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Ultrasound-Guided Erector Spinae Plane Block versus Intrathecal Morphine in Patients Undergoing Ambulatory Wall Abdominal Surgery: A Prospective Randomized Study in Gabon

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Abstract

Introduction: Ambulatory surgery requires effective analgesia with few side effects to allow a return home on the day of surgery. The aim of the study was to compare the efficacy of intrathecal morphine (Ram) and erector spinae plane block (ESP) in outpatient abdominal wall surgery. **Methodology**: Thirty-six patients were randomized into two groups. The ESP group (n = 23) benefited from the ESP block with bupivacaine 5% (20 ml) followed by spinal anesthesia with bupivacaine (7.5 mg) and sufenta (2.5 µg). The Ram group (n = 13) benefited from spinal anesthesia with bupivacaine (7.5 mg), sufenta (2.5 µg) and morphine (100 µg). The primary endpoint was whether or not to return home on the day of surgery. The secondary endpoint was the pain score by the visual analog scale (VAS) in the post-intervention monitoring room (SSPI). After 2 hours (H2) and one day (D1) after surgery, the morphine consumption in the immediate postoperative period (mg) and the undesirable effects. **Results:** Inguinal hernia surgery predominated (n = 30). No difference in age (45.05 vs 50.7; p = 0.4), ASA score (1.43 vs 1.53; p = 0.57). All patients (n = 36) returned home on the day of surgery. No difference in postoperative pain in SSPI (p = 0.6), 2 hours after surgery (p = 0.40) and the day after surgery (p = 0.6). Postoperative morphine consumption was identical (0.9 mg vs 0.2 mg, p = 0.2). There were 2 urinary retentions in the Ram group. **Conclusion:** The erector spinae plane block and intrathecal morphine are well tolerated

and perfectly compatible with the requirements of outpatient abdominal wall surgery.

Keywords

Spinal Erector Block, Intrathecal Morphine, Ambulatory, Hernia, Gabon

1. Introduction

Abdominal wall surgery is frequently performed in outpatient. The effectiveness of outpatient surgery is based on an anesthetic strategy and the primary objective is effective analgesia with few side effects to allow a return home on the day of surgery. Locoregional anesthesia techniques have long been effective in outpatient surgery, such as spinal anesthesia. Studies show that it is compatible with the requirements of outpatient surgery despite some side effects [1] [2]. New local anesthetics such as chloroprocaine improve postoperative recovery [3]. They are an interesting option for day surgery. Since 2018, the Erector Spinae Plane Block (ESPB) has been used in abdominal surgery analgesia, with some efficacy and few side effects. The ESP block has been little studied in outpatient abdominal wall surgery. Some studies have shown its effectiveness in urological [4] and digestive [5] surgery outside of an ambulatory context.

The study by Kjartan Eskjaer Hannig showed, in a series of 4 cases, the effectiveness of the combination of ESP block and laparoscopic cholecystectomy under general anesthesia on an outpatient basis [6].

However, very few studies have evaluated the effectiveness of ESP block in outpatient abdominal surgery by laparotomy under spinal anesthesia.

Studies have shown the effectiveness of intrathecal morphine in abdominal and digestive surgery [7].

The aim of the study was to compare the effectiveness of intrathecal morphine with that of erector spinae plane block (ESPB) in two types of laparotomy abdominal wall surgery (hydrocele and hernia) performed under spinal anesthesia.

2. Material and Method

The study was carried out in the context of a humanitarian mission and received approval from the ethics committee of the Gabon military health service.

2.1. Study Design

This study is a randomized controlled clinical trial conducted for patients undergoing elective wall abdominal under spinal anesthesia. This manuscript follows the applicable CONSORT guidelines (https://www.consort-statement.org/). The study was conducted in accordance with the Declaration of Helsinki and written informed consent was obtained from all subjects participating in the trial. This study was approved by the Gabonese Staff of military health service (No:

01/MDN/DGSSM/HMCC) on 01 September 2022.

Allocation arrangements were concealed in numbered opaque envelopes. The anesthesiologist and patients were informed about the study groups. Group allocation was made using a randomization table.

2.2. Setting

The study performed during a humanitarian mission in medical-surgical field hospital of the military health service of Gabon, from 29 October to 3 November 2022. Humanitarian operations are carried out in the hinterland with disadvantaged populations who have difficulty accessing hospital structures.

2.3. Participants

The eligible patients were undergone abdominal wall laparotomy surgery (inguinal hernia repair, hydrocele) performed under spinal anesthesia.

2.4. Inclusion Criteria

Adult patients, American Society of Anesthesiology (ASA) score 1 and 2 undergoing abdominal wall surgery under spinal anesthesia.

2.5. Non-Inclusion Criteria

Patient undergoing abdominal wall surgery under general anesthesia, ASA 3 patient, children.

2.6. Variables

The variables studied were demographic (age, sex), ASA score, and type of surgery. The primary endpoint was whether or not to return home on the day of surgery. The secondary endpoint was the pain score, which was calculated using the visual analogic scale (VAS) in the post-anesthesia care unit (PACU). After 2 hours (H2) and one day (D1) after surgery, the morphine consumption in the immediate postoperative period (mg) and the undesirable effects.

2.7. Protocol

Preoperative management: A preoperative patient visit was done to take medical history, perform a clinical examination, provide reassurance, and explain the method of anesthesia. The patient's back was examined to detect any spinal deformities and difficult regional blocks. Patients fasted for about 6 to 8 hours before surgery. All patients underwent blood tests to monitor hemostasis, renal and hepatic function.

Intraoperative Management: Monitoring equipment was attached to the patients and included pulse oximetry, noninvasive blood pressure monitoring, five-lead electrocardiogram, and temperature probe in the axillary hollow. All patients received 20 mg of nefopam and 1 g of paracetamol intravenous 30 min before the end of surgery.

Patients were randomized into two groups to receive one of the two protocols. The Erector Spinae Plane Block group (ESPB group) benefited from a unilateral block of the erector spinae muscles at the level of the 7th thoracic vertebra under ultrasound with 20ml of bupivacaine 5% followed by spinal anesthesia with bupivacaine (7.5 mg), sufenta (2.5 μg). The intrathecal morphine group (Ram group) benefited from spinal anesthesia with bupivacaine (7.5 mg), sufenta (2.5 μg) and morphine (100 μg).

In the PACU, all patients received 1 g of paracetamol IV every 8 h until the exit for home and if the VAS scale is greater than 5, patients receive 1 mg of intravenous morphine. The exit to home was conditional on a modified aldrete score of 12.

Erector Spinae Plane Block (ESPB) Technique: Patients were placed in a prone position, and ultrasound-guided ESPB was performed using a SonoSite M-TURBO with the linear probe. The transducer was positioned in a transverse midline position at the level of the 7th thoracic vertebra. After the identification of the spinous process and interspinous muscles, the probe was moved laterally to identify the multifidus (MF) and longissimus (LG) muscles. After identifying the muscles and decontamination of the skin, the ESPB was performed under real-time ultrasound guidance using an insulated 80 mm 22G echogenic needle which was inserted in-plane lateral to the medial direction through the belly of the LG toward the MF muscle. After negative aspiration, 20 mL 5% bupivacaine was injected on the side of surgery in the interface between the MF and LG muscles only in the ESPB group. The locally injected solution was prepared and injected by the same anesthesiologist.

2.8. Bias

To reduce bias and confounding factors, all the surgeries were performed by the same surgeon. All the erector spinae muscle blocks were carried out by the same anesthetist, and postoperative monitoring was carried out by the same nurse anesthetist.

2.9. Study Size

The ideal sample size was calculated using the Schwartz formula with a prevalence of hernia repair of 40% during the last activity of the military field hospital, a risk of error at 5% and an accuracy of 5%, which gives us 369 patients in each group. Considering the duration of the humanitarian mission, a reduced sample was expected. The power of the study will be affected.

2.10. Measurements

All outcomes were recorded by the anesthetist who made ESPB and was allocated group. The first postoperative request for analgesia, and total analgesic consumption during the first postoperative 24 h were recorded. Postoperative pain assessment was done at 2, 8, 12, and 24 h using the VAS scale. HR and BP were recorded

and analyzed at different time points: Preoperative (baseline), 10 min after the regional block, with the surgical incision, every 15 minutes until the end of the surgery, in PACU every hour until discharge and return at home.

2.11. Statistical Analysis

The categorical variables are presented as a number with a percentage in parentheses. Summary statistics were calculated using IBM SPSS 20. The Shapiro-Wilk test was used to assess normality. The continuous variables (postoperative morphine consumption, hemodynamics) between the two studied groups were analyzed using the Wilcoxon test, and the categorical and dichotomous variables (number of patients requiring morphine) were analyzed using the chi-square test. The repeated measurements of postoperative pain score values were expressed as mean ± standard deviation (continuous variables) or as a percentage of the group from which they were derived (categorical variables). Data with variables completed were analyzed in the study. A p-value < 0.05 was considered significant.

3. Results

Participants: over the study period, out of the 50 patients operated on, 36 patients were included. Figure 1 summarizes the flow chart.

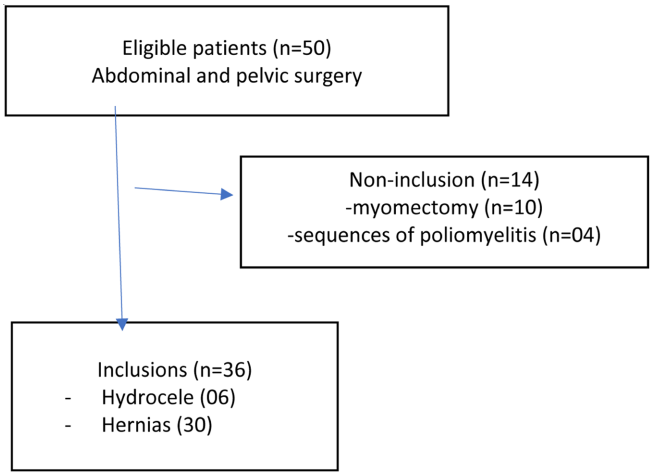

Figure 1. Consort flow chart.

Male gender and inguinal hernia surgery predominate among patients included in the study. Table 1 summarizes demographic characteristics.

Table 1. Demographics data.

Item	ESPB group (n = 23)	Ram group (n = 13)	p
Sex (number)	Male: 21 Female: 02	Male: 11 Female: 02	
Surgery (number)	-inguinal hernia: 19 -Hydrocele: 04	-Inguinal hernia: 11 -Hydrocele: 02	

Continued

Mean age (years)	45.05	50.07	0.49
ASA score	1.43	1.53	0.57

Table 2 and Figure 2 summarize the postoperative data.

Table 2. Post-operative data.

Item	ESPB group (n = 23)	Groupe RA (n = 13)	p
Morphine consumption (mg)	0.9	0.2	0.20
Ambulatory (number)	23	13	
urinary retention (number)	0	2	

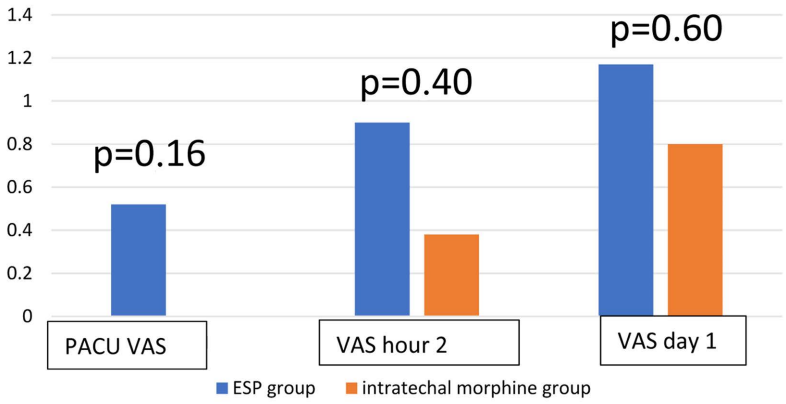

Figure 2. Pain score.

4. Discussion

The aim of the study was to compare the analgesic effectiveness and tolerance of intrathecal morphine and erector spinae muscle block in outpatient abdominal wall surgery by laparotomy under spinal anesthesia.

4.1. Key Results

4.1.1. The Primary Endpoint

The study reveals that all of the operated patients were able to return home on the day of the surgery. Thus, both protocols were compatible with outpatient surgery. Few studies have evaluated the interest of ESP block in outpatient abdominal wall surgery. The study by Kjartan Eskjaer Hannig showed the feasibility in the outpatient setting of a laparoscopic cholecystectomy under general anesthesia associated with an ESP block in a series of 04 cases. Through this series of cases, we can extrapolate external validity with hernia surgery, a surgery performed on an outpatient basis for a long time, given that cholecystectomy is more aggressive than hernia surgery and this surgery is performed under general anesthesia [6]. W. Rattenberry shows that spinal anesthesia with bupivacaine is compatible with the requirements of a day surgery [2].

4.1.2. The Secondary Endpoint

The secondary endpoint elements were represented by the pain score by the visual analogic scale (VAS) in the post-anesthesic care unit (PACU), after 2 hours (H2) and one day (D1) after surgery, the morphine consumption in the immediate postoperative period (mg) and the undesirable effects.

4.2. Pain Score

There was no statistically significant difference. This data confirms the effectiveness of the two analgesic techniques. The study by Ryung A. Kang showed the non-inferiority of block ESP on intrathecal morphine in laparoscopic liver surgery under general anesthesia during a randomized study [8]. Similarly, Madhurjya Baishya found no difference in pain scores by comparing ESP block and intrathecal morphine in urological surgery during a randomized study [9].

Numerous comparative studies have found the efficacy of intrathecal morphine and ESP block in several surgeries [10]-[13], but few have shown it in an outpatient setting, such as the case series of Kjartan Eskjaer Hannig [6].

4.3. Morphine Consumption

Morphine consumption postoperatively was very low in both groups. There was no difference between the two groups. This data confirms the analgesic efficacy of the two techniques. Ryung A Kang found the same result in liver surgery [8]. Madhurjya Baishya, in a randomized study comparing intrathecal morphine and ESP block in urological surgery, found opioid consumption at 355 µg in the ESP block group and 240 in the intrathecal group with a non-significant difference ($p = 0.09$) [9]. As in our study, the consumption of opioids seems slightly higher in the ESP group with no significant difference. The small sample size may explain this absence of significant statistical difference.

4.4. Undesirable Effects

Our study found two urinary retentions in the intrathecal morphine group. The study by Ryung A. Kang found significantly greater side effects in the intrathecal morphine group compared to the ESP group in laparoscopic liver surgery [8]. However, the study by Madhurjya Baishya did not find any significant difference in the ESP and intrathecal morphine groups [9]. Indeed, intrathecal morphine is responsible for adverse effects, nausea, vomiting, pruritus and urinary retention, and these side effects are exacerbated by the dose. Ryung A Kang's study used 400 µg of morphine intrathecally compared to 150 µg for Madhurjya Baishya's study [8] [9]. The intrathecal morphine dose of 100 µg in our study explains the low incidence of side effects.

4.5. Limitations

Our study is limited by the small sampling, which reduces its power. All surgeries were performed by the same surgeon using the same surgical technique. The

anesthesia was performed by the same anesthesiologist. This avoided a confounding bias related to surgery. The nature of the techniques was not compatible with double-blind randomization.

4.6. Generalizability

Despite the lack of power in our sample, our methodology allows us to validate the results externally.

5. Conclusion

Despite the small sample size, our study shows the effectiveness and good tolerance of the erector spinae muscle block in wall abdominal outpatient surgery compared to a reference technique such as intrathecal morphine. ESPB can be considered a good adjuvant to spinal anesthesia for patients undergoing ambulatory wall abdominal surgery because it achieves adequate perioperative pain relief, reduction of perioperative morphine consumption, and reduction of the undesirable effect of intrathecal morphine. This technique deserves to be developed in countries with difficult access to major analgesics such as morphine.

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Conflicts of Interest

The authors declare no conflict of interest.

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