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Body Mass Index and Clinical Outcomes During Cesarean Section Under Spinal Anesthesia

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Abstract: *Introduction:* Obese pregnant women, especially morbidly obese, are at greater risk of undergoing a cesarean section (CS). Clinical outcomes have been associated with an increase in body mass index (BMI). *Objective*: The objective of the study was to evaluate the sensory block level, the perioperative times, the incidence of maternal hypotension, the Apgar score, and the birth weight between the BMI strata of pregnant women undergoing CS. *Method*: In this prospective cohort study were included women with singleton pregnancies undergoing spinal anesthesia for elective CS. The pregnant women were classified according to BMI at delivery: normal (18.5–25 $kg.m^{-2}$), overweight (25–29.9 $kg.m^{-2}$), obese (30–39.9 $kg.m^{-2}$), and morbidly obese (≥ 40 $kg.m^{-2}$). The primary outcome was the total operative time. *Results*: Among 540 patients analyzed, 252 (46.7%) were obese and 54 (10%) were morbidly obese. The sensory block level (> T4) was higher in morbidly obese patients (18.5%) compared to patients with normal BMI (4%) and overweight (7.5%), $p < 0.05$. The median and interquartile range of the spinal-to-incision interval was longer in morbidly obese patients [13 (10–16.2) minutes] compared with normal BMI [10 (8–12) minutes] and overweight [10 (9.5–14) minutes], $p < 0.000$; and obese [11 (10–15) minutes], $p < 0.00$. Also, it was longer in obese patients compared with normal BMI, $p < 0.00$. The mean and standard deviation (SD) of the total operative time was longer in morbidly obese patients (70.2 ± 21 minutes) compared to those with normal BMI (59.7 ± 12 minutes) and overweight (61.3 ± 17 minutes), $p < 0.00$; and in obese (65.4 ± 18 minutes) compared with normal BMI, $p < 0.05$. The incidence of maternal hypotension was higher in morbidly obese patients (79.6%) compared with normal BMI (58.7%) and overweight (61%), $p < 0.05$; and in obese patients (71.8%) compared with normal BMI and overweight, $p < 0.05$. The birth weight of morbidly obese patients (3,553 ± 623 g) was higher than in patients with normal BMI (3,020 ± 626 g) and overweight (3,187 ± 587 g), $p < 0.000$; and in obese patients compared with normal BMI and overweight, $p < 0.00$. The incision-to-delivery interval, Apgar score < 7 at 5 minutes were similar in the different BMI strata. *Conclusion:* The increase in BMI is associated with longer perioperative times, higher sensory block level, higher incidence of maternal hypotension, and higher birth weight.

Keywords: Obesity, Cesarean Section, Operative Times, Spinal Anesthesia, Maternal Hypotension

1. Introduction

Obesity is on the rise in low and middle-income countries [1]. This increase in the prevalence of obesity in the general population extends to women of reproductive age. Obesity during pregnancy is associated with several perinatal complications (preeclampsia, gestational diabetes mellitus, venous thromboembolism, obstructive sleep apnea, prematurity, congenital fetal abnormality, fetal macrosomia, and stillbirth) [2]. Between 2014 and 2017, 55.8% of deliveries were performed via cesarean section (6,580,432 operations) in Brazil, which places Brazil as one of the leaders in the ranking of cesarean sections in the world [3]. Esteves-Pereira et al. reported the risk of maternal death in the postpartum period was almost three times higher with cesarean section than with vaginal delivery (OR 2.87, 95% CI 1.63–5.06) [4]. Obese pregnant women, especially morbidly obese, are at greater risk of undergoing a cesarean section [5, 6].

Regional anesthesia (spinal, epidural, or combined) is the preferred technique for cesarean section in obese pregnant women [7]. Previous studies have reported in obese patients greater technical difficulty in performing regional block [8, 9], increased number of episodes and incidence of intraoperative maternal hypotension [10, 11], the increased time interval from spinal anesthesia to skin incision [12], the increased time interval from the skin incision to delivery [13-15], increased total operative time [13, 16, 17], increased intraoperative bleeding [11], as well as neonatal acidosis [13, 18, 19], and worsening of the Apgar score (AS) [20]. However, the impact of maternal obesity on perioperative clinical outcomes is a matter of debate.

The objective of the study was to evaluate the sensory block level, the perioperative times, the incidence of maternal hypotension, the AS, and the birth weight between the BMI strata of pregnant women undergoing CS.

2. Methods

The Research Ethics Committee of the institution approved this cohort prospective study. We obtained written, informed consent from all patients.

2.1. Inclusion Criteria

In this study were included pregnant women with singleton pregnancies and gestational age > 34 weeks undergoing elective cesarean section under spinal anesthesia between September 2019 and April 2021.

2.2. Exclusion Criteria

Exclusion criteria included suspected or diagnosed placenta accreta, spinal anesthesia failure, intraoperative complications (bleeding requiring transfusion, puerperal hysterectomy), and fetal abnormality.

2.3. Anesthesia and Operative Technique

In the operating room, every patient was monitored with pulse oximetry, continuous electrocardioscopy, and non-invasive blood pressure throughout the anesthetic-surgical procedure. It was obtained the mean of the systolic blood pressure of three consecutive measurements with an interval of two minutes with the patient in a sitting position. Then, 500 mL of lactated ringer's solution was administered intravenously immediately before spinal puncture and approximately 10 $mL.kg^{-1}.h^{-1}$ of the same solution until the end of the operation. The spinal puncture was performed with the patient in a sitting position in the L2 to L5 interspaces with a 25G or 27G Quincke needle. Hyperbaric bupivacaine (2.5 mL) plus morphine 100 µg (0.5 mL) was administered into the subarachnoid space at a rate of 1 mL every 10-15 seconds. Immediately afterward, the patient was placed in horizontal dorsal decubitus with a lateral deviation of 15° on the operating table or manual displacement of the uterus to the left until fetal extraction. Sensory block was assessed by the loss of pain sensation. All patients received an indwelling urinary catheter. The operation started as soon as the T6 dermatome was reached.

The operation was performed using the Pfannenstiel technique.

Hypotension was defined as systolic blood pressure (SBP) < 100 mmHg or more than a 20% reduction of the SBP baseline, and 5 mg of bolus of ephedrine was used to treat it.

2.4. Data Collection

Data were collected regarding the variables: age, weight and height, BMI, parity, gestational age, comorbidities, previous cesarean section, tubal ligation, dermatome level (sensory block) reached 15 minutes after lumbar puncture, the interval from the spinal puncture to the skin incision (spinal-to-incision interval), the interval from skin incision to delivery (incision-to-delivery interval), and the interval from the skin incision to the completion of the surgery (total operative time), the last three intervals were measured in minutes. It was also collected data regarding the incidence of maternal hypotension, birth weight, and AS < 7 at 5 minutes. The primary outcome was the total operative time. BMI was stratified into four categories according to World Health Organization (WHO) guidelines in: normal (18.5-24.9 $kg.m^{-2}$), overweight (25.0-29.9 $kg.m^{-2}$), obese (30-39.9 $kg.m^{-2}$) and morbidly obese (40 $kg.m^{-2}$ or greater). BMI was calculated for each patient based on patient reported height and weight at delivery.

2.5. Sample Size Calculation

The sample size calculation was based on the mean ± standard deviation (SD) of 79 minutes (39) of the total operative time in morbidly obese pregnant women reported by Vricella et al. [21]. It was considered a maximum estimation error of 3.9 minutes, a confidence level of 95%, and an alpha error of 0.05. Thus, it was necessary to include at least 388 parturients in this study. To compensate for possible losses we added 30% to this number, making a final sample of 505 parturients.

2.6. Statistical Analysis

Continuous data with normal distribution were analyzed by analysis of variance (ANOVA) followed by the Tukey's test for post hoc analysis if necessary. Discrete or continuous data without normal distribution and ordinal data were analyzed by the Kruskal-Wallis test followed by the Mann-Whitney test for post hoc analysis if necessary. For categorical data, the Chi-square test was used to detect differences between groups and Fisher's exact test to detect differences within groups. A significance level of 5% for rejection of the null hypothesis was established p value < 0.05. The analyzes were performed using Statistical Package for Social Sciences version 21.

3. Results

For the study, 604 pregnant women were recruited. Of these, 557 were evaluated. Five patients were excluded due to lack of weight or height data, and twelve patients were excluded due to failed anesthesia. The data of 540 pregnant women were analyzed (Figure 1).

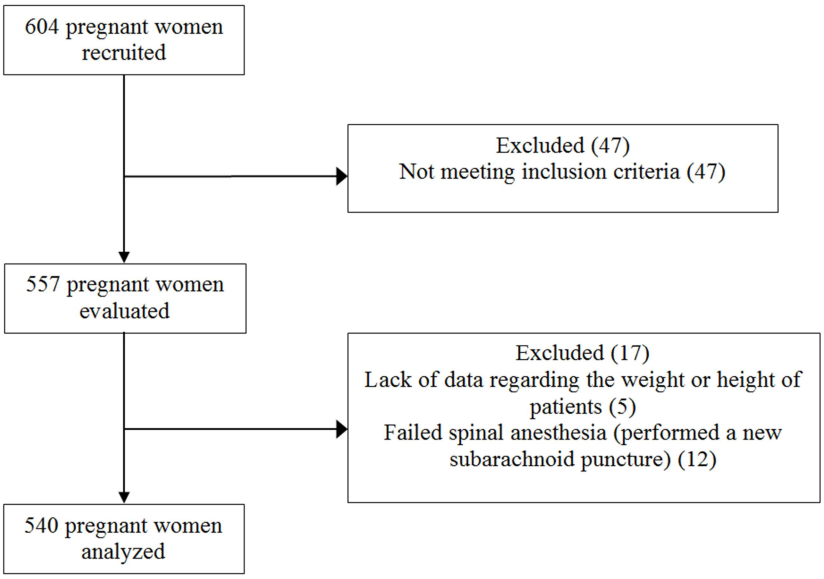

Figure 1. *Flowchart of the study patients.*

Of the total of 540 patients, 221 (40.9%) underwent a first cesarean section and 319 (59.1%) had already undergone a cesarean section previously. Two hundred and thirty-four patients (43.3%) had a normal or overweight BMI, 252 (46.7%) were obese, and 54 (10%) were morbidly obese at the time of the cesarean section.

Morbidly obese pregnant women had a higher mean and SD of the age than those with normal BMI and overweight (29.8 ± 5.8 vs 25.2 ± 6.4 years, $p < 0.000$ and 29.8 ± 5.8 vs 27.2 ± 6.1 years, $p < 0.05$, respectively); and obese women were older than those with normal BMI (28.2 ± 6.4 vs 25.2 ± 6.4 years, $p < 0.00$). Age and the other clinical-demographic characteristics of the patients according to BMI strata are shown in Table 1.

There was a higher extent of the sensory block level (above T4) in morbidly obese patients (18.5%) when compared to patients with normal BMI (4%) and overweight (7.5%), $p < 0.05$.

The median and interquartile range (IQR) of the spinal-to-incision interval was longer in morbidly obese patients 13 (10-16.2 minutes) compared with normal BMI 10 (8-12 minutes) and overweight 10 (9.5-14 minutes), $p < 0.000$ and $p < 0.00$, respectively.

The median and IQR of the incision-to-delivery interval were not different between the BMI strata, $p = 0.80$ (Kruskal-Wallis test).

The total operative time was significantly longer in morbidly obese patients (70.2 ± 21 minutes) compared with those with normal BMI (59.7 ± 12 minutes) and overweight (61.3 ± 17 minutes), $p < 0.00$. Also, the total operation time was longer in obese patients (65.4 ± 18 minutes) compared with normal BMI (59.7 ± 12 minutes), $p < 0.05$.

The incidence of maternal hypotension was higher in morbidly obese patients (79.6%) compared with normal BMI (58.7%) and overweight (61%), $p < 0.05$. There was also a higher incidence of hypotension in obese patients (71.8%) compared with normal BMI (58.7%) and overweight patients (61%), $p < 0.05$.

The mean and SD of the birth weight of neonate of morbidly obese (3,553 ± 623 g) and obese patients (3,385 ± 592 g) were greater than in patients with normal BMI (3,020 ± 626 g) and overweight (3,187 ± 587 g), $p < 0.000$ and $p < 0.00$, respectively.

Six neonates had AS < 7 at 5 minutes and recovered promptly with face mask ventilation and the AS was not statistically different between the BMI strata. The obstetric and neonatal outcomes in the groups are shown in Table 2.

Table 1. *Clinical-demographic characteristics of Study Patients.*

BMI at delivery	**Normal**	**Overweight**	**Obese**	**Morbidly obese**
	n= 75	**n= 159**	**n= 252**	**n= 54**
Maternal age (years)	25.2 ± 6.4	27.2 ± 6.1	28.2 ± 6.4[#]	29.8 ± 5.8*
Gestacional age (weeks)	38.7 ± 2.1	38.7 ± 1.9	38.9 ± 1.9	38.4 ± 1.8
Parity				
0	24 (32)	43 (27)	34 (13.5)[§]	6 (11.1)[&]
1-2	40 (53.3)	92 (57.9)	157 (62.3)	34 (63)
3 or more	11 (14.7)	24 (15.1)	61 (24.2)[¶]	14 (25.9)
Previous cesarean section				
0	42 (56)	75 (47.2)	89 (35.3)[&]	1 15 (27.8)[&]
1-2	30 (40)	73 (45.9)	145 (57.5)[&]	32 (59.2)[π]
3 or more	3 (4)	11 (6.9)	18 (7.1)	7 (13)
Comorbidity				
Gestacional hypertension	4 (5.3)	12 (7.6)	44 (17.7)[&]	17 (32.1)**
Gestacional diabetes	2 (2.7)	10 (6.4)	26 (10.4)[π]	10 (18.9)[&]
Others[$]	7 (9.3)	14 (8.9)	40 (16.1)	19 (35.8)[¶¶]
Missing	0 (0)	2 (1.2)	3 (1.1)	1 (1.8)
Tubal ligation	14 (18.9)	33 (21.6)	68 (28.5)	21 (40.4)[Σ]

BMI = Body mass index ($Kg.m^{-2}$)
Data expressed as mean ± standard deviation and n (%).
[$] Chronic arterial hypertension, hypothyroidism, type II diabetes mellitus, and asthma.
Comparisons performed by Mann-Whitney U test or Tukey test for continuous data and Fisher's exact test for categorical data.
* $p < 0.000$ compared with normal BMI, and $p < 0.05$ compared with overweight.
[#] $p < 0.00$ compared with normal BMI.
[&] $p < 0.05$ compared with normal BMI and overweight.
[§] $p < 0.000$ compared with normal BMI and overweight.
[¶] $p < 0.05$ compared with overweight.
[π] $p < 0.05$ compared with normal BMI.
** $p < 0.000$ compared with normal BMI and overweight, and $p < 0.05$ compared with obese.
[¶¶] $p < 0.000$ compared with normal BMI and overweight, and $p < 0.00$ with obese.
[Σ] $p < 0.00$ compared with normal BMI and overweight.

Table 2. *Obstetric and Neonatal Outcomes in Study Groups.*

BMI at delivery	**Normal**	**Overweight**	**Obese**	**Morbidly obese**
	n= 75	n=159	n= 252	n= 54
Sensory block level				
< T4	3 (4)	12 (7.5)	23 (9.1)	10 (18.5) *
T4-T6	71 (94.7)	140 (91.3)	227 (90.1)	44 (81.5)
Missing	1 (1.3)	2 (1.2)	2 (0.8)	0 (0)
Spinal-to-incision interval (min)	10 (8-12)	10 (9.5-14)	11 (10-15)[#]	13 (10-16.2)[¶]
Missing	0 (0)	6 (3.7)	3 (1.2)	0 (0)
Incision-to-delivery interval (min)	1 10 (7.7-12)	10 (7-13)	10 (7-14)	10 (7-14.2)
Missing	1 (1.3)	2 (1.2)	3 (1.1)	0 (0)
Total operative time (min)	59.7 ± 12	61.3 ± 17	65.4 ± 18[§]	70.2 ± 21[&]
Missing	0 (0)	2 (1.3)	5 (1.9)	1 (1.8)
Maternal hypotension	44 (58.7)	97 (61)	181 (71.8) *	43 (79.6) *
Missing	0 (0)	0 (0)	1 (0.4)	0 (0)
Birth weight (g)	3,020 ± 626	3,187 ± 587	3,385 ± 592[£]	3,553 ± 623[Ω]
Apgar Score < 7 at 5 minutes	1 (1.2)	3 (1.1)	1 (0.4)	1 (1.8)

BMI = Body mass index ($kg.m^{-2}$). Data expressed as mean and standard deviation, median and interquartile range, and n (%).
Comparisons performed by Mann-Whitney U test or Tukey test for continuous data and Fisher's exact test for categorical data.
* $p < 0.05$ compared with normal BMI and overweight.
[¶] $p < 0.000$ compared with normal BMI and overweight, and $p < 0.00$ compared with obese.
[#] $p < 0.00$ compared with normal BMI.
[&] $p < 0.00$ compared with normal BMI and overweight.
[§] $p < 0.05$ compared with normal BMI.
[Ω] $p < 0.000$ compared with normal BMI, and $p < 0.00$ compared with overweight.
[£] $p < 0.00$ compared with normal BMI, and $p < 0.00$ compared with overweight.

4. Discussion

In this cohort, 56.7% of pregnant women were obese or morbidly obese, reflecting the global trend of increasing obesity among pregnant women [22].

Obese and morbidly obese pregnant women were older, were more likely multiparous, had more previous cesarean sections, and had a higher prevalence of hypertension and gestational diabetes than those with a normal or overweight

BMI. These results are in line with other studies [14, 23].

The total operative time was on average approximately 10 minutes longer in morbidly obese patients undergoing a first or repeated cesarean section than in patients with normal BMI or overweight patients ($p < 0.00$). Interestingly, Doherty et al. [17] reported that patients with an operation duration > 60 minutes, 82% had a BMI ≥ 30 kg.m^{-2}. In addition, Butwick et al. [24] reported longer intraoperative periods must be considered when deciding on the mode of anesthesia for patients with a BMI ≥ 40 kg.m^{-2}. Recently, a large prospective observational study, included 24,761 parturients (60.3% of them received spinal anesthesia) reported the association of increased BMI in pregnant women with prolonged anesthesia and operative time [25]. In this last study, the total operative time was on average approximately 20 minutes shorter in the different BMI strata compared to our study. This difference can be explained, at least in part, because in our institution the patients are mostly operated on by doctors in training. In addition, studies have associated an increase in operative time with a higher risk of bleeding, lower AS, lower umbilical cord pH in neonates, and longer hospital stay [17]. However, future studies should be carried out to clarify the importance of the relationship between the increase in total operative time as the BMI increases.

Regional anesthesia, despite the potential technical difficulty, has become the preferred technique in obese pregnant women [7]. However, one of the most frequent undesirable events of regional anesthesia, especially in spinal anesthesia, is maternal hypotension [26]. The increase in abdominal pressure caused by obesity associated with the gravid uterus can reduce the volume of cerebrospinal fluid (affecting the dilution of the administered local anesthetic), and lead to the displacement of cerebrospinal fluid from the lumbosacral region to the upper regions. These two mechanisms may have a greater effect on the speed of onset and/or a higher extent of sympathetic blockade leading to hypotension [27, 28]. The higher incidence of hypotension in obese pregnant women may be explained by a higher extent of sympathetic blockade, aortocaval compression by the gravid uterus [29], and imbalance between endogenous vasoactive substances, mainly a decrease in angiotensin II, an increase in prostaglandins and nitric oxide [30].

The dose of 12.5 mg of heavy bupivacaine associated with 0.1 mg of morphine has been routinely used in spinal anesthesia for cesarean section in our service [31]. Furthermore, the use of this dose is supported by the study of Lee et al. [32] who reported that the 95% effective dose (ED95) and the 95% confidence interval (95% CI) of the heavy bupivacaine, obtained through the up-down technique of modified sequential allocation, was similar for eutrophic and obese women [12.78 mg (95% CI: 10.75 to + infinity) and 11.86 mg (95% CI: 11.31 to 15.61), respectively].

In this study, there was a higher extension of the sensory block level (above T4) in morbidly obese patients (18.5%) compared to patients with normal BMI (4%) and overweight (7.5%), $p < 0.05$. A study compared pregnant women with a BMI > 40 with those with a BMI < 32 kg.m^{-2} and reported a 2-dermatome difference in median block height for loss of temperature sensation between BMI > 40 and BMI < 32 kg.m^{-2} (T2 vs T4, 95% CI of the difference in medians 0–2 dermatomes) [33]. Lamon et al. [34], studied 5,015 parturients and concluded that patients with a BMI ≥ 50 kg.m^{-2} were more likely to develop high spinal blocks (≥ T1) than those with a BMI < 30 kg.m^{-2} [odds ration (OR) (95% CI: 6.3 (2.2, 18.5)].

More recently, Elmeliegy [11] studied three groups of 40 parturients, group A (BMI < 30 kg.m^{-2}), group B (BMI 30 - 45 kg.m^{-2}), and group C (BMI > 45 kg.m^{-2}) undergoing elective cesarean section who received 12.5 mg of hyperbaric bupivacaine. He reported higher extent of sensory block level (above T4) in C (52.5%) compared with groups A (12.5%) and B (25%), $p < 0.000$ and 0.05, respectively. Reinforcing the association between block extent and hypotension, he also reported a greater number of episodes of hypotension in group C (5.98 ± 2.38) compared with group A (3.28 ± 2.31) and B (3.98 ± 1.54), $p < 0.001$. The results of these last three studies, as well as the result of this present study, indicate that obese and morbidly obese patients are more susceptible to a greater extent of spinal anesthesia and its most common consequence: hypotension.

Hypotension is frequently observed after spinal anesthesia for cesarean section with potential adverse consequences for the mother-fetus binomial. In this study, hypotension was defined as SBP < 100 mmHg or more than a 20% reduction of the SBP baseline. The criteria used to define hypotension are important because the incidence can vary from 7.4% to 74.1% depending on the criteria used [35]. A review, which included prospective studies, reported an incidence of maternal hypotension of 59.3% when using the same definition of hypotension used in this study [35]. The incidence of maternal hypotension in our study was approximately 68% regardless of BMI level. This result was not very different from two other observational studies that reported an incidence of hypotension in 64 and 65.1% [36, 37], suggesting the persistence of high rates of maternal hypotension.

The incidence of hypotension, in this study, the patients with normal BMI, overweight, obese and morbidly obese were 58.7, 61, 71.8 and 79.6%, respectively. Which was significatively higher in obese and morbidly obese patients compared with normal BMI and overweight.

Fakherpour et al. [38], prospectively, studied 511 parturients undergoing spinal anesthesia. They classified hypotension into three degrees according to SBP: mild, moderate, and severe. Mild hypotension was defined as a reduction of ≥ 10% and ≤ 20%, moderate as a reduction of > 20% and ≤ 30%, and severe as a reduction of > 30% in baseline SBP. And they reported an incidence of mild, moderate, and severe hypotension at 20%, 35%, and 40%, respectively. Furthermore, they showed six and five folds increased risk of moderate and severe hypotension, respectively, in parturients with a BMI ≥ 30 kg.m^{-2}.

In this study, we found a high incidence of maternal hypotension among women undergoing cesarean section, especially among obese and morbidly obese patients, which brings us to an important question to address. The use of phenylephrine prophylactically has been recommended to prevent maternal hypotension [39]. Thus, future studies that evaluate the use of phenylephrine in continuous infusion should be carried out to prevent maternal hypotension in obese pregnant women.

The spinal-to-incision interval was associated with an increase in the BMI of parturientes, in the present study. The preparation of obese pregnant women, especially morbidly obese, may require more time, including indwelling vesical catheter, antiseptic preparation of the skin, fixation of adipose tissue retractors, and positioning of the patient. The longer spinal-to-incision interval may have undesirable effects for both the parturient and the neonate. Shitemaw et al. [36] showed a spinal-to-incision interval > 6 minutes was associated with an 80% increase in the incidence of maternal hypotension [adjusted OR (95% CI) = 1.803 (1.04–3.14)]. Also, a spinal-to-incision interval ≥ 16 minutes was associated with a 168% increase in neonatal acidosis (pH ≤ 7.10) [(OR (95% CI): 2.68 (1.43-4.91)] [40]. In our study, umbilical arterial blood collection was not performed, preventing this type of analysis.

The incision-to-delivery interval was similar in all BMI strata in this study. Differently from four studies in which the incision-to-delivery interval increased proportionally with the increase in the BMI of pregnant women [13-15, 19].

Maternal obesity is associated with an increased risk of delivering a large-for-gestational-age neonate [OR (95% CI): 1.7 (1.1–2.5)] [41]. In our study, neonates of obese and morbidly obese mothers were heavier than non-obese mothers. These results are consistent with other recently published studies [20, 42].

In the present study, only six neonates had an AS lower than < 7 at 5 minutes. Studies have reported an association between an increase in BMI and an AS < 7 at 5 minutes [13, 20]. And more recently, the systematic review with meta-analysis conducted by Vats et al. [43] confirmed this association. They reported BMI ≥ 30 $kg.m^{-2}$ had a higher risk of AS < 7 at 5 minutes [OR: 1.47 (95% CI 1.23–1.75), I-squared statistics = 90%, $p < 0.001$].

5. Conclusion

In conclusion, approximately 57% of the pregnant women were obese or morbidly obese. Total operative time was significantly longer in obese patients than in patients with normal BMI, in morbidly obese patients than in patients with normal BMI, and in overweight patients undergoing elective cesarean section under spinal anesthesia. In addition, increased BMI was associated with longer spinal-to-incision interval, higher sensory block level, higher incidence of maternal hypotension, and higher birth weight. 6. Limitations.

This study has some limitations. First, although the sample size was strong enough to demonstrate differences in the total operative time (primary outcome) and other outcomes such as the spinal-to-incision interval, sensory block level, incidence of hypotension, and weight birth in different BMI strata. However, the sample size may not has been enough to show differences in some other outcomes such as the incision-to-delivery interval, as well as AS < 7 at 5 minutes. Second, some confounding factors that were not accounted for, such as the type of presentation of the fetus, and which physician performed the procedure (whether resident or attending physician) may have affected the results of perioperative outcomes. Third, we could have assessed the neonate's acid-base balance status which could be affected by the parturient's BMI [13, 18, 19].

Future studies should be carried out to clarify the impact of pregnant women's BMI on clinical, anesthetic, obstetric, and neonatal outcomes during cesarean section.

Conflict of Interest

The authors declare that they have no competing interests.

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