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Original Research Article

The Efficacy of Transverse Abdominal Plane Block with Bupivacaine Combined with Dexamethasone for the Management of Post-Caesarean Pain

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Abstract: ***Introduction:*** Caesarean section (CS) is a commonly performed major surgical procedure that causes significant postoperative pain. The objective of this study was to evaluate the efficacy of the transverse abdominal plane block (TAPB) in the management of post-caesarean pain at the Souro Sanou Teaching Hospital (CHUSS) of Bobo Dioulasso. ***Methodology:*** This was a single blind randomised clinical trial. One hundred patients admitted for CS under spinal anaesthesia were randomised into two groups using the sealed envelope method. The intrathecal morphine (ITM) group received 100 µg morphine intrathecally at induction and the TAPB group a bilateral TAPB at the end of the caesarean section with 20 ml of 0.25% bupivacaine and 4 mg dexamethasone in the same syringe on each side. The proportion of mild pain, numeric rating scale (NRS) < 3 on mobilisation at 24 hours post-caesarean was the primary outcome. ***Results:*** The 2 groups were comparable for socio-demographic and clinical characteristics. The mean age of the patients was 28.14 ± 6.34 years and 29.08 ± 5.58 years (p=0.43). At rest at 24 hours post-op, the proportion of NRS < 3 was 100% for the TAPB group and 88% for the ITM group (p=0.49). On mobilisation at 24 hours post-op, 96% of patients in the TAPB group and 74% in the ITM group (p=0.002) had a NRS < 3. At rest at 48 hours post-op, it was 100% for the TAPB group and 88% for the ITM group (p=0.027). On mobilisation at 48 hours post-op, it was 94% for the TAPB group and 70% for the ITM group (p=0.002). Postoperative nausea and vomiting (PONV) were present in 50% of patients in the ITM group and 6% in the TAPB group (p<0.001). ***Conclusion*****:** TAPB significantly reduced pain scores on mobilisation in the post-caesarean period with a significant reduction in PONV.

Keywords: Caesarean Section-Postoperative Pain-Transverse abdominal plane block-Burkina Faso.

INTRODUCTION

Caesarean section (CS) is a commonly performed major surgical procedure that results in significant postoperative pain and patient dissatisfaction [1]. Postoperative pain not only causes psychological torture to patients, but also has a negative impact on patient rehabilitation after surgery and wound recovery [2]. Pain after CS is classified as severe with maximum intensity during the first 48 postoperative hours, hence the need to explore effective analgesic methods for parturient women after CS [3].

Intrathecal morphine (ITM) is considered the gold standard for the management of post-caesarean pain [4]. Although ITM has obvious analgesic benefits, its side effects such as nausea, vomiting, itching and even respiratory depression limit its subsequent application [5]. Alternative techniques are therefore required. With the rapid development of ultrasound technology, the use of transverse abdominal plane block (TAPB) in locoregional anaesthesia is becoming increasingly common. Randomised controlled trials have demonstrated the efficacy of TAPB as a component of a multimodal regimen in providing postoperative analgesia after abdominal surgery, including caesarean

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delivery [6, 7]. Two metanalyses in 2012 [8] and 2021 [2] compared the analgesic effect of TAPB and ITM after CS. The results of these metanalyses indicated that ITM produced a superior analgesic effect compared with TAPB at rest and during movements 24 hours after the operation. However, in most of these studies, the local anaesthetic was used without adjuvant in the TAPB protocols. This raises the question of whether the addition of dexamethasone to the local anaesthetic during TAPB could improve pain scores after CS. The aim of the present study was to evaluate the analgesic efficacy of TAPB using the combination of bupivacaine and dexamethasone in caesarean delivery under spinal anaesthesia.

METHODOLOGY

The protocol was authorised by the Burkina Faso Health Research Ethics Committee (number 2022-09-209, on 05 October 2022) and by the CHUSS administration (on 27 June 2022). The study was registered in clinicaltrial.gov (NCT05588752 on 19 October 2022). Written consent was obtained for each patient included in the study.

This was a single-blind randomised clinical trial which ran from 20 October to 20 December 2022. Parturient women aged at least 18 years and classified as ASA I or ASA II who underwent caesarean section under spinal anaesthesia at the Souro Sanou Teaching Hospital (CHUSS) in Bobo-Dioulasso were included in the study. Parturient women with cognitive disorders, chronic preoperative pain, allergy to local anaesthetics and morphine, and code-red caesarean sections were not included in the study. Patients with total or partial failure of spinal anaesthesia, irregular postoperative follow-up, early postoperative complication (< 48 hours), or failure of TAPB were excluded from the study. The sample size was calculated using the BiostaTGV application with the following data: the proportion of mild pain was 47.1% at the 24th post-caesarean hour with the ITM protocol at the CHUSS [9] ; a difference of 30% between the two protocols TAPB and ITM; a unilateral significant threshold (1-alpha) of 95%; a power (1-beta) of 90%. The minimum size calculated was 43 patients for each group. To take account of the risk of exclusion, 50 patients were included in each group.

Randomisation

Patients were randomised at the pre-anaesthetic visit into the ITM and TAPB groups. They were randomised in groups of four so that in each group of four patients there were two patients for the ITM protocol and two patients for the TAPB protocol. Sealed envelopes containing the patient number and randomisation group were prepared in advance. To ensure randomisation, the envelopes were opened consecutively: envelope 1 containing the protocol for the first patient, envelope 2 containing the protocol for the second patient, and so on. Randomisation was carried out by an anaesthetist who was not involved in data collection.

Anaesthesia protocol

All patients were seen at the pre-anaesthetic consultation and/or the pre-anaesthetic visit for a caesarean section, and were given explanations about the strategy for managing post-operative pain, especially the need to call on staff in the event of pain. The numerical rating scale (NRS) chosen as the assessment scale was presented to them, stressing the importance of the number the patient was going to give. This number could be given verbally or by gesture. The patients were told that the treatment to be instituted would depend on the NRS's assessment of the pain. This explanation was repeated at the pre-anaesthetic visit (scheduled caesarean section) and immediately post-operatively for all patients. When the patient did not speak a language spoken by the practitioner, an interpreter was used (a member of the hospital's healthcare team or the patient's family). In the operating theatre, all patients received haemodynamic monitoring, continuous pulsed oxygen saturation and an 18-gauge venous line. Spinal anaesthesia was performed between L3-L4 or L4-L5 with a 25 gauge needle in a seated parturient woman. The Tuffier line was used as the location technique. Patients in the ITM protocol received 7.5 mg of 0.5% isobaric bupivacaine, 25 µg of fentanyl and 100 µg of morphine at induction. Patients in the TAPB protocol received 7.5 mg of 0.5% isobaric bupivacaine and 25 µg of fentanyl at induction; then, at the end of the caesarean section, bilateral TAPB with 20 ml of bupivacaine combined with 4 mg dexamethasone on each side using an ultrasound scanner (EDAN brand) equipped with a 12 MHz probe protected by a sterile plastic envelope via the subcostal route. The blocks were performed by an intensive care anaesthetist and a senior resident, due to the constraints of emergency caesarean sections. After spinal anaesthesia, non-invasive blood pressure (NIBP) was monitored every minute for fifteen minutes and then every three minutes. Sensory level was assessed using the cold test after spinal anaesthesia and was satisfactory if the sensory level was T4-T6. The Bromage score was also assessed before incision. Incisions during caesarean sections were made using the Joel Cohen technique. Intraoperative hypotension was managed with boluses of ephedrine combined with crystalloid filling (0.9% isotonic saline or ringer lactate).

Postoperative period

At the end of the caesarean section, the parturient women were admitted directly to the post-op ward. Data were collected by two trained anaesthesia residents using a questionnaire. The questionnaire was completed by hand. Preoperative data were taken from the pre-anaesthetic consultation form. Intraoperative data were taken from the anaesthesia record. Postoperatively, data were collected from the patient and from the medical record. During the post-operative follow-up visits, the patient's pain was assessed using the NRS. Pain was assessed at 2, 4, 6, 12, 24 and 48 hours post-op at rest and during mobilisation. After surgery, postoperative adverse events such as nausea, vomiting

and pruritus were assessed using a categorical scale. After surgery, the patient was monitored continuously for two hours in the post-op ward, allowing continuous recording of oxygen saturation, heart rate and NIBP every fifteen minutes. After the first two hours, postoperative monitoring was standard. In accordance with the department's protocol, postoperative analgesia consisted of: slow intravenous paracetamol 1g/6h from the 2nd post-caesarean hour; tramadol 1 mg/kg/8h from the 2nd post-caesarean hour; intrarectal diclofenac 100mg/12h from the 6th postoperative hour. Patients with NRS scores greater than 6 were managed with intravenous morphine titration.

Assessment criteria

The primary endpoint was the proportion of patients with mild pain on mobilisation at the 24th postoperative hour. Pain was considered mild when it was less than 3 on the numerical rating scale (NRS < 3). The secondary endpoints were: the proportion of mild pain at rest at the 24th postoperative hour; the proportion of mild pain on mobilisation at the 48th postoperative hour; the proportion of mild pain at rest at the 48th postoperative hour; the incidence of post-operative nausea and vomiting in the first 48 hours post-operatively; the incidence of pruritus in the first 48 hours post-operatively; and the maternal satisfaction rate with pain management in the first 48 hours post-operatively.

Data collection and statistical analysis

The data were entered and analysed using Epi-Data software version 3.1. Data were studied using the mean (with standard deviation) or median (with interquartiles) for quantitative variables. Qualitative variables were described by their proportion. Proportions were compared using the Chi 2 test. Means and medians were compared using Student's t-test. A value of $p < 0.05$ was considered statistically significant.

RESULTS

A total of 105 patients were eligible for the study (Figure 1). The preoperative clinical characteristics of the patients are summarised in Table I. Caesarean sections were performed urgently in 78% of cases (Table II). The proportion of mild pain at rest was similar in the 2 groups (Table III), whereas it was higher in the TAPB group on mobilisation (Table IV). However, the median pain score was lower both at rest and on mobilisation in the TAPB group except at 6 hours post-op (Figures 2 and 3). Patient characteristics according to maternal satisfaction and side effects are shown in Table V.

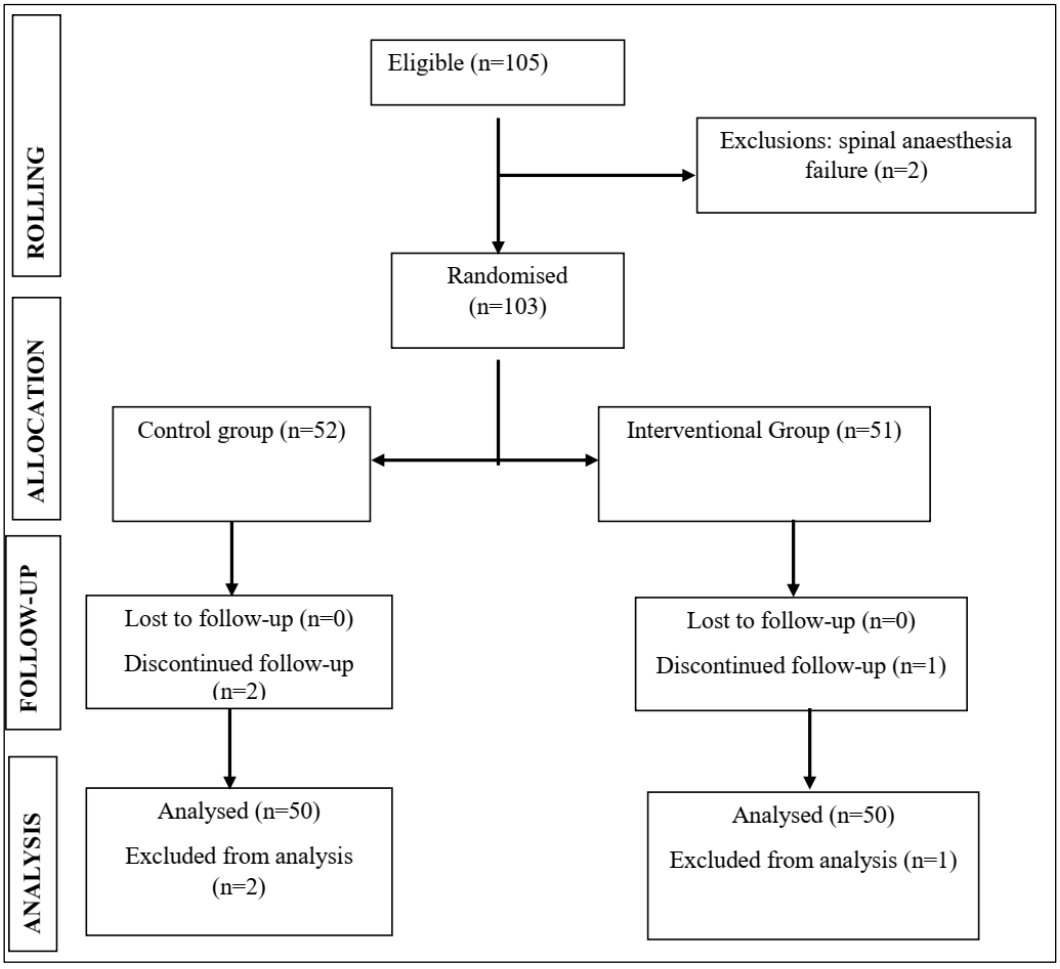

Figure 1: Flow chart of study patients

Table I: Distribution of patients by indication for caesarean section

Indications	**ITM**	**TAPB**	**Total**	**P value**
AFD	14	12	**26**	
Multiscar uterus	10	13	**23**	
Fetal malpresentation	7	6	13	
Scarred uterus	7	4	11	
FPD	2	5	7	
Fetal macrosomia	4	2	6	0,39
Threatened Uterine Rupture Syndrome	3	2	5	
Severe pre-eclampsia	2	3	5	
Sickle cell crisis	1	3	4	
Total	50	50	100	

AFD: acute fœtal distress; FPD: fetopelvic disproportion; ITM: intrathecal morphine; TAPB: TAP block

Table II: Preoperative clinical characteristics of patients

	ITM	**TAPB**	**P value**
Age **mean (years)**	28 ± 6	29 ± 6	0,43
BMI			
Normal	16(32%)	12(24%)	0,64
Overweight	23(46%)	27(54%)	
Obesity	11(22%)	11(22%)	
ATCD anaesthesia			
GA	3(6%)	4(8%)	
Spinal anaesthesia	18(36%)	21(42%)	0,73
None	29(58%)	25(50%)	
ASA Score			
1	26(52%)	34(68%)	0,1
2	24(48%)	16(32%)	
Context			
Emergency	37(74%)	41(82%)	0,33
Programme	13(26%)	9(18%)	
Sensitive level			
T6	6(12%)	7(14%)	
T4	44 (88%)	43(86%)	0,71
Bromage Score			
2	9(18%)	5(10%)	0,25
3	41(82%)	45(90%)	

ITM**:** intrathecal morphine; BMI: body mass index; ATCD: antecedent; GA: general anaesthesia; TAPB: TAP block

Table III: Distribution of patients according to the proportion of mild pain at rest

Timetable	**ITM**	**TAPB**	**Total**	**P value**
H2				
• NRS < 3	47(94%)	49(98%)	96	
• NRS ≥ 3	3(6%)	1(2%)	4	0,62
H4				
• NRS < 3	48(96%)	49(98%)	97	
• NRS ≥ 3	2(4%)	1(2%)	3	0,99
H6				
• NRS < 3	46(92%)	50(100%)	96	
• NRS ≥ 3	4(8%)	0(0%)	4	0,12
H12				
• NRS < 3	46(92%)	50(100%)	96	
• NRS ≥ 3	4(8%)	0(0%)	4	0,12
H24				
• NRS < 3	48(96%)	50(100%)	98	
• NRS ≥ 3	2(4%)	0(0%)	2	0,49
H48				
• NRS < 3	44(88%)	50(100%)	94	
• NRS ≥ 3	6(12%)	0(0%)	6	0,027

ITM: intrathecal morphine; TAPB : TAP block; NRS: numerical rating scale

Table IV: Distribution of patients according to the proportion of mild pain on mobilisation

Timetable	ITM	TAPB	Total	P value
H2				
• NRS < 3	25(50%)	42(84%)	67	
• NRS ≥ 3	25(50%)	8(16%)	33	0,001
H4				
• NRS < 3	31(62%)	42(84%)	73	
• NRS ≥ 3	19(38%)	8(16%)	27	0,013
H6				
• NRS < 3	35(70%)	41(82%)	76	
• NRS ≥ 3	15(30%)	9(18%)	24	0,16
H12				
• NRS < 3	41(82%)	47(94%)	88	
• NRS ≥ 3	9(18%)	3(6%)	12	0,065
H24				
• NRS < 3	37(74%)	48(96%)	85	
• NRS ≥ 3	13(26%)	2(4%)	15	0,002
H48				
• NRS < 3	35(70%)	47(94%)	82	
• NRS ≥ 3	15(30%)	3(6%)	18	0,002

ITM: intrathecal morphine; TAPB: TAP block; NRS: numerical rating scale

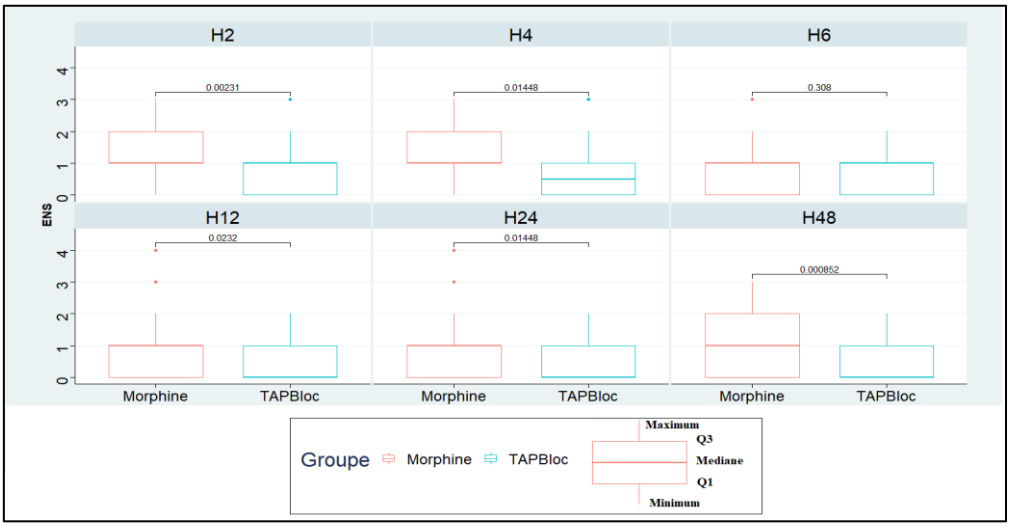

Figure 1: Distribution of patients according to median rest pain score
ENS = NRS= numerical rating scale

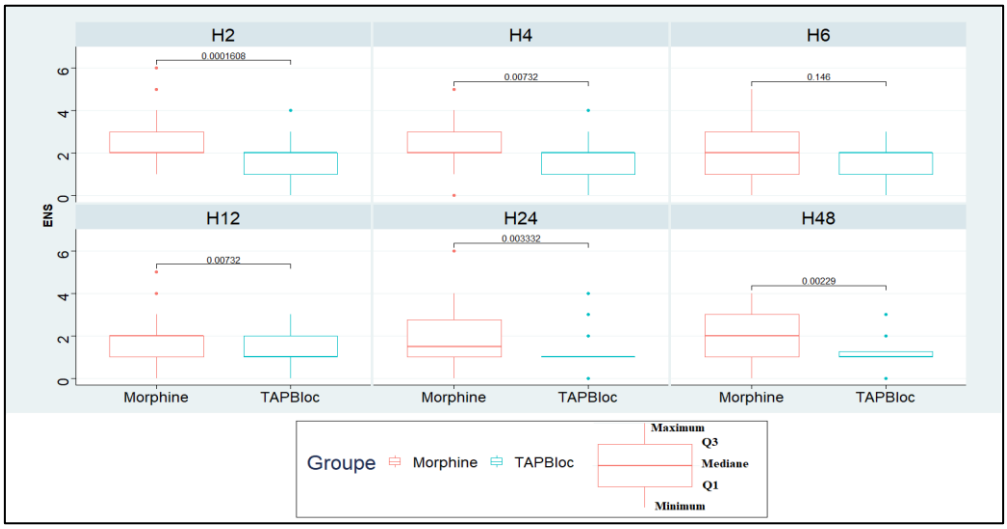

Figure 2: Distribution of patients according to median pain score on mobilisation
ENS = NRS= numerical rating scale

Table V: Characteristics of patients according to side effects and maternal satisfaction

	ITM	TAPB	P value
PONV			
None	25(50%)	47(94%)	
Mild	10(20%)	3(6%)	
Moderate	15(30%)	0(0%)	0,001
Pruritus			
None	21(42%)	46(92%)	
Mild	9(18%)	4(8%)	0,001
Moderate	20(40%)	0(0%)	
Satisfaction			
Very satisfied	7(14%)	40(80%)	0.001
satisfied	40(80%)	9(18%)	
Not satisfied	3(6%)	1(2%)	

PONV: postoperative nausea and vomiting; ITM: intrathecal morphine; TAPB: TAP block

DISCUSSION

This study showed that TAPB with bupivacaine combined with dexamethasone perineurally offered better analgesic efficacy and a lower pain score on mobilisation than ITM despite the evaluation bias associated with single blinding. Indeed, at 24 hours post-op almost all patients had a low pain score on mobilisation and the median score at the same time did not exceed one in the TAPB group, whereas it was almost two in the ITM group. However, at 6 hours and 12 hours post-op the TAPB protocol did not appear to be superior to the ITM protocol. The small sample size and the use of diclofenac as a suppository could explain this interval of reduced efficacy. The suppository route is known for its pharmacological variability in both children and adults [10]. Similarly, a performance bias related to the performance of TAPB by two different practitioners may impact on the efficacy of TAPB. In the literature, most studies comparing TAPB and ITM during caesarean sections under spinal anaesthesia found that ITM offered better analgesia than TAPB both at rest and during mobilisation. Thus, Bedru *et al.*, in Ethiopia reported a proportion of adequate analgesia at rest of 62.6% for ITM compared with 37.4% for TAPB ($p<0.001$) [11]. He also reported 65.8% adequate analgesia during mobilisation for ITM, compared with 34.2% for TAPB. A study in Uganda found that ITM was more efficient than TAPB both at rest and during mobilisation, with a statistically significant difference within 24 hours of the operation [12]. Also, the metanalysis by Yang *et al.* in 2021 found that parturient women in the ITM groups showed greater analgesic effects than those in the TAPB group [2]. Kanazi *et al.*, found that pain scores during the first 4 hours at rest and on mobilisation were lower in the morphine group than in the TAPB group, but similar at the other follow-up times [13]. However, other authors found that ITM and TAPB provided clinically similar results for pain relief after caesarean section [14, 15]. In our study, the proportion of mild pain at rest was similar in both groups except at 48 hours post-op, whereas on mobilisation the pain score for the TAPB group was lower during the first 48 hours postoperatively. The difference in results with those of the aforementioned studies could be explained by the technique used to perform the TAPB. Bedru *et al.* performed the TAPB using anatomical landmarks, whereas ours were performed under ultrasound with greater precision. Ultrasound guidance is used to check the correct position of the needle, which is incorrect in more than half of cases, as it has been shown for blind ilio-hypogastric blocks [16]. Finally, echo-guidance objectifies, controls and readjusts the injection site of the local anaesthetic volume in real time, ensuring the success of the block [17]. The ultrasound-guided approach therefore offers advantages due to the direct visualisation of the local anaesthetic injected and could be less operator-dependent, resulting in greater precision and better analgesia. In the metanalysis by Yang *et al*, the only study to use an adjuvant was that of Kwikiriza *et al.*, [15] (adrenalised bupivacaine) which was subsequently excluded due to heterogeneity. In our study, the use of perineural dexamethasone as an adjuvant could also explain the efficacy observed. Perineural dexamethasone improves the quality of analgesia and significantly prolongs the duration of sensory block [18]. In our study, bupivacaine combined with dexamethasone demonstrated the superiority of this technique during the first 48 hours. The systematic use of analgesics postoperatively as part of multimodal analgesia helped to reduce the intensity of post-caesarean pain. Moreover, understanding of the assessment tool used and the joy of having a live child in an emergency context could also influence pain scores. In sub-Saharan Africa, the majority of caesarean sections are performed as emergencies, as shown by the results of our study.

In this study the incidence of PONV was higher in the ITM group than in the TAPB group. The incidence of PONV is higher in at-risk populations, so the identification of preoperative risk factors is essential in the interpretation of postoperative data [19]. Notwithstanding this limitation of the study, the results are superimposed on those reported in the literature, which found a higher incidence of PONV in the ITM group than in the TAPB group [2, 8, 13]. Indeed, the incidence of post-caesarean PONV after intrathecal administration of morphine can be as high as 60% [20].

It was 50% in our study. In the immediate postoperative period, the systematic combination of paracetamol and tramadol raises questions about the potentiation of the side effects of morphine in the mother and the potential deleterious consequences for the newborn. These side effects, particularly PONV and sedation, will be increased in patients with ultra-rapid metabolism of tramadol [21]. This situation does not favour accelerated rehabilitation after caesarean section and disrupts the mother-infant relationship. Patients in the ITM group experienced more pruritus than those in the TAPB group. The same was true in the metanalysis by Yang *et al.*, [21]. Pruritus is a frequent side effect of morphine use in pregnant women due to the interaction of oestrogen with opioid receptors [22]. When pruritus is intense, it should be treated with naloxone, which antagonises the analgesic effect of morphine; this is a strong argument against the MIT protocol. TAPB, rather than an alternative, should be the technique of choice in patients with a history of pruritus following caesarean section. The majority of patients in the TAPB group were very satisfied with the quality of their postoperative pain management compared with those in the MIT group. Our results differ from those of other authors who found similar satisfaction in the two groups [13, 14]. He low intensity of pain, the low incidence of PONV and pruritus could explain this satisfaction of patients in the TAPB group as they allow the patient to care for the newborn and encourage communication with the family.

CONCLUSION

TAPB with the combination of bupivacaine and dexamethasone is more effective than ITM in the management of post-caesarean pain, despite the limitations of this study. It was also associated with a lower incidence of PONV and pruritus, offering greater maternal satisfaction with the management of post-caesarean pain than ITM. Consequently, this technique favours maternal post-caesarean rehabilitation. TAPB with bupivacaine combined with dexamethasone should therefore be the analgesic technique of choice during caesarean section. However, the practice of this technique requires material resources, in particular an ultrasound scanner and LRA needles. In a context of limited resources, an evaluation of the cost and benefits of this technique is essential in order to assess the relevance of its widespread use.

Conflicts of Interest: No

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