mother and the fetus. Identifying factors that influence the incidence and severity of hypotension is crucial for improving anesthetic management and ensuring better clinical outcomes.

One factor that has garnered attention in recent research is abdominal circumference (AC). AC, which reflects the size of the uterus and the volume of amniotic fluid, could potentially affect the distribution of spinal anesthetics and the resulting hemodynamic changes. An enlarged abdomen may be associated with increased intra-

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abdominal pressure and uterine enlargement, which can impact venous return and the spread of anesthetic agents, leading to more pronounced hypotension.

Several mechanisms may explain the correlation between AC and hypotension. Larger abdominal circumferences are often linked to an enlarged uterus, which can compress the inferior vena cava and reduce venous return to the heart. This compression might contribute to lower blood pressure by decreasing cardiac output. Additionally, the increased size of the uterus can cause engorgement of the epidural venous plexus, which may reduce cerebrospinal fluid volume and constrict the intrathecal space, potentially leading to a higher degree of cephalad spread of spinal anesthesia and more extensive sympathetic blockade. (1)

In clinical practice, understanding the correlation between AC and hypotension could have practical implications. If AC is found to be a reliable predictor of hypotension, it could be used as a preoperative assessment tool to better anticipate and manage hypotensive risks. This might involve adjusting the dosages of local anesthetics based on AC or implementing early interventions to prevent significant drops in MAP.

2. Objectives

The objective of this study is to investigate the correlation between abdominal circumference and the incidence of hypotension in parturients undergoing cesarean section under spinal anesthesia.

3. Methods

After getting approval from the Institutional Human Ethical Committee, we included 60 pregnant women who fulfilled the inclusion criteria, which included American society of anesthesiologists Grade II & III patients aged < 45 years posted for elective and emergency cesarean section under spinal anaesthesia. Patients who were excluded from this study were patients who denied consent, patient undergoing cesarean section under general anesthesia, high risk pregnancies like placenta previa, abruptio placenta, eclampsia (or) pre-eclampsia, coagulation disorders, local infection at site of injection. On the day of surgery, the abdominal circumference of all enrolled patients was measured at the level of the umbilicus before administering spinal anesthesia. Participants were divided into two groups based on abdominal circumference measurements: those with a circumference of 100 cm or less and those with a circumference greater than 100 cm and baseline parameters were recorded. Spinal anesthesia was performed using a standard technique by the anesthetist. Blood pressure, mean arterial pressure (MAP), heart rate (HR), and the level of spinal anesthesia were monitored every 10 minutes using non-invasive methods.

4. Results

The study was analyzed by descriptive statistical analysis.The study population predominantly consisted of individuals aged 25-30 years (48%), followed by those aged 30-35 years (28%). The majority of participants were in the 60-70 kg weight range (50%), with the 70-80 kg range next (26.33%). Most participants had a height between 160-170 cm (43%), and the 26G Quincke needle was the most commonly used (37%). Participants were divided into two abdominal circumference groups: "Larger" (52%) and "Smaller" (48%).

The majority of individuals in smaller circumference group had a baseline MAP in the 80-90 mmHg range, comprising 55% of the sample, or 16 participants. The next most common MAP range was 70-80 mmHg, with 8 participants, representing 28% of the group. The least frequent MAP range was 90-100 mmHg, observed in 5 participants, or 17% of the sample. This distribution indicates that the baseline MAP for the smaller circumference group is predominantly concentrated in the 80-90 mmHg range, with fewer participants at the lower and higher ends of the spectrum.

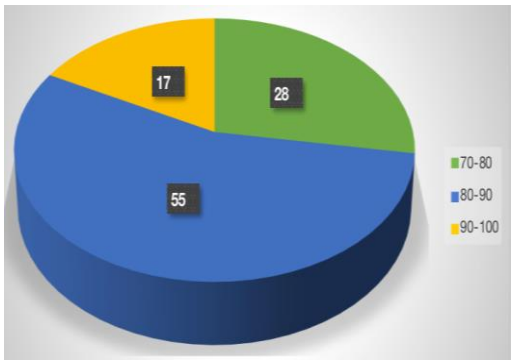

Figure 1 : MAP baseline percentage in smaller circumference

The majority of participants in the larger circumference group had a baseline MAP in the 80-90 mmHg range, representing 42% of the sample, or 13 individuals. The next largest group had a baseline MAP in the 70-80 mmHg range, with 10 participants, or 32%. The least common MAP range was 90-100 mmHg, observed in 8

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participants, accounting for 8% of the group. This distribution shows that the baseline MAP for the larger circumference group is most frequently found in the 80-90 mmHg range, with a smaller proportion of participants at both the lower and higher MAP ranges.

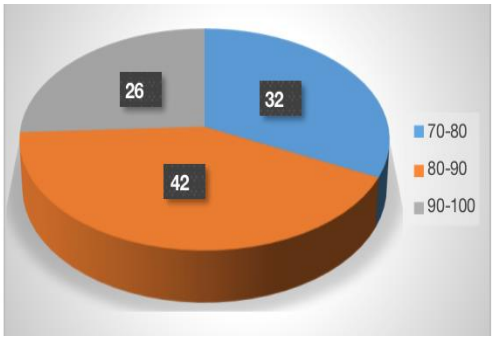

Figure 2 : MAP baseline percentage in larger circumference

In the group of participants with smaller abdominal circumference , after spinal anesthesia 15 participants (52%) experienced hypotension, defined as a MAP decrease greater than 20% from baseline. The remaining 14 participants (48%) did not experience significant hypotension, with a MAP decrease of less than 20%. This distribution shows a nearly even split between those who did and did not experience substantial hypotension, indicating a moderate association between smaller abdominal circumference and the likelihood of experiencing a notable drop in MAP following spinal anesthesia.

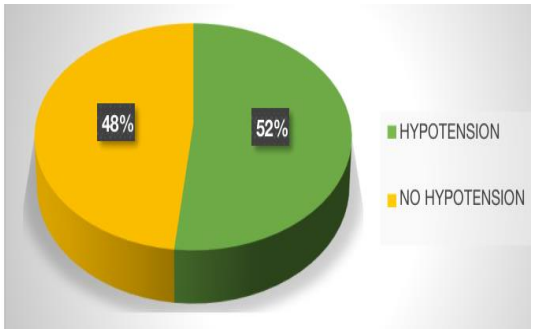

Figure 3 : Hypotension percentage in smaller circumference after spinal anaesthesia

In the group of participants with larger abdominal circumference , after spinal anesthesia, 20 participants (65%) experienced hypotension, defined as a decrease in MAP of more than 20% from baseline. Conversely, 11 participants (35%) did not experience hypotension, with a MAP decrease of less than 20%. This distribution indicates a higher prevalence of significant hypotension in the larger circumference group, highlighting the increased risk of pronounced MAP reduction following spinal anesthesia in individuals with larger abdominal circumference

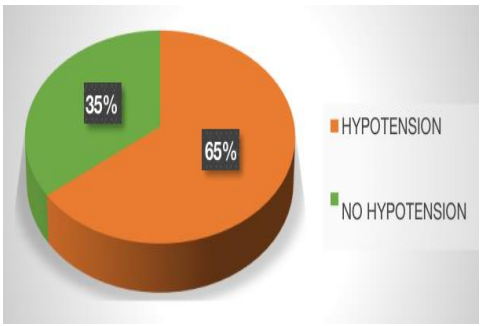

Figure 4 : Hypotension percentage in larger circumference after spinal anaesthesia

5. Discussion

In this study, we found that although the incidence of hypotension, defined by a mean arterial pressure (MAP) decrease of less than 20% from baseline, did not significantly differ between parturients with larger and smaller abdominal circumferences (AC), a marked drop in MAP was observed in the larger AC group. This notable drop in MAP in the larger AC group could be attributed to several factors.

One possible explanation is that hypotension following spinal anesthesia is typically managed preemptively by the anesthesiology team to prevent fetal injury due to uteroplacental hypoperfusion. As such, the management strategies might have mitigated the overall incidence of hypotension observed, but did not entirely prevent significant drops in MAP. The treatment protocol often involves early intervention, potentially masking a more pronounced effect of AC on hypotension.(2)

Another factor to consider is the variability in defining clinically significant hypotension. Our study faced challenges in applying a standardized MAP value for hypotension, as definitions vary across studies. This variability could impact the comparability of our results. While we observed a more substantial drop in MAP with larger AC, the absence of a uniform definition for hypotension makes direct comparisons difficult.(3)

The increase in MAP drop associated with larger AC could be related to physiological changes such as the

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compression of the inferior vena cava by an enlarged uterus, leading to engorgement of the epidural venous plexus and a reduced volume of cerebrospinal fluid. This compression might contribute to a higher degree of cephalad spread of spinal anesthesia, enhancing sympathectomy and resulting in lower MAP. However, our study did not assess the impact of AC on the level of anesthesia directly, as the assessment was made only post-anesthesia and before surgical incision.(4)

Moreover, factors like AC and vertebral column length impact the cephalad distribution of spinal anesthesia, we did not evaluate abdominal pressure, which could have provided additional insights into the mechanisms affecting MAP. High abdominal pressure is known to correlate with increased risk of hypotension, but the absence of abdominal pressure data in our study is a limitation.(5)

Furthermore, while the relationship between AC and increased abdominal pressure is established, our study did not measure abdominal pressure. This absence limits our ability to fully explain the mechanisms behind the observed MAP drops. Incorporating abdominal pressure measurements in future research could provide additional insights into how AC impacts hypotension.

In conclusion, our findings suggest that larger AC, potentially associated with factors such as aortocaval compression or elevated intra-abdominal pressure, contribute to significant drops in MAP. Despite the lack of significant differences in hypotension incidence between the AC groups, our results highlight the importance of considering AC as a variable in predicting and managing hypotensive episodes during spinal anesthesia. Future research should include abdominal pressure measurements and explore additional variables like trunk length to refine our understanding of these relationships and improve clinical management strategies.(6)

Given that AC is a readily measurable and operator-independent variable, its inclusion in preoperative assessments could help anesthesiologists anticipate and manage hypotensive episodes more effectively.(7) Adjusting local anesthetic dosages based on AC might also reduce the likelihood of hypotension. Additionally, considering body weight in dose adjustments could further optimize outcomes. Future research should explore the role of trunk length and other factors to refine our understanding of spinal anesthesia's effects and improve management strategies.

6. Conclusion

Pregnancy-related increases in abdominal circumference are associated with significant decreases in mean arterial pressure from baseline. However, the incidence of hypotension did not show a significant difference between groups with larger and smaller abdominal circumferences. This suggests that while abdominal circumference affects mean arterial pressure, it may not be a definitive predictor of hypotension risk in parturients undergoing cesarean section under spinal anesthesia.

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