Scholars Journal of Applied Medical Sciences
Abbreviated Key Title: Sch J App Med Sci
ISSN 2347-954X (Print) | ISSN 2320-6691 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Anaesthesia-resuscitation

Spinal Anaesthesia for Caesarean Section: Prospective and Comparative Study of the Use of Hyperbaric Bupivacaine: 10 mg Versus 7.5 mg

Ba Elhadji Boubacar[1]*, Ndiaye Pape Ibrahima[1], Isambatra Miharisoa[1], Gaye Ibrahima[1], Barboza Dénis[2], Leye Papa Alassane[1], Bah Mamadou Diawo[1], Kane Oumar[1]

[1]Faculty of Medicine, Cheikh Anta Diop University, Dakar, Senegal
[2]Assane Seck University of Ziguinchor, Ziguinchor 27000, Senegal

DOI: https://doi.org/10.36347/sjams.2025.v13i01.043 | **Received:** 19.12.2024 | **Accepted:** 23.01.2025 | **Published:** 25.01.2025

***Corresponding author:** Ba Elhadji Boubacar
Faculty of Medicine, Cheikh Anta Diop University, Dakar, Senegal

Abstract **Original Research Article**

Introduction*:** Spinal anesthesia in obstetrics is indicated for uncomplicated or semi -urgent elective cesarean section outside of labor or during labor and in the absence of an epidural catheter. Although the trend is toward the use of a dose of bupivacaine increasingly weak, the search for the optimal dose remains a permanent concern in our hospital structures. The aim of this work was to compare the clinical effects of two hyperbaric Bupivacaine protocols (7.5 mg versus 10 mg) during spinal anesthesia for cesarean section. ***Patients and Methods*:** This is a prospective, descriptive and analytical study, conducted at the regional hospital of Ourossogui over a period of 3 months, involving 42 patients scheduled for cesarean section under spinal anesthesia. The population was divided into two equal groups (G1: 10 mg; G2: 7.5 mg) with random selection without morphological discrimination, according to a regular sequence: G1-G2; G1-G2... ***Results: The mean age was 24.79 years in our series (23.8 years for G1 and 24.6 years for G2). The following were observed in the 10 mg group (G1): a greater variation in blood pressure, a higher mean consumption of ephedrine, a longer duration of motor blockade and a higher incidence of complications of spinal anesthesia. However, in this group (G1), it was noted that the parturient was more comfortable during the high points (less pain) of the surgery. Furthermore, there was no correlation between the dose of Bupivacaine and the intensity of the motor blockade, as well as the sensory level. We did not record any major complications such as postpartum hemorrhage, maternal or perinatal death. All patients were transferred to hospital at the end of the procedure. ***Conclusion*:** In this preliminary work, the dose of 10 mg seems to be preferable due to the absence of major complications and better comfort for the parturient.

Keywords: Spinal anesthesia, cesarean section, hyperbaric bupivacaine, comparison.

INTRODUCTION

Cesarean section is a surgical procedure aimed at delivering the child abdominally in a pregnant woman, to effectively prevent maternal and perinatal morbidity and mortality [1]. It is performed, among other things, under locoregional anesthesia providing perioperative and postoperative maternal and fetal safety, child reception and postoperative analgesia [2]. Spinal anesthesia for cesarean section is indicated in uncomplicated elective surgery, in semi-urgent surgery outside of labor or during labor and in the absence of an epidural catheter [2]. It can cause a significant drop in blood pressure in the mother during a cesarean section. Reducing the extension of the spinal block with low doses of 0.5% hyperbaric bupivacaine should protect against the effects of sympathetic denervation [3]. Thus, given the disparity of doses used in our structures in Senegal, we proposed to conduct this study to evaluate the clinical effects of the two doses of hyperbaric bupivacaine 0.5% (10 mg versus 7.5 mg) most frequently used.

PATIENTS AND METHODS

This is a prospective, comparative, descriptive study with analytical aims conducted over a period of 3 months, from April 1 to June 30, 2022. The study population consisted of parturients scheduled to undergo a cesarean section under spinal anesthesia at the anesthesia-resuscitation department of the Ourossogui regional hospital center (CHRO). We included patients who had an indication for a scheduled or emergency cesarean section. deferred (not requiring maternal -fetal rescue cesarean section), without contraindication to spinal anesthesia, having given informed consent and

measuring more than 150 cm. Failure of spinal anesthesia was the only exclusion criterion in our series. A total of 42 patients were selected, divided into two equal groups: G1 (group 1: 10 mg); G2 (group 2: 7.5 mg). The choice was made as the patients were admitted and the sequence was regular: G1-G2; G1-G2; G1-G2 …

Upon admission to the maternity ward, the patient was welcomed by a midwife and then placed on a bed. Subsequently, an IV line was inserted, the biological assessment (in the absence of a prior biological assessment) was taken and a bladder catheter was inserted. The anesthetist carried out an emergency pre-anesthetic consultation before the patient was transferred to the operating room.

In the operating room, once the checklist was completed, the patient was placed on the operating table in left lateral decubitus. Monitoring was performed using a multiparametric scope: ECG with 3 leads, non-invasive arterial pressure (PANI) and pulsed oxygen saturation.

Vascular filling was initiated with isotonic saline at a rate of 10 ml/kg for all parturients. Antibiotic prophylaxis was administered 30 min before incision, based on 2nd generation cephalosporin. Hyperbaric bupivacaine 0.5% was the local anesthetic (LA) used at a rate of 10 mg or 7.5 mg (depending on group, G1 or G2) with 25 µg of fentanyl as an adjuvant for all patients. The puncture was performed with 25 G pencil-point spinal needles. Monitoring of hemodynamic variations after the injection of the LA was performed by measuring blood pressure (non-invasive) at the 2nd ^{min}, then every 5 minutes. Pain assessment during the high points of surgery was performed according to the numerical pain scale score. Motor block power was assessed using the Bromage score. The sensory level was determined bilaterally by a cold sensation test using an ice cube, with an assessment at the 3rd ^{min}, 5th ^{min}, 7th min, 10th ^{min}, 15th ^{min} and 20th ^{min}. Correction of arterial hypotension related to spinal anesthesia involved vascular filling with crystalloids and ephedrine in bolus of 6 mg every 5 minutes, with a MAP target greater than 65 mmHg. An oxytocin injection protocol at a rate of 10 IU IVD, followed by 10 IU continuous infusion in 5% glucose saline was performed after clamping the umbilical cord. Misoprostol 800 µg could be used rectally at the end of the procedure to enhance uterine retraction in cases of uterine overdistension, macrosomia, multiple pregnancy, and uterine myomatosis. The main points of surgery were: incision, retraction of the abdominal wall muscles, hysterotomy, fetal extraction, delivery, uterine suture, and layer-by-layer parietal closure.

Postoperative monitoring elements were: heart rate, noninvasive blood pressure, pulse oxygen saturation, diuresis, level of uterine retraction, vaginal bleeding and condition of the surgical dressing. At the end of the procedure, patients were transferred to the postoperative care room (PCCU) for postoperative monitoring. Postoperative treatment was administered parenterally, combining: analgesia based on paracetamol (1 g/6h IVL), nefopam (20 mg/6h IVL) and an NSAID (every 12h, in the absence of contraindications). Thrombophylaxis based on enoxaparin 4000 IU/day subcutaneously was started 6 to 8 h after the procedure in the absence of contraindications and bleeding.

The parameters studied and compared were: epidemiological data, surgical history and terrain, obstetric history (pregnancy, parity), preoperative assessment data (clinical and biological), intraoperative data (variations in systolic blood pressure, pain during the high points of surgery, motor block, sensory block, treatment of arterial hypotension, duration of surgery, APGAR score at the first minute after extraction), postoperative data (complications of anesthesia, duration of motor block, patient outcome).

The data were collected using questionnaires designed for this purpose.

The analytical study was done with cross-tabulations. For the interpretation of the data, the KHI2 test was used with a significance threshold of 5%, i.e. a p-value < 0.05.

RESULTS

During the study period, 573 deliveries were performed, including 236 by cesarean section, a rate of 41.18%. Cesarean sections were performed under spinal anesthesia in 152 patients, or 64.4%.

After sampling, our work focused on a population of 42 parturients divided into two equal groups (21 patients X 2), very young with a mean age of 24.79 years +/- 6.2, a median of 24 years and a predominance of age group between 16 and 25 years, (see Figure 1). The mean height was 162 cm [160-173 cm] with a predominance of the interval [161-165 cm [or 28.5% (Figure 2). The mean BMI was 23.05 kg/m² with extremes of 16.9 and 28.2 kg/m². Only two cases of obesity were noted in our series, or 4.76%. The distribution of patients according to the degree of urgency was as follows: 52.4% of cases in semi - emergency; 35.7% of emergency cases; 11.9% of prophylactic cases.

Preoperatively, we noted a higher mean height in group 1 (166.2 cm > 157.8 cm). The demographic and preoperative parameters of patients in each group are shown in Table 1.

After comparing the two groups of parturients, the analytical results were:

- The 10 mg bupivacaine protocol resulted in more variation in SBP compared to the 7.5 mg protocol, but the difference was not statistically significant (Table 2).

- In terms of frequency, less pain or discomfort was noted during the high points of surgery with group 1 (10 mg). However, significant dependence was only observed at the time of delivery (p = 0.01) (see table 3).
- The difference between the 10 mg and 7.5 mg protocols in motor block intensity and sensory level after 10 minutes of spinal injection was not statistically significant with p-values of 0.96.
- The mean duration of motor block during the Bupivacaine 10 mg protocol was 167.90 min versus 130.24 min with the 7.5 mg protocol. This difference was statistically significant with a p-value of 0.00138 (Figure 3).
- Vasoconstrictor requirements were significantly higher with the 10 mg dose, resulting in a mean ephedrine consumption 2.7 times higher and a significant p-value of 0.00276 (see Figure 4).
- Post-spinal headaches were 2.5 times more frequent with the 10 mg group and the relationship was statistically significant at p = 0.02. The distribution of other complications of spinal anesthesia did not show any significant difference (see Table 4).
- The mean APGAR score at the first minute for group 1 was 8, and 7 for group 2. There was no significant dependence between APGAR score at the first minute and the dose of bupivacaine (p-value = 0.09).

We did not observe any major maternal and fetal complications (hemorrhage, maternal or perinatal death) during or after surgery in our series.

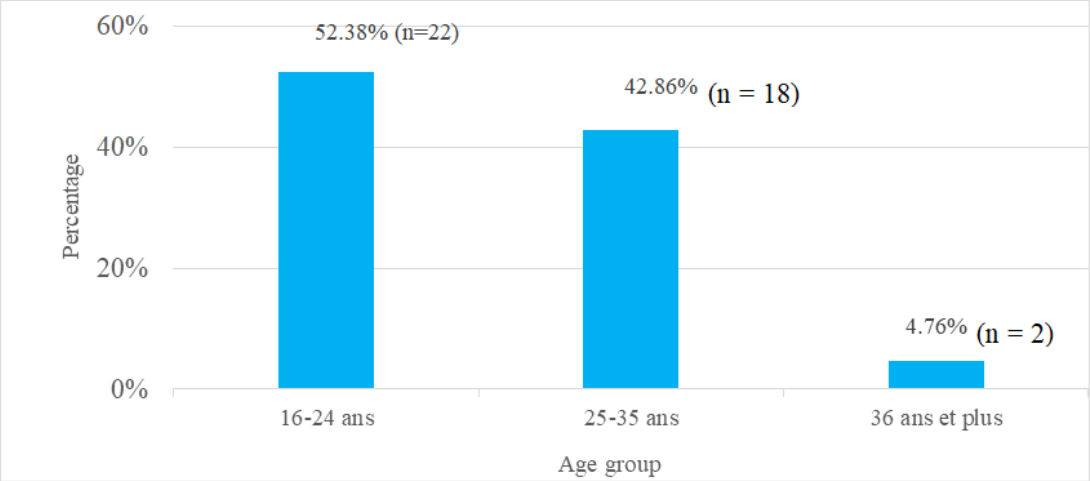

Figure 1: Distribution of patients by age group

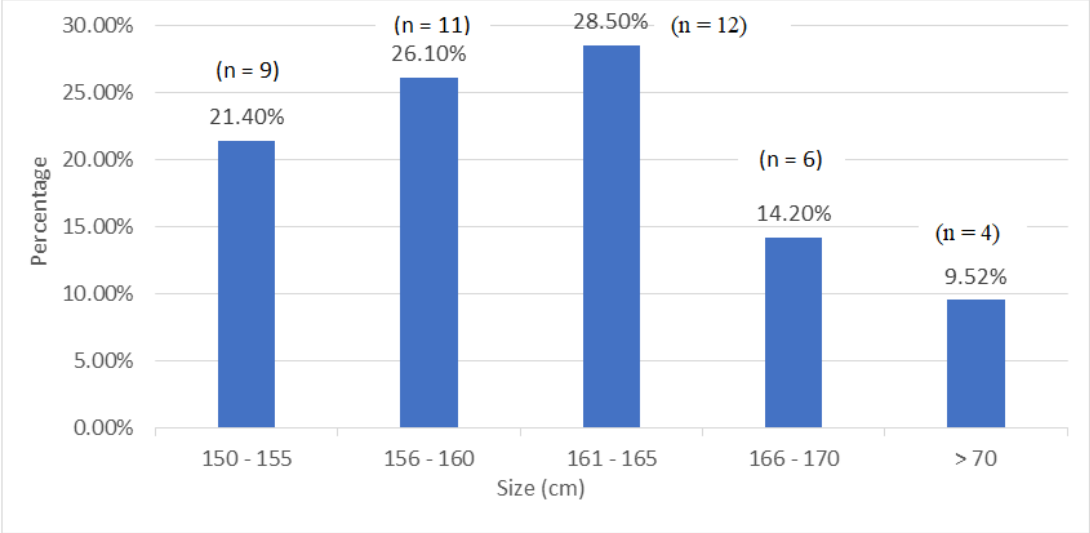

Figure 2: Distribution of patients according to size

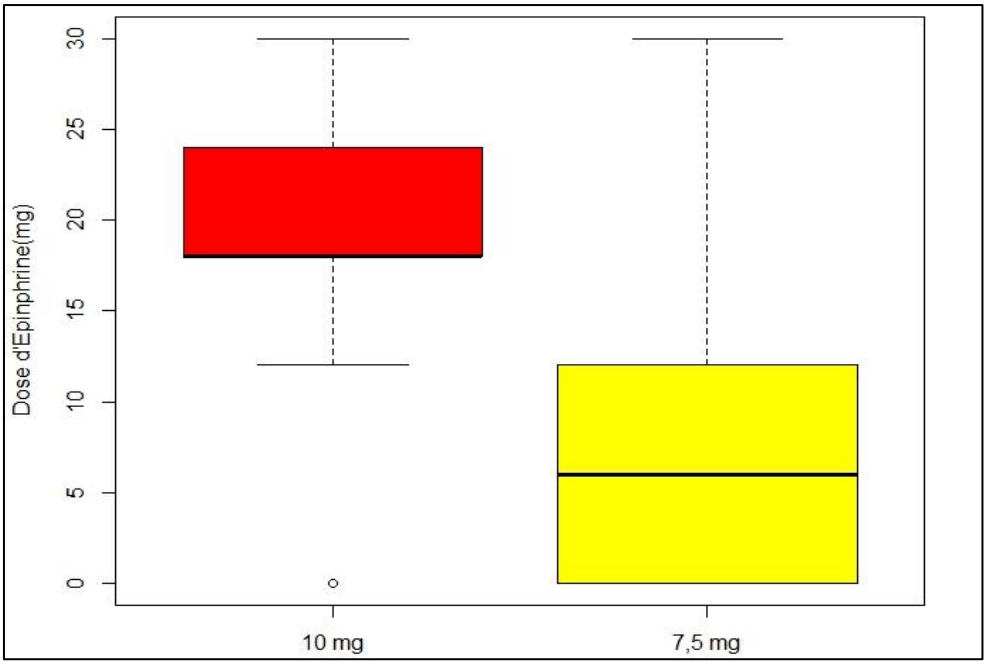

Figure 3: Comparative analysis of the dose of ephedrine used during the treatment of hypotension

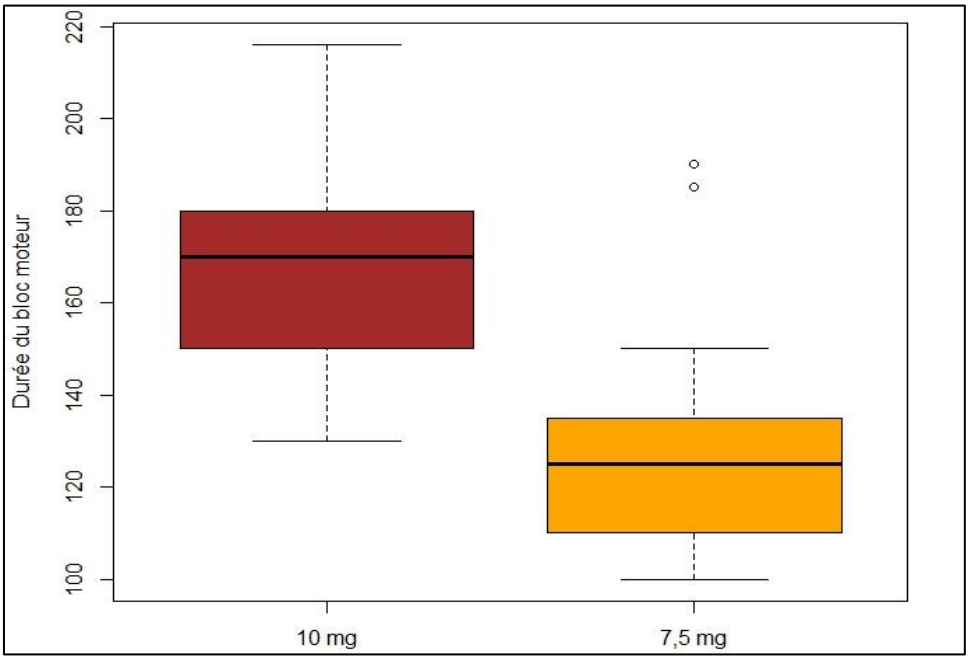

Figure 4: Comparative analysis of engine block duration

Table 1: Distribution of the 02 groups of patients according to epidemiological data

	Group 10 mg	**Group 7.5 mg**
Effective	n = 21 parturients	n = 21 parturients
Average age	23.88 years old	24.61 years old
Size	166.2 cm	157.8 cm
BMI	24.8 kg/m²	21.7 kg/m²
Lands	Sickle cell disease: 1 (7.12%) Obesity: 1 (7.76%)	Sickle cell disease: 1 (8.41%) Obesity: 1 (7.14%)
Surgical history	Cesarean section: 7 (42%)	Cesarean section: 11 (43.34%)
Gesture	Primigravida: 6 (15.18%) Paucigest : 7 (17.34%) Multigesture: 8 (19.34%)	Primigravida: 6 (14.67%) Paucigest : 11 (25.14%) Multigesture: 4 (9.2%)

Parity	Primiparous: 7 (14.23%) Pauciparous : 8 (22.46%) Multiparous: 6 (14.4%)	Primiparous: 6 (13.67%) Pauciparous : 11 (24.97%) Multiparous: 4 (11.51%)
Term of pregnancy (SA)	38.4	40.2
Number of CPN	4+/-2	4+/-1
Comorbidities	Pregnancy-induced hypertension: 6 (28%) Preeclampsia: 3 (9%)	Pregnancy-induced hypertension: 4 (21%) Gestational diabetes: 3 (7.14%)
Indications for cesarean section	Fetal: 9 (38% 9) Maternal -fetal: 14 (29%) Kindergarten: 26 (36%)	Fetal: 5 (28.17%) Maternal -fetal: 14 (29.12%) Kindergarten: 11 (18%)
Degree of urgency	Semi-emergency: 12 (34%) Emergency: 7 (18%) Prophylactic: 2 (6%)	Semi-emergency: 10 (18%) Emergency: 8 (19.1%) Prophylactic: 3 (6.9%)

Table 2: Comparative analysis on the variation of PAS after RA injection

Time	**Protocol**		**p-value**
	10 mg (%)	**7.5 mg (%)**	
2 minutes	11.62	6.38	0.09
5 minutes	21.52	14.28	0.051
10 minutes	25.33	17.76	0.08
15 minutes	21.48	17.42	0.27
20 minutes	21.71	14.90	0.14

Table 3: Comparative analysis of pain during the key moments of surgery

Protocol	**Yes (%)**	**No (%)**	**Chi2**	**P**	**GOLD**	**95% CI**
Incision						
10 mg	4 (19.05)	17 (80.95)	2.78	0.09		
7.5 mg	9 (42.86)	12 (57.14)				
Muscle spacing						
10 mg	15 (71.43)	6 (28.57)	0.53	0.47		
7.5 mg	17 (80.95)	4 (19.05)				
Hysterotomy						
10 mg	5 (23.81)	16 (76.16)	2.59	0.11		
7.5 mg	10 (47.62)	11 (52.38)				
Extraction of the fetus						
10 mg	10 (47.62)	11 (52.38)	2.47	0.11		
7.5 mg	16 (76.19)	5 (23.81)				
Deliverance						
10 mg	0	21 (100)	5.67	0.01	0	Not defined
7.5 mg	5 (23.81)	16 (76.19)				
Suture of the uterus						
10 mg	0	21 (100)	1.13	0.06		
7.5 mg	4 (19.04)	17 (80.95)				
Closure of the peritoneum						
10 mg	0	21 (100)	1.02	0.32		
7.5 mg	1 (4.76)	20 (95.24)				
Skin closure						
10 mg	0	21 (100)	1.02	0.31		
7.5 mg	1 (4.76)	20 (95.24)				

Table 4: Comparative analysis of complications of anesthesia

Protocol	**Yes (%)**	**No (%)**	**Chi 2**	**P**	**GOLD**	**95% CI**
Nausea-vomiting during surgery						
10 mg	7 (33.33)	14 (66.67)	2.93	0.08		
7.5 mg	2 (9.52)	19 (90.47)				
Postoperative nausea-vomiting						
10 mg	11 (52.38)	10 (47.62)	3.63	0.06		
7.5 mg	5 (23.81)	16 (76.19)				

Peroperative chills						
10 mg	2 (9.52)	19 (90.48)	2.1	0.15		
7.5 mg	0	21 (100)				
Postoperative chills						
10 mg	14 (66.67)	7 (33.33)	1.55	0.21		
7.5 mg	10 (47.62)	11 (52.38)				
Headache						
10 mg	11 (52.38)	10 (47.62)	5.08	0.02	4.67	1.17-18.68
7.5 mg	4 (19.05)	17 (80.95)				

DISCUSSION

During our study period, the cesarean rate out of the total number of deliveries was 41.18%, of which 64.4% were performed under spinal anesthesia. This rate was similar to that of Nehme M [4] in 2020, which found a rate of 40.56%. In 2021 in Saint-Louis, Dia CA [5] recorded a higher rate (53.7%) compared to our study. According to the WHO, the optimal cesarean rate should be between 10 and 15% of births even for developed countries [6].

Our study population was very young with an average age of 24.79 years. However, similar studies found in the literature have objectified a higher average age between 27 and 33 years [7-9].

The height of the parturients was slightly small with an average of 162 cm [160-173 cm]. This trend was confirmed in other works. Indeed Ben David [9] found an average height of 163.9 cm, Gunusen I [10] at 161.8 cm and Turhanoglu S [8] at 161.6 cm.

In our series, the indications for cesarean section were dominated by the fetal prognosis (73.79%). On the contrary, Dia CA [5] in 2021 had objectified in his study a predominance of dystocia (50.3%) [5] and Gierczak C [11] a predominance of the scarred uterus (35.9%).

The hemodynamic impact associated with the induction of spinal anesthesia is secondary to a blockade of the preganglionic sympathetic system, responsible for arterial hypotension and bradycardia [12]. The variation in SBP in our series was more marked in group 1 (10 mg). This result was superimposable with that of Ben David [9] (10 mg VS 5 mg) who noted a higher incidence of hypotension with the 10 mg protocol. At the same time, the average consumption of ephedrine seemed to be dose-dependent in our study. This statement has been found in the literature. Indeed, the consumption of vasoconstrictors during spinal anesthesia increases with the dose of bupivacaine administered.

Like Ben David [9], we noted better comfort regarding pain during the key moments of surgery in group 1. However, in his comparative study on the efficacy of hyperbaric Bupivacaine 0.5% intrathecally at 8 mg, 10 mg or 12 mg, Choi DH [13] concluded that there was no pain during cesarean section from a dose of 8 mg.

Unlike Ben-David B [9] (10mg VS 5mg) and Vercauteren MP [14] (12.5 mg > VS 4.5 mg), we did not find any dependence between the dose and the intensity of the motor block. However, the relationship between the dose and the duration of this motor block was significant in our series and in the data found in the literature [1, 15, 16].

The strong peritoneal stimulation existing during cesarean section requires obtaining a higher level of anesthesia, classically at T5, to eliminate the risk of residual visceral pain during cesarean section [1, 17]. Even if the dose did not seem to impact on the sensory level in our work, other studies have objectified a sensory level and an onset time proportional to the dose [9, 18].

Regarding complications of spinal anesthesia in our parturients, we observed a higher incidence in group 1. The frequency of nausea-vomiting was proportional to the dose of bupivacaine in our series. This was confirmed by the work of Bryson GL [16] and Gunusen I [10]. Perioperative and postoperative chills were more marked with group 1. This trend was confirmed in the work of Choi DH [13]. Even if we did not find in the literature [8, 19] a link between the incidence of headaches and the dose of bupivacaine, our work has objectified a more marked frequency in group 1.

We did not note any correlation (p-value=0.09) between the APGAR score at extraction and the dose of Bupivacaine used for spinal anesthesia. This conclusion was found in the work of Turhanoglu [8] and that of Tyagi [20].

CONCLUSION

Spinal anesthesia is the reference technique for cesarean section, due to the ease of the technique, its low mortality rate, its low systemic toxicity and its extreme effectiveness in muscle relaxation. We did not observe any major complications in our series. The 10 mg dose was associated with a higher frequency of minor complications of spinal anesthesia, but nevertheless offered better intraoperative comfort for the parturient.

Remerciements:

- Anesthesia-resuscitation department of the regional hospital of Ourossogui
- Anesthesia-resuscitation department of the Fann University Hospital

Conflicts of Interest: None

REFERENCES

1. Chassard, D., & Bouvet, L. (2015). Anesthesia for cesarean section. *Anesth Resuscitation*, *1*(1), 10-18.
2. Pottier, O., Deman, P., Richart, P., Quintin, C., Vallet, B., & Ducloy-Bouthors, A. S. (2011). Anesthesia for cesarean and resuscitation. 53rd national congress of anesthesia and resuscitation. SFAR 2011.
3. Casati, A., Fanelli, G., Aldegheri, G., Colnaghi, E., Casaletti, E., Cedrati, V., & Torri, G. (1999). Frequency of hypotension during conventional or asymmetric hyperbaric spinal block. *Regional anesthesia and pain medicine*, *24*(3), 214-219.
4. Nehme, M. (2019). Perioperative management of emergency cesarean sections at the maternity ward of Aristid le Dantec hospital regarding 254 cases from September 1, 2018 to August 31, 2019. Thesis in Anesthesia-Resuscitation. Dakar, UCAD 2020; n°199.
5. Day, C. A. (2021). Anesthesia for emergency cesarean section at the Saint-Louis regional hospital center regarding 195 cases. DES Anesthesia-resuscitation thesis. Dakar, UCAD; n°185.
6. World Health Organization. Trends in maternal mortality 2000–2017. Estimates from WHO, UNICEF, UNFPA, World Bank Group, and United Nations Population Division. WHO; 2109.
7. Leo, S., Sng, B. L., Lim, Y., & Sia, A. T. (2009). A randomized comparison of low doses of hyperbaric bupivacaine in combined spinal-epidural anesthesia for cesarean delivery. *Anesthesia & Analgesia*, *109*(5), 1600-1605.
8. Turhanoglu, S., Kaya, S., & Erdogan, H. (2009). Is there an advantage in using low-dose intrathecal bupivacaine for cesarean section?. *Journal of anesthesia*, *23*(3), 353-357.
9. Ben-David, B., Miller, G., Gavriel, R., & Gurevitch, A. (2000). Low-dose bupivacaine-fentanyl spinal anesthesia for cesarean delivery. *Regional Anesthesia & Pain Medicine*, *25*(3), 235-239.
10. Gunusen, I., Karaman, S., Sargin, A., & Firat, V. (2011). A randomized comparison of different doses of intrathecal levobupivacaine combined with fentanyl for elective cesarean section: prospective, double-blinded study. *Journal of anesthesia*, *25*, 205-212.
11. Gierczak, C. (2021). Spinal anesthesia for cesarean section: multicenter descriptive study. Thesis Med. France; University of Clermont Auvergne 2021.
12. Tensière, A., Rackelboom, T., & Migon A. (2012). Fundamentals of analgesia and anesthesia in obstetrics. *EMC*, *9*(3).
13. Choi, D. H., Ahn, H. J., & Kim, M. H. (2000). Bupivacaine-sparing effect of fentanyl in spinal anesthesia for cesarean delivery. *Regional Anesthesia & Pain Medicine*, *25*(3), 240-245.
14. Vercauteren, M. P., Coppejans, H. C., Hoffmann, V. L., Saldien, V., & Adriaensen, H. A. (1998). Small-dose hyperbaric versus plain bupivacaine during spinal anesthesia for cesarean section. *Anesthesia & Analgesia*, *86*(5), 989-993.
15. Bouchnak, M., Belhadj, N., Chaaoua, T., Azaiez, W., Hamdi, M., & Maghrebi, H. Spinal anesthesia for cesarean section: does injection speed influence the incidence of hypotension?.
16. Bryson, G. L., MacNeil, R., Jeyaraj, L. M., & Rosaeg, O. P. (2007). Small dose spinal bupivacaine for Cesarean delivery does not reduce hypotension but accelerates motor recovery. *Canadian Journal of Anesthesia*, *54*(7), 531.
17. Aya, G., Fayoumeu, F., & Benhamou, F. (2014). Protocol in obstetric anesthesia and analgesia. Elsevier Masson, Paris, 2015p.
18. Ginosar, Y., Mirikatani, E., Drover, D. R., Cohen, S. E., & Riley, E. T. (2004). ED50 and ED95 of intrathecal hyperbaric bupivacaine coadministered with opioids for cesarean delivery. *Anesthesiology*, *100*(3), 676-682.
19. Cesur, M. E. H. M. E. T., Alici, H. A., Erdem, A. F., Borekci, B., & Silbir, F. (2008). Spinal anesthesia with sequential administration of plain and hyperbaric bupivacaine provides satisfactory analgesia with hemodynamic stability in cesarean section. *International journal of obstetric anesthesia*, *17*(3), 217-222.
20. Tyagi, A., Kakkar, A., Kumar, S., Sethi, A. K., & Salhotra, R. (2012). ED50 of hyperbaric bupivacaine with fentanyl for cesarean delivery under combined spinal epidural in normotensive and preeclamptic patients. *Regional Anesthesia & Pain Medicine*, *37*(1), 40-44.