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SCIENTIFIC ARTICLE

A comparison of two different doses of morphine added to spinal bupivacaine for inguinal hernia repair ☆

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Abstract

Background and objectives: The aim of this study was to compare the effects of two different doses of intrathecal morphine on postoperative analgesia, postoperative first mobilization and urination times and the severity of side effects.

Methods: After Institutional Ethical Committee approval, 48 ASA I-II patients were enrolled in this randomized double-blinded study. Spinal anesthesia was performed with 0.1 mg (Group I, $n = 22$) or 0.4 mg (Group II, $n = 26$) ITM in addition to 7.5 mg heavy bupivacaine. The first analgesic requirement, first mobilization and voiding times, and postoperative side effects were recorded. Statistical analyses were performed using SPSS 15.0 and $p < 0.05$ was considered as statistically significant. The numeric data were analyzed by the t-test and presented as mean $\pm$ SD. Categorical data were analyzed with the chi-square test and expressed as number of patients and percentage.

Results: Demographic data were similar among groups. There were no differences related to postoperative pain, first analgesic requirements, and first mobilization and first voiding times. The only difference between two groups was the vomiting incidence. In Group II 23% ($n = 6$) of the patients had vomiting during the first postoperative 24 h compared to 0% in Group I ($p = 0.025$).

Conclusion: For inguinal hernia repairs, the dose of 0.1 mg of ITM provides comparable post-operative analgesia with a dose of 0.4 mg, with significantly lower vomiting incidence when combined with low dose heavy bupivacaine.

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Comparação de duas doses diferentes de morfina adicionadas à bupivacaína em raquianestesia para herniorrafia inguinal

Resumo

Justificativa e objetivos: O objetivo deste estudo foi comparar os efeitos de duas doses diferentes de morfina intratecal (MIT) sobre a analgesia no pós-operatório, os tempos até a primeira mobilização e micção no pós-operatório e a gravidade dos efeitos colaterais.

Métodos: Após a aprovação do Comitê de Ética Institucional, 48 pacientes com estado físico ASA I-II foram incluídos neste estudo randômico e duplo-cego. A raquianestesia foi realizada com 0,1 mg (Grupo I, n = 22) ou 0,4 mg (Grupo II, n = 26) de MIT adicionados a 7,5 mg de bupivacaína hiperbárica. Os tempos até a primeira necessidade de analgésico, mobilização e micção e os efeitos colaterais no pós-operatório foram registrados. As análises estatísticas foram realizadas usando o programa SPSS 15.0 e $p < 0,05$ foi considerado estatisticamente significativo. Os dados numéricos foram analisados com o teste-t e expressos como média $\pm$ DP. Os dados categóricos foram analisados com o teste do qui-quadrado e expressos como número de pacientes e porcentagem.

Resultados: Os dados demográficos foram semelhantes entre os grupos. Não houve diferenças em relação à dor, tempos até a primeira necessidade de analgésicos, primeira mobilização e primeira micção. A única diferença entre os dois grupos foi a incidência vômito. No Grupo II, 23% (n = 6) das pacientes apresentaram vômito durante as primeiras 24 horas de pós-operatório, em comparação com 0% no Grupo I ($p = 0,025$).

Conclusão: Para herniorrafia inguinal, a dose de 0,1 mg de MIT fornece analgesia comparável à dose de 0,4 mg, com uma incidência de vômito significativamente menor quando combinada com uma dose baixa de bupivacaína hiperbárica.

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Introduction

Pain after inguinal hernia repair is described as moderate to severe and may be associated with prolonged hospital stay. Furthermore, in the literature there are some clues that suggest that inadequate postoperative pain management may be a risk factor for persistent chronic pain after inguinal hernia repair.[1] It is well known that the combination of intrathecal low dose local anesthetics with opioids produce a synergistic effect without prolonging motor block and therefore delaying discharge.[2] Intrathecal morphine (ITM) may be a good alternative for postoperative pain management with its long duration of spinal analgesia. However, the side effects such as nausea, vomiting, pruritus and late respiratory depression may be restraining its application. In several studies, it is suggested that lower doses of ITM produce good quality and long duration postoperative analgesia while reducing the incidence of side effects.[3–5]

The primary aim of this study was to compare the effects of two different doses of ITM in combination with low dose heavy bupivacaine on postoperative pain management in inguinal hernia repair surgery. The secondary aim was to compare the first mobilization and voiding times and side effects between the two groups.

Methods

After Institutional Ethical Committee approval and patients' written informed consent, 48 ASA physical status I-II patients, aged 18–65 years, undergoing elective unilateral open inguinal hernia repair surgery were prospectively enrolled in this randomized double-blinded study. Exclusion criteria included contraindications to spinal anesthesia, central or peripheral neuropathies, severe respiratory or cardiac diseases, chronic analgesic use and history of substance abuse or allergy to local anesthetics.

The study was recorded to www.clinicaltrials.gov with the registration number of NCT 02001948.

Patients were randomly assigned into two Groups I and II, according to a sealed envelope method. In Group I (n = 22), patients received 0.1 mg morphine with 7.5 mg heavy bupivacaine intrathecally and in Group II (n = 26), patients received 0.4 mg morphine with 7.5 mg heavy bupivacaine intrathecally.

After standard monitoring (electrocardiography, heart rate, pulse oximetry and noninvasive arterial blood pressure) an 18-gauge intravenous (iv) cannula was inserted at the forearm opposite to the surgical side and routine iv premedication (midazolam 0.03 mg/kg) was given.

Spinal anesthesia was performed using the midline approach. Patients were placed in the lateral decubitus position with the operational side down. After local infiltration with 2% lidocaine, a 25 gauge Quincke spinal needle (Spinocan®, B Braun Melsungen Ag, D-Melsungen) was inserted at the L2-3 or L3-4 interspace. On aspiration of clear cerebrospinal fluid, 7.5 mg of 0.5% heavy bupivacaine was administered in combination with the assigned morphine dose. The drugs were combined in saline, and a total of 2 mL was administered. An anesthesiologist blinded to the

patients' group assignments performed spinal anesthesia. Patients were held in the same position for 15 min and then they were placed in the supine position for the surgery.

After spinal injection, a blinded observer followed up the evolution of spinal block. Sensory block was assessed using loss of pinprick sensation while motor block was assessed using a 4-point modified Bromage score (0 = no motor block, 1 = hip blocked; 2 = hip and knee blocked; 3 = hip, knee and ankle blocked). The onset of surgical anesthesia was defined as the loss of pinprick sensation at ≥T10 with a Bromage score ≥2. The inability to reach a sensory block at T10 within 30 min after spinal injection was considered as block failure. Hypotension (decrease in systolic blood pressure ≥ 30% of baseline) was treated with 200 mL of normal saline over 10 min and if this was not sufficient, 5 mg of ephedrine was given iv. Bradycardia (decrease in heart rate below 45 bpm) was treated with 0.5 mg iv atropine.[6]

The hemodynamic parameters during the procedure were also recorded. During the postoperative period in the hospital pain was assessed with a visual analog scale (VAS) score of 0–10 and a VAS score of higher than 3 were treated with rescue analgesic IV tramadol 25 mg, repeated as necessary. Thereafter, when patients were ready for discharge from the hospital, they were given a prescription of NSAID and were asked to note the use of analgesic drugs at home if necessary. During the PACU stay, at ward and for the first 24 h postoperative side effects (nausea, vomiting, pruritus, and dizziness) were followed up and recorded. Also, first mobilization and voiding times and first analgesic requirement were recorded. Those who complained of urinary retention were catheterized with a simple rubber catheter and were recorded as urinary retention.

A telephone call follow-up was performed 3 days after surgery to evaluate the postoperative pain and the incidence of side effects including dizziness, nausea and vomiting.

Statistics

Data were statistically analyzed using SPSS version 15.0 (SPSS Inc., Chicago, IL). A pilot study was conducted before the initiation of the study and mean, and standard deviation of first analgesic requirement time was found to be 5 ± 2 h with an α-error of 0.05 and a β-error of 0.2. The main outcome of the study was determined as an increase in the first analgesic requirement time by 25%, and a sample size of 44 patients in two groups (Group I, $n = 22$; and Group II, $n = 22$) was calculated. The numeric data were analyzed by the t-test and presented as mean ± SD. Categorical data were analyzed with the chi-square test and expressed as number of patients and percentage. A p-value of less than 0.05 was considered to indicate statistical significance.

Table 1 Demographic data.

Group	I ($n = 22$)	II ($n = 26$)
Age (year)	51 ± 15	52 ± 14
Gender (M/F)	20/0	24/2
Weight (kg)	76.9 ± 12	74.8 ± 6.8
Height (cm)	171.9 ± 5.6	168.5 ± 5.7

All values are shown as mean ± SD.

Results

Demographic data were similar among groups (Table 1). Surgical anesthesia was achieved for all the patients, and no spinal failure was observed. There were no statistically significant differences in hemodynamic parameters and pulse oximetry measurements. The clinically relevant hypotension or bradycardia requiring intervention was not observed in both groups.

Table 2 shows the first mobilization, first voiding, urinary retention incidence and first analgesic requirement times for patients who had pain. No significant differences were observed between groups related to these parameters. The use of rescue analgesic in the hospital (tramadol 25 mg iv) was similar among groups. No patients needed rescue analgesic during their stay at PACU and only two patients in Group I and three patients in Group II needed rescue analgesic during the first postoperative 24 h. No patient used any analgesic at home.

Morphine related postoperative side effects were also assessed. The only difference between two groups was the vomiting incidence. In Group II 23% ($n = 6$) of the patients had an episode of vomiting during the first postoperative 24 h compared to 0% in Group I ($p = 0.025$) (Table 3).

None of the patients in both groups developed clinical evidence of severe respiratory depression at any time.

Discussion

Results of this randomized prospective double-blinded study demonstrated that 0.1 mg ITM had similar anesthetic and postoperative analgesic effects when compared to 0.4 mg of ITM. However, the incidence of vomiting was higher with 0.4 mg of morphine.

The choice of anesthetic technique for open inguinal hernia repair depends on several factors including the patient and surgeon choices, postoperative pain management, recovery time and postoperative morbidity.[7] However, spinal anesthesia is mostly preferred and widely used for open

Table 2 Postoperative anesthetic recovery and analgesia.

Group	I ($n = 22$)	II ($n = 26$)	p-Value
First mobilization time (h)	5.5 ± 2	5.9 ± 3	NS
First urination time (h)	7 ± 2	7.6 ± 4.6	NS
Urinary retention (%)	15%	11.5%	NS
First analgesia time (h)	5 (4–12)	4 (0.3–24)	NS

h, hours.
All values are shown as mean ± SD, median (minimum–maximum) and percentage.

Table 3 Postoperative side effects during the first postoperative 24 h related to intrathecal morphine use.

Group	I (n = 22)	II (n = 26)	p-Values
Nausea (n/%)	4/20%	8/30.7%	NS
Vomiting (n/%)	0/0%	6/23%	0.025
Pruritus (n/%)	6/30%	7/26.9%	NS
Dizziness (n/%)	2/10%	5/19.2%	NS
Analgesic requirement (n/%)	2/10%	3/11.5%	NS

All values are shown as number and percentage.

inguinal hernia repair, providing a fast onset and effective sensory and motor blockade.[8]

Postoperative pain management

Pain after inguinal hernia repair is defined as moderate to severe and can be associated with prolonged hospital stay. In addition, insufficient treatment of early postoperative pain may cause persistent chronic pain.[1] Earlier studies have shown that the addition of intrathecal opioids to local anesthetics in spinal anesthesia may improve postoperative pain management of ambulatory inguinal hernia repair.[2,9,10] In their study Girgin et al. compared the combination of intrathecal 25 μg fentanyl and low dose levobupivacaine with a higher dose of levobupivacaine alone. The early postoperative pain score was lower in the group with intrathecal fentanyl. In this study, the addition of fentanyl has shortened the readiness for discharge time of the patients and ameliorated the postoperative pain management. In another study Gupta et al. reported that the postoperative pain incidence at PACU was 20–25%, and the early postoperative pain incidence (first 24 h) was 50% with intrathecal fentanyl 25 μg and bupivacaine combination.[10] Similarly, in our study the two different doses of ITM provided satisfactory postoperative analgesia. Additionally, in our study only 10.0–11.5% of the patients needed a rescue analgesic during the first 24 h, and none of them needed any analgesic at PACU. The long lasting effect of ITM may be a good alternative for the management of postoperative pain in inguinal hernia repair.

Inguinal hernia repair is a surgical procedure with moderate to high degree postoperative pain. It should be well managed to prevent the development of chronic postoperative pain. Therefore, the use of a longer acting intrathecal opioid might be a good alternative. In our study, the addition of two different doses of ITM did not change the postoperative pain incidence or analgesic requirement. Therefore, a dose of 0.1 mg of morphine can be a good alternative for postoperative pain management for hernia repairs.

Side effects

The side effects of intrathecal opioids are discussed in several studies. In their study, Girgin et al. compared different doses of ITM for cesarean delivery and reported that higher doses of ITM resulted in a higher incidence of pruritus (15.5% vs. 39.5%).[11] In another study Gupta et al. used a combination of intrathecal fentanyl with bupivacaine and reported an incidence of pruritus of 50–60%.[10] In our study, the

incidence of pruritus was similar with the previous studies. However, there was no difference between the two different doses of ITM. Moreover, in our study the frequency of nausea and vomiting were higher than the previously reported studies in the literature (20–30% and 0–23%, respectively). Also, the incidence of vomiting was significantly higher with higher dose of ITM (0.4 mg vs. 0.1 mg). This side effect may limit the use of higher doses of ITM in inguinal hernia repair.

Postoperative recovery

In our study, all patients were able to stand and walk without help after approximately 340 min and void after 440 min. These results are longer than the finding of studies with fentanyl. This delay in postoperative recovery may retard the home discharge of patients. This delay in discharge may be a serious problem and may decrease the patient satisfaction.

A limitation of this study is that intraoperative fluid management and the urinary retention assessed with a bladder scan were not followed up. Also, the patients' satisfaction and discharge times are important data, which were not assessed in this study. These data may be crucial for the selection of anesthesia technique for inguinal hernia repair procedures.

In conclusion, the addition of 0.1 mg ITM to 7.5 mg of heavy bupivacaine for spinal anesthesia produces comparable postoperative analgesia to that produced with 0.4 mg of ITM, but with a lower incidence of nausea.

Conflicts of interest

The authors declare no conflicts of interest.

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