ORIGINAL ARTICLE

The comparison of spinal anesthesia with general anesthesia on the postoperative pain scores and analgesic requirements after elective lower abdominal surgery: A randomized, double-blinded study

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Background: The aim of this study was to compare the postoperative pain scores and morphine requirements between spinal anesthesia (SA) with hyperbaric bupivacaine 0.5% and general anesthesia (GA) with 1 Minimal alveolar concentration minimal alveolar concentration (MAC) of isoflurane in 50% N_2O and O_2 after elective lower abdominal surgery. **Materials and Methods:** In this randomized clinical trial, 68 patients with American Society of Anesthesiologists (ASA) I or II undergoing lower abdominal surgery were randomly assigned to have elective lower abdominal surgery under SA (n = 34) or GA (n = 34). The SA group received 3 cc of 0.5% hyperbaric bupivacaine (15 mg), at L3–L4 interspace intrathecally and also 2 mic/kg fentanyl and 0.15 mg/kg morphine intravenously for intraoperative analgesia. In the GA group, induction of anesthesia was carried out with Na thiopental 6 mg/kg body weight, fentanyl 2 mic/kg body weight, morphine 0.15 mg/kg, and atracurium 0.6 mg/kg body weight, and then, trachea was intubated. The primary outcome was postoperative pain scores at rest and under stress on a visual analog scale and the secondary outcome was morphine requirement by the patients. Outcome measures were recorded at 2, 4, 6, 12, and 24 h postoperatively. The duration of postanesthesia care unit (PACU) and hospital stay were recorded. Intraoperative parameters, postoperative pain scores, complications, recovery time, and the duration of hospital stay at follow up were compared between the two groups. **Results:** Patients in SA group had significantly lower scores of a postoperative pain at rest (3.4 ± 1.6 and 4.1 ± 1.2 at 2 and 4 h postoperatively vs. 5.2 ± 1.5 and 5.8 ± 0.9 in the GA group with $P < 0.05$), but there were no significant differences between both groups for scores of postoperative pain at 6, 12, and 24 h. The amount of morphine requirement in 6 h postoperatively was significantly lower in the SA group (10.2 ± 4.3 mg vs. 15.6 ± 5.6 mg in the GA group with $P < 0.05$), but there were not significant differences between the two groups after 6 h postoperatively. The duration of PACU stay was shorter for the GA group than the SA group (75 ± 6 vs. 126 ± 12 min, $P < 0.001$), but there was no significant differences between the duration of hospital stay between the two groups (1.8 ± 0.6 vs. 2.1 ± 0.8 days). **Conclusion:** Although in patients undergoing elective lower abdominal surgery with SA may have lower pain scores and also lower morphine requirement in the first 6 h postoperatively, but after that there were no significant differences between SA and GA regarding postoperative pain scores and analgesic requirements and so more attention should be given to their postoperation pain relief.

Key words: Analgesic requirements, general anesthesia, postoperative pain, spinal anesthesia

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INTRODUCTION

Pain is generally considered an important postsurgical complication, which may result in serious morbidities if left unaddressed.[1]

Postoperative pain management remains a significant challenge after abdominal surgery.[2]

Elective lower abdominal surgery can be safely performed under general anesthesia (GA) or spinal anesthesia (SA).

Patients satisfaction and the ability to carry out prolonged operations are the advantages of using GA, and alternatively, the most important advantages of SA are the decrease in intraoperative blood loss, the decrease in perioperative cardiac disrhythmia, postoperative hypoxic episode, reduce the risk of acid aspiration syndrome, and also arterial and venous thrombosis.[3]

Acute postoperative pain management is challenging and also a major concern in lower abdominal surgeries.[4]

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The usual method of the pain control in half of the patients often does not provide an adequate analgesia and postoperative pain can delay patient's recovery.[5]

Apart from standard GA, SA is extensively applied. Nevertheless, the administered type of anesthesia is ultimately based on anesthesiologist's decision.

Anesthetic technique appears to be effective in postoperative pain.[6]

The cost of anesthesia plays a major role in the choice of anesthesia so that the minor surgeries under SA were reported to cost less.[7]

Medical literature review showed that there are yet controversies whether SA or GA offers better advantages for lower abdominal surgery regarding postoperative pain scores and some emphasized that further study must be performed before final conclusion elucidated.[8-14]

For more clarification of this important topic, we designed the present study to evaluate postoperative pain scores and also postoperative morphine requirement after GA or SA techniques, in elective lower abdominal surgery.

The aim of this study was to compare GA and SA in terms of the postoperative pain score and morphine requirement in lower abdominal surgeries.

In the current study, we tested the hypothesis that SA with hyperbaric bupivacaine 0.5% is superior to GA with isuflurane to reduce the postoperative pain and analgesic consumption after elective lower abdominal surgery.

MATERIALS AND METHODS

Sixty eight ASA physical status I and II aged 20-65 years patients who were scheduled for elective lower abdominal surgery under GA or SA participated in this randomized double-blinded clinical trial (Project Number 384141).

The study protocol was approved by our Institute Ethics Committee, and all patients gave written, informed consent. The study was performed in Alzahra University Hospital in Isfahan in 2008.

The patients with history of chronic inflammatory disease, history of drug or alcohol abuse, psychiatric illness, and those with any current acute or chronic pain conditions, and BMI >30 kg/m^2 did not included in the study and patients with prolonged intubation after surgery, failed SA, allergies to opioids and any unpredictable condition in surgery or any complication such as hypotension or bleeding were excluded. Also, the patients who required analgesic during operation more than the protocol of our study were excluded.

The sample size was estimated based on a power calculation, which showed that at least 34 patients per group were necessary to achieve 80% power to detect a 20% difference between the two groups in the Visual Analog Scale (VAS) scoring with a equal to 0.05.

Patients were randomly allocated into GA or SA groups using sealed envelopes with 34 patients in each group, respectively [Figure 1].

All patients were shown how to use VAS (0 = no pain, 10 = worst possible pain) the day before surgery.

The baseline heart rate (HR), systolic, diastolic, and mean arterial pressure, and also SaO_2 were recorded every 15 min during the entire anesthesia period and also recorded every 15 min during the recovery period. No premedication was given to the patients.

In the GA group, induction of anesthesia was carried out with sodium thiopental 6 mg/kg body weight, fentanyl 2 mic/kg body weight, morphine 0.15 mg/kg, and atracurium 0.6 mg/kg body weight, and then, trachea was intubated.

Maintenance of anesthesia was performed with 50% N_2O and O_2 and also 1 MAC of isoflurane with controlled ventilation. At the end of the surgery, the residual of neuromuscular block was reversed with a mixture of 0.02 mg/kg body weight atropine and 0.04 mg/kg body weight of neostigmine.

In SA group, after preloading patients with 10 ml/kg Ringer solution over 10-20 min, the patient was placed in a seated position. After proper disinfection and topical anesthesia, SA was performed at L3–L4 interspace with a 23-gauge Quincke spinal needle after local infiltration of 3 ml of 2% xylocaine. A 3 cc of hyperbaric bupivacaine 0.5% (15 mg) were injected intrathecally. Positive aspiration of clear cerebrospinal fluid before and after the injection confirmed correct needle placement.

In SA group, fentanyl 2 mic/kg and morphine 0.15 mg/kg was administered intravenously for better intraoperative analgesia.

Oxygen at 6 l/min via a facemask was administered afterwards.

Duration of surgery (from skin incision to skin closure) and also duration of recovery period (from arriving to recovery room to discharge from that) were recorded.

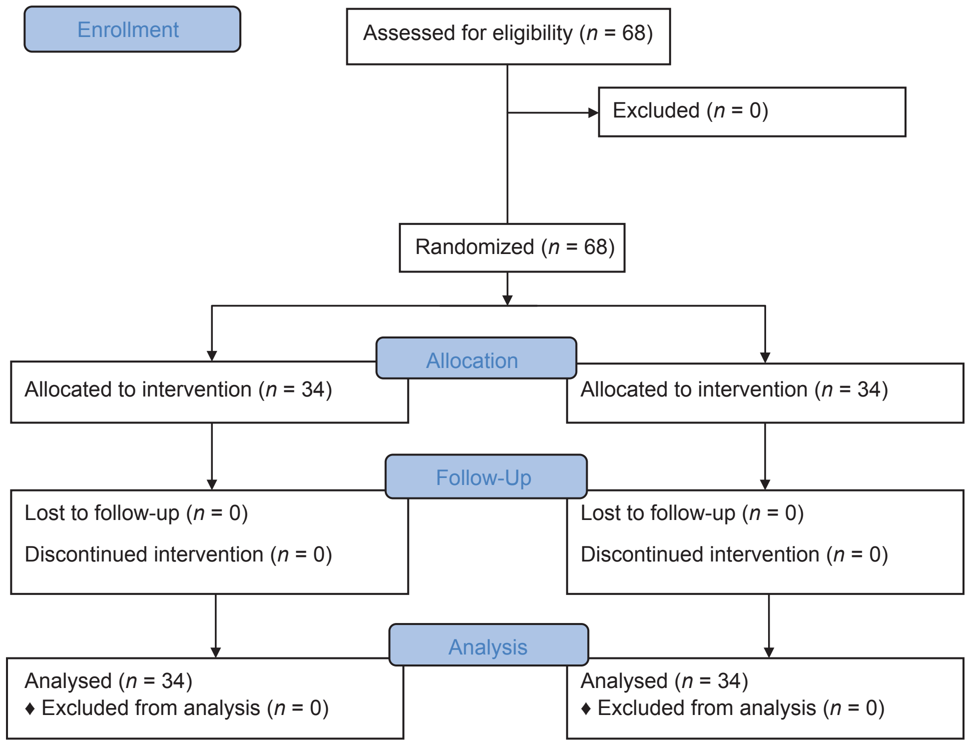

Figure 1: Consort diagram of the study

The pain scores recorded in the recovery room at 2, 4, 6, 12, and 24 h after surgery by an anesthesiologist blinded to the treatment groups. The time to first analgesic requirement was calculated from arriving to recovery room until the first dose of morphine consumption.

The numbers of supplementary analgesics required by each patient in a 24 h period and total morphine consumptions were recorded.

Any local and systemic complications contain hemodynamic changes, tachycardia (HR >120/min) or bradycardia (HR <60/min), Postoperative nausea and vomiting (PONV), respiratory depression and shivering were recorded.

Duration of surgery (the time from start of surgery to the closure of the wound by dressing) and also duration of recovery stay (the time from arrival to the PACU to discharge from that) were recorded.

If patients were awake and had no pain more than 30 mm, PONV or hemodynamic instability, they were discharged from PACU in GA group.

In SA group, when patients had no pain more than 30 mm, PONV, and at least two segment regression of spinal block, they were discharged from PACU.

When the patient was discharged from recovery ($t = 0$), the severity of the pain was assessed with VAS. Then, VAS was evaluated 2, 6, and 24 h after the patient was admitted in ward. If VAS score was more than 40 mm, then 0.15 mg/kg morphine was given intravenously, if the score did not reduce within 15-20 min, an additional 0. 1 mg/kg morphine was administered and the total morphine consumption was recorded. Postoperative pain was assessed for 24 h using a VAS (0 defined as no pain and a 10 defined as the worst pain ever experienced).

Postoperative analgesics used and total administered dosage of morphine were recorded till 24 h after surgery.

The average of severity of the postoperative pain in the lower abdominal surgeries which assessed by VAS in both groups was evaluated in 2, 4, 6, 12, and 24 h after surgery and also the average of received analgesic (morphine) in both groups was compared in 2, 4, 6, 12, and 24 h after surgery.

In addition, the incidence of PONV was recorded.

Collected data entered into a computer and analyzed by SPSS version 18 software.

Data are presented as mean ± SD or number (percent).

Data such as age, weight, anesthesia time, recovery time, mean of pain score, mean of morphine consumption, and mean time to first analgesia requirement were compared with using a student's *t*- test, sex distribution, ASA physical status, and frequency of morphine consumption were measured by using χ2- test or Fisher's exact test if needed.

The trend and change of HR, systolic, diastolic, and MAP during point time were analyzed by repeated measures of the ANOVA test.

$P < 0.05$ was considered statistically significant.

Finally, two groups were compared in terms of the severity of the post operative pain and the amount of received opioid.

Statistical analysis was performed by using analysis of variance with Fisher's protected least square difference test for multiple comparisons among means.

In addition, the difference between these trends was analyzed by paired *t*-tests. Probability values <0.05 were considered significant.

RESULTS

The two groups of patients were comparable with respect to sex, age, weight, height, male-to-female ratio, ASA physical status, and duration of surgery [Table 1].

Patients characteristics, duration of surgery, and hospital stay in two groups

All the procedures were completed by the allocated methods of anesthesia, as there were no conversions from spinal to GA.

Intraoperative maximum mean arterial blood pressure and HR changes were not significantly different between the two groups ($P > 0.05$) [Table 2].

Intraoperative and postoperative outcomes in two group

The mean age of groups 1 and 2 was 46.7 ± 6.4 and 49.4 ± 8.2 years, respectively, and according to the *t*-test, there was not a significant differences between them ($P > 0.05$).

Both study groups were comparable with respect to their demographic data. The base line values of both groups showed no significant differences ($P > 0.05$).

The VAS at 2 and 4 h after the surgery and also the total morphine consumption during the 6 h after surgery in the SA group was statistically lower than the GA group, but there were no significant differences between the two groups regarding 6-24 h postoperative pain scores and analgesic requirements ($P > 0.05$) [Table 3].

Table 1: Patients characteristics and duration of surgery and hospital stay

Variable	SA group (*n*=34)	GA group (*n*=34)
Sex (M/F)	8/26	11/23
Age (year)	46.7±6.4	49.4±8.2
ASA (I/II)	21/13	19/15
Weight (kg)	68±5.2	71.2±12.4
Height (cm)	168±13	172±9
Duration of surgery (min)	96±25	110±35
Duration of hospital stay (day)	1.8±0.6	2.1±0.8

Values are presented as mean±SD or number, SA=Spinal anesthesia; GA=General anesthesia; No significant difference was noted between two groups; ASA= American society of anesthesiologists

Table 2: Maximum HR, BP, blood loss, morphine use and PACU stay

Variable	SA group (*n*=34)	GA group (*n*=34)	*P* value
Maximum heart rate changes (mm Hg)	-20±4.6	+24±6.8	<0.05
Maximum mean arterial blood pressure changes (mmHg)	−35.3±12.5	−23.4±4.9	<0.05
Blood loss	500±130	580±95	<0.05
Total morphine use in 6 h postoperatively (mg)	10.2±4.3	15.6±0.9	<0.05
Total morphine use after 6 to 24 h postoperatively (mg)	15.45±4.3	17.2±6.5	>0.05
PACU stay (min)	126±12	75±6	<0.05

Values are presented as mean±SD or number (%); SA=Spinal anesthesia; GA=General anesthesia; HR=Heart rate; PACU=Postanesthesia care unit; BP=???

Table 3: Visual analog scale

Variable (postoperative)	SA group (*n*=34)	GA group (*n*=34)	*P* value
2 h	3.4±1.6	5.2±1.5	<0.05
4 h	4.1±1.2	5.8±0.9	<0.05
6 h	5.2±0.9	5.6±0.4	>0.05
12 h	3.7±1.2	3.6±0.96	>0.05
24 h	3.0±0.8	3.12±0.82	>0.05

Values are presented as mean±SD or number (%), SA=Spinal anesthesia, GA=General anesthesia; VAS=Visual analog scale

Postoperative pain scores in two groups

Time to first analgesia was not significant between the two groups.

According to the repeated measures ANOVA, mean changes of heart rates, Sat O_2, Systolic, diastolic and mean arterial pressure (SBP, DBP, MAP) during the anesthesia period and recovery time in both groups was not statistically significant ($P > 0.05$).

The incidence of postoperative complications such as hypotension, hypertension, tachycardia or bradycardia, PONV, and shivering were very low (2 shivering in the GA group, 3 PONV in the GA group, and 1 in the SA group, 2 hypotension in the SA group, and 1 bradycardia in the GA group) and the statistical analysis were not possible.

DISCUSSION

SA or GA have been performed for elective lower abdominal surgeries but limited randomized controlled prospective, investigation have been carried out to establish whether one of these is better in decreasing postoperative pain scores.[12-14]

Effective management of acute postoperative pain is challenging. The purpose of this study was to answer a simple question frequency asked by patients and also by some health provider: Which anesthesia (spinal or general) is the best for the surgery?

And which one has the less postoperative pain scores?

This study showed that SA with hyperbaric bupivacaine 0.5% is only superior to the GA for reducing pain intensity and analgesia requirement and number of demands of supplemental morphine in the first 4-6 postoperative hour after lower elective abdominal surgery. Mean changes of HR and blood pressure were statistically lower during the operation period and also during the first 6 postoperative hours after that which may revealed to lower pain during that period.

But after that period until 24 h there were not statistically significant differences between the two groups regarding postoperative pain scores and also postoperative morphine consumption.

Previous studies were not in accordance with the results of this study. Massicotte and coworker compared SA with GA on morphine requirement and postoperative pain score after abdominal hysterectomy. They concluded that postoperative pain at rest was lower in SA group until the 18th h and under stress until 48th h. They consumed at least two times less morphine at each time interval than the GA group. But Massicotte and his coworker used intrathecal morphine and fentanyl with local anesthetic which can cause different result on postoperative pain than our study.[15]

In a recent study Kessous *et al*. in a case-controlled study in 153 patients under either SA or GA for cesarean section showed that postoperative meperidine requirements in the first 24 h were significantly higher in the GA than SA and pain scores were graded after 8 h in the GA versus the SA and this reversed at 48 h.[13]

Eduardo Imelloni and coworker reported the importance of postoperative pain relief in laparoscopic cholecystectomy and concluded that SA was associated with an extremely low level of postoperative pain and better recovery than GA.[14]

In another study, Ganano and coworker concluded that patients in the GA group were admitted to the postanesthesia care unit with a higher pain score and needed more analgesic than patients in the SA group (both $P < 0.01$).[12]

Wang and coworker in a randomized clinical trial in 60 women scheduled for lower abdominal surgery under GA or SA concluded that postoperative pain after lower abdominal surgery can be significantly decreased if the surgery is performed under SA with 3 ml of hyperbaric 0.5% bupivacaine.[16] Their results showed that pain score at rest was significantly lower in the SA group than the GA group 6-24 h after surgery, but our results showed that patients in the SA group had significantly lower scores only at the first 6 h postoperatively and there were no significant differences on postoperative pain scores after 6 h in the two groups and so it is an important finding that needs more researches in this field.

CONCLUSION

In this study, we assessed the postoperative pain in lower abdominal surgeries in two groups with GA and SA.

In conclusion, our data suggest that there is no significant difference between the postoperative pain in GA and SA in these patients, and SA with 3 cc hyperbaric bupivacaine 0.5% do not provide enough pain relief after lower abdominal surgery and supplemental opioids should therefore be given to achieve effective analgesia in the postoperative period.

The amount of received analgesic had a declining trend in both groups postoperatively. However, 6 h after the surgery in GA group, there was a peak of analgesic requirement. Even this dose is more than the first dose after discharging from post operative care unit. The reason is not properly clear, but it seems that the inflammatory reactions due to anesthetic's medicines and surgery are responsible.

Finally, we suggest similar studies to compare the type of anesthesia in other type of surgeries, and on the other hand as acute pain management in patients with preoperative narcotic dependency or acute opioid tolerance is challenging so their postoperative pain require further studies.

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