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Correlation between body mass index and the difficult neuroaxial anesthesia approach in electively scheduled patients

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Abstract
Background and Objective: Given the frequent observation that obesity increases the technical difficulty of neuroaxial regional anesthesia, and the lack of specific studies in the Mexican population linking BMI to the number of attempts, this study aimed to determine the correlation between Body Mass Index (BMI) and "Difficult Neuroaxial Regional Anesthesia" in elective surgery patients at HGZ 20.
Methodology: A prospective, observational study was conducted at HGZ 20 in Puebla, approved by the ethics committee. 383 patients (aged 18-60) eligible for neuroaxial anesthesia were included. Pearson correlation ($p < 0.5$) was used to analyze the relationship between BMI and procedural difficulty.
Results and Conclusion: The sample had a mean age of 44 years (predominantly female). It was confirmed that both Type II diabetes and any degree of obesity negatively impact the ease of the approach. Surprisingly, second-year anesthesiology residents demonstrated the greatest success (fewest attempts) on the first try in obese patients. The study concluded that a positive correlation exists between an elevated BMI and difficulty in performing neuroaxial anesthesia.

Keywords: Body mass index, neuroaxial regional anesthesia, obesity, approach, difficult

Introduction

General Background

The Body Mass Index (BMI), or Quetelet index, is the current method used to evaluate nutritional status in adults, calculated by dividing weight (kg) by height squared (m^2) [1]. The World Health Organization (WHO) considers it the most useful measure for defining overweight (BMI $\geq$ 25 kg/m^2) and obesity (BMI $\geq$ 30 kg/m^2). This classification includes more severe categories, such as Grade II obesity (BMI $\geq$ 40 kg/m^2) and Grade III or morbid obesity (BMI $\geq$ 50 kg/m^2) (2). Obesity is defined as an excess of body fat caused by multiple factors, including genetic, endocrine, and central nervous system factors [2].

Neuroaxial Anesthesia

The first record of regional anesthesia (a spinal block) dates to 1898 by August Bier, who used cocaine for an ankle surgery, observing the sensory and motor block, as well as its effects and initial complications [3-4].

Neuroaxial Anesthesia is a technique used in surgery and obstetrics that consists of inserting a needle or catheter into an intervertebral space to administer a local anesthetic. This blocks nerve conduction (at the level of the roots, ganglia, and spinal cord), producing a specific sensory and/or motor block depending on the dose, volume, or concentration used. It allows the patient to be awake or sedated, avoids muscle relaxants, and contributes to postoperative analgesia [5-6].

There are two main types

1. **Epidural Anesthesia:** The anesthetic (and/or opioids) is administered in the epidural space. It allows for a single dose or the placement of a catheter for continuous analgesia [5].
2. **Spinal Anesthesia (Subarachnoid Block):** The anesthetic is placed in the subarachnoid (intradural) space, mixing with the cerebrospinal fluid. It produces rapid, complete, and safe anesthesia (sensory, autonomic, and motor block) [5].

Technique and Procedure

Patient positioning is fundamental to facilitating the procedure by opening the interspinous spaces. The most common positions are the sitting position (seated, back arched, chin to chest) and the lateral decubitus position (lying on the side, knees flexed toward the abdomen) [8].

There are two main approaches to access the subarachnoid space: the midline approach (the most common, guided by Tuffier's line, which connects the iliac crests and usually corresponds to L4) and the paramedian approach (starting 1 cm lateral and 1 cm caudal to the midline, with a specific angulation). In the paramedian approach, it is common to encounter bone, requiring redirection of the needle [9].

The procedure involves, after choosing the position and approach, infiltrating local anesthetic into the skin. An introducer is inserted with a 10-15° cephalad inclination, and the needle is advanced through the tissues (subcutaneous) and ligaments (supraspinous, interspinous, ligamentum flavum) until crossing the arachnoid, at which point the outflow of cerebrospinal fluid should be observed [9].

Benefits, Risks, and Obesity

The benefits of neuroaxial anesthesia include rapid analgesia, a decrease in postoperative pulmonary complications, reduction of ileus, and improvements in vasodilation [9].

Contraindications are rare but include sepsis, coagulation abnormalities, elevated intracranial pressure, or previous back surgeries [9].

Complications can be mild (back pain, post-dural puncture headache) or severe and potentially fatal (epidural hematoma, meningitis, cardiac arrest, permanent neurological injury) [10, 11].

Specific Considerations in Obesity

Obesity and spinal pathologies are factors that predict difficulty in the neuroaxial approach, which can lead to multiple attempts and complications [12]. In the context of elective surgery (scheduled procedures that allow for a multidisciplinary preoperative evaluation) [13], obese patients present a higher risk of perioperative complications [14].

Although regional anesthesia is the technique of choice for obese patients, it has a high failure rate [14, 16]. This requires special considerations, such as the use of extra-long needles, weight-adjusted drugs, and antithrombotic measures [15].

Specific studies have addressed this difficulty. A study in Mexico with Class III obesity patients (BMI 47.5) for cesarean section described a technique where patients were asked to identify their own waistline to help locate the midline, even requiring four hands to successfully perform the procedure [15]. Another retrospective study on obstetric analgesia (BMI >30) observed that only 34% of blocks were successful on the first attempt by a resident, although the attending physician managed to complete it if the resident failed [17].

Materials and Methods

A descriptive, observational, prospective, and unicentric study was designed. The sample was calculated at 383 patients, selected from a source population of 4605 patients treated at the General Zone Hospital number 20 "La Margarita" in Puebla, Mexico. Patients aged 18 to 60 years, of both sexes, scheduled for elective surgery under neuroaxial regional anesthesia, who presented with obesity (Grade I, II, III, or morbid) and who signed the informed consent, were included. Pregnant patients and those with normal BMI or overweight were excluded. Sociodemographic variables, comorbidities, BMI, type of approach (medial, paramedian), position (sitting, lateral decubitus), number of attempts (1, 2-3, >3), and operator experience (Attending Physician, Resident R3, R2, R1) were collected. For statistical analysis, Pearson correlation (with significance $p < 0.5$) was used for the main objective, and Chi-square for the secondary objectives.

Results

The purpose of the research was to determine if obese patients present greater difficulty in neuroaxial anesthesia, which was assessed by correlating the Body Mass Index (BMI) with the number of attempts required for the technique. The study sample consisted of 383 patients, selected from a total population of 4605. (Table 1)

The descriptive analysis of the sample yielded the following data:

- The mean age of the participants was 44.6 years (±9.8).
- There was a predominance of women, representing 74.9% (n=287) of the sample, compared to 25.1% (n=96) of men.
- Regarding BMI, the most frequent grade of obesity was type I, present in 84.6% (n=242) of cases, followed by grade II with 12% (n=46). This trend held when broken down by gender, with type I obesity being the most common in both women (85%, n=244) and men (83.3%, n=80).
- The main comorbidities recorded were obesity (99%), systemic arterial hypertension (23%), and type 2 diabetes (11%). To a lesser extent, other diseases (6.8%), hypothyroidism (1.8%), chronic kidney disease (0.8%), and type 1 diabetes (0.3%) were present. It was noted that some patients had more than one comorbidity.

Table 1: Demographic Variables. We observe the mean and standard deviation of the demographic variables used in the 383 patients.

	N	Min	Max	Media	Deviation
Height	383	1.40	1.81	1.5540	0.06910
Body mass index	383	1	3	2.00	0.684
Age	383	30.00	53.01	32.9679	2.81894
Weight	383	18.00	60.00	44.6945	9.88537
	383	62.00	129.00	79.7645	9.83608

Analysis of the procedures revealed that gynecological surgeries were the most frequent (48.3%), with uterine myomatosis being the main one (17%). These were

followed by general surgery interventions (33.9%), notably umbilical hernia (11.5%) and inguinal hernia (7%).
Regarding the anesthetic technique, the lateral decubitus position was predominant (91.38%) over the sitting position (8.6%), and the medial approach was the most used (81.7%).
The study also recorded an average of 2 puncture attempts per patient (with a range of 1 to 3), with the combined block being the most common procedure (85.9%). The most frequent operators were second-year residents (41.8%) and first-year residents (36.6%). The anesthetic of choice was Hyperbaric Bupivacaine (74.4%), and to a lesser extent, its combination with Fentanyl (23%).
When classifying interventions by specialty, gynecological surgeries were the most frequent (48.3%), with uterine myomatosis being prominent (17%). These were followed by general surgeries (33.9%), where umbilical (11.5%) and inguinal (7%) hernia repairs were the most common.
Regarding the anesthetic technique, the predominant position was lateral decubitus (91.38%), used much more than the sitting position (8.6%). The preferred approach was the medial (81.7%), while the superior paramedian (12.8%) and inferior paramedian (5.5%) approaches were used less frequently.

The study's inferential analysis used Pearson correlation to confirm the main hypothesis, finding a statistically significant relationship (p = .000) between the degree of obesity and the number of puncture attempts (approach difficulty).
The results showed a positive correlation that increases with the level of obesity:

- **Grade I Obesity:** Low correlation (r = .195).
- **Grade II Obesity:** Low correlation, but higher (r = .229).
- **Grade III Obesity:** Moderate correlation (r = .324).

This evidence made it possible to reject the null hypothesis and accept the study's hypothesis: the greater the degree of obesity, the greater the difficulty.
Regarding comorbidities, their correlations with difficulty were analyzed, with most being very low: hypertension (r = .030), kidney disease (r = .042), and hypothyroidism (r = .085). However, type II diabetes (T2DM) showed the highest correlation (r = .131), in contrast to type I (r = .013). This suggests that T2DM is the only comorbidity that might correlate with the approach difficulty, further inferring that the duration of T2DM could increase this difficulty. (Table 2)

Table 2: Pearson Correlation. Variables in the Pearson correlation, where the number of attempts and degree of obesity were analyzed.

		Age	Weight	Height	Body Mass Index	Number of attempts
Age	Pearson Correlation	1	-0.173	-0.165	-0.075	0.065
	Bilateral significance		0.001	0.001	0.144	0.205
	N	383	383	383	383	382
Weight	Pearson Correlation	-0.173	1	0.710	0.685	0.199
	Bilateral significance	0.001		0.000	0.000	0.000
	N	383	383	383	383	382
Height	Pearson Correlation	-0.165	0.710	1	-0.024	-0.033
	Bilateral significance	0.001	0.000		0.634	0.516
	N	383	383	383	383	382
Body mass index	Pearson Correlation	-0.075	0.685	-0.024	1	0.324
	Bilateral significance	0.144	0.000	0.634		0.000
	N	383	383	383	383	382
Number of Attempts	Pearson Correlation	0.065	0.199	0.033	0.324	1
	Bilateral significance	0.205	0.000	0.516	0.000	
	N	383	383	383	383	382

The Pearson Chi-square test was used to analyze the relationship between the number of puncture attempts and the operator's experience level (Attending physician or resident R1, R2, R3). The main findings were:

- First attempt: Second-year residents (R2) had the highest success rate (30.0%), followed by R1s (23.7%). R3s (9.7%) and attending physicians (9.5%) showed the lowest percentages on the first attempt.
- Second attempt: R3s resolved the vast majority of their cases on this attempt (77.4%), followed by R1s (54.7%) and R2s (45.6%).
- Third attempt: Attending physicians showed the highest success rate at this point (57.1%), suggesting they intervened in the most complex cases. R2s (24.4%) and R1s (21.6%) had similar percentages, while R3s had the lowest (12.9%).

Discussion

Discussion and Study Comparison The study's results align with those of Higgins Guerra (11), who also found a higher percentage of failed blocks and more puncture attempts in patients with a BMI over 25 kg/m², due to difficulty identifying anatomical landmarks [11]. In contrast, Gaona Ramírez [15] achieved high success (92.8% on the first attempt) in pregnant women with Grade III obesity by using a "waist identification" technique in the sitting position. In the current study (which excluded pregnant women), the sitting position (used in 3.1% of cases) was 100% successful, but it was only adopted after at least two previous failed attempts in another position, and the use of the waist location technique was not documented [15].
Nazar [16] highlights the importance of the anesthesiologist's experience, a factor also considered in this study. Unlike suggestions elsewhere, this study did not require special equipment (needles) for obese patients. Furthermore, in line with Kim [10], no significant differences or adjustments in administered anesthetic doses based on the degree of obesity were reported [10].
Findings, Limitations, and Conclusions Various authors mention the high frequency of comorbidities such as hypertension and type 2 diabetes in obese patients (especially women). However, unlike this investigation, they usually do not correlate these diseases with the

difficulty of neuroaxial anesthesia, nor do they report the number of attempts (10).
The main limitation of this study was the lack of neuroaxial anesthesia equipment designed for obese patients, which could have artificially increased the number of attempts. The use of image guidance, such as ultrasound, was also not considered as a variable.

Conclusions: The study confirms a correlation between obesity (at any grade) and difficulty in performing neuroaxial regional anesthesia. Type II diabetes was the comorbidity that also showed a correlation with technical difficulty. It was observed that obese patients (mostly women) required at least two attempts to achieve a successful block.

Conclusion
The study confirms a correlation between obesity (at any grade) and difficulty in performing neuroaxial regional anesthesia. Type II diabetes was the comorbidity that also showed a correlation with technical difficulty. It was observed that obese patients (mostly women) required at least two attempts to achieve a successful block.

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Conflict of Interest
Not available

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References

1. Lebuffe G, Andrieu G, Wierre F, *et al*. Anesthesia in the obese. J Visc Surg. 2010 Oct;147(5):e11–9.
2. Kaye A, Lingle B, Brothers J, *et al*. The patient with obesity and super-super obesity: perioperative anesthetic considerations. Saudi J Anaesth. 2022;16(3):332–8.
3. De La Cuadra JC, Altermatt F, Kychenthal C. Anestesia espinal: parte I. Historia. Rev Chil Anest. 2020;49(2):393–7.
4. Gómez R. Historia de la anestesiología. Rev Mex Anestesiol. 2021;44(4):288–99.
5. Rosales K, Coto C, Naranjo S. Ultrasonido en anestesia neuroaxial. Rev Med Sinergia. 2020;5(12):e619.
6. Zehao W, Yun W. Development of guidance techniques for regional anesthesia: past, present and future. J Pain Res. 2021;14:1631–41.
7. Morante A, Ulloa V, Luna M, *et al*. Anestesia regional neuroaxial. RECIAMUC. 2022;6(4):21–30.
8. Saquipay H, Bravo R. Ventajas del uso de anestesia epidural en cirugía abdominal. Rev Cient Mundo Investig Conoc. 2021;5(4):75–86.
9. Hio-Jin K, Won H, Hyung W, *et al*. Obesity is independently associated with spinal anesthesia outcomes: a prospective observational study. [Journal name missing]. [Year];[volume(issue)]:[pages].
10. Higgins G. Anestesia regional en el paciente con obesidad. Anestesia en Obesidad. 2019;42(Suppl 1):S50–2.
11. Vargas A. Validación y algoritmo del neuroeje en anestesia. Anes Mex. 2019;31(2):59–66.
12. Castillo L. Cuerpo extraño en región neuroaxial: reporte de caso. Rev Chil Anest. 2022;51(6):736–9.
13. Jay B. Recent advances in anesthesia of the obese patient. F1000Res. 2018;1(1):1–5.
14. Gaona R. Autoidentificación de la cintura útil en la ubicación del sitio de punción en anestesia neuroaxial de paciente obstétrica con obesidad clase III. Rev Mex Anestesiol. 2021;44(4):250–7.
15. Nazar JC, Coloma DR, Contreras CJ, Molina PI, Fuentes HR. [Title missing]. [Journal name missing]. [Year];[volume(issue)]:[pages].
16. Aguado MA, Echeverri MF, Faitot V, Ourchane R, Dahmani S, Magheru M, *et al*. An observational study of factors leading to difficulty in resident anaesthesiologists identifying the epidural space in obstetric patients. Int J Obstet Anesth. 2011;20(2):124–7.

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