Abdelnaim et al. Ain-Shams Journal of Anesthesiology (2018) 10:10
https://doi.org/10.1186/s42077-018-0012-8

Ain-Shams Journal of Anesthesiology

ORIGINAL ARTICLE Open Access

Comparison between bupivacaine–dexmedetomidine mixture and bupivacaine–magnesium mixture when used for wound infiltration before skin incision in surgeries for hernia repair regarding their intraoperative and postoperative analgesic effects

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Abstract

Background: Wound infiltration with local anesthetics was developed to provide intraoperative and postoperative analgesia and to reduce opioid consumption and its side effects.

Methods: This is a prospective randomized, double-blinded study. A total of 45 patients, American Society of Anesthesiologists physical status I–II, aged from 18 to 60 years scheduled for open abdominal surgeries were randomly assigned to one of the following groups to receive wound infiltration 2 min prior to skin incision: group I: bupivacaine 0.25% alone (20 ml) ($n = 15$), group II: bupivacaine 0.25% + magnesium sulfate (1 g) (20 ml) ($n = 15$), and group III: bupivacaine 0.25% + dexmedetomidine (70 μg) (20 ml) ($n = 15$). Induction and maintenance were done according to our hospital protocol. Heart rate (HR) and systolic blood pressure (SBP) at baseline and every 15 min till the end of surgery, the need for supplemental fentanyl, and the concentration of inhalational anesthetic were assessed. Postoperatively, Ramsay sedation scale was assessed 10 min post extubation and every 30 min for 6 h; visual analog scale was assessed at rest and every 30 min for 6 h postoperatively; time to the first request of analgesia and the cumulative analgesic consumption were recorded; HR and SBP were recorded for 6 h.

Results: The concentration of inhalational isoflurane and the need for supplemental fentanyl intraoperatively were significantly lower in group III than in groups I and II. Postoperatively in group III, HR and SBP and visual analog scale scores were significantly lower compared with groups I and II. Ramsay sedation score was significantly higher in group III up to 2 h after recovery in comparison to groups I and II. Group III showed longer time for the first request of analgesia and a lower need for postoperative opioids in comparison to groups I and II.

Conclusions: Wound infiltration with dexmedetomidine–bupivacaine mixture before skin incision decreases the anesthetic requirements, provides prolonged analgesia, and decreases the need for rescue analgesics in patients undergoing open abdominal surgeries.

Keywords: Analgesia, Dexmedetomidine, Open abdominal surgeries, Wound infiltration

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Table 1 Demographic data of patients

	Group I ($n = 15$)	Group II ($n = 15$)	Group III ($n = 15$)	*P* value
Age (years)	33.47 ± 8.4	33.47 ± 8.4	35.20 ± 6.6	0.78
Sex (male/female)	8/7	6/9	7/8	0.10

Data presented as mean ± SD and number of cases

Background

Laparotomy incisions are commonly associated with persistent postoperative pain, which is usually treated with NSAIDs or opioids. However, these drugs can induce serious side effects such as gastrointestinal adverse events, postoperative bleeding, vomiting, respiratory depression, and sedation (Maund et al. 2011).

Wound infiltration was developed to provide intraoperative and postoperative analgesia either alone or with other analgesic regimens to reduce opioid consumption and avoid their side effects (Schurrm et al. 2004).

Dexmedetomidine is a potent and highly selective α-2 adrenoceptor agonist with sympatholytic, sedative, amnestic, and opioid-sparing analgesic effect. It was considered a safe adjunct in many clinical anesthetic applications. It has been used as an adjunct to general anesthesia when given as an intravenous premedication at a dose of 0.33–0.67 μg/kg 1 min before surgery (Ebert et al. 2000). Dexmedetomidine was also used as an adjunct to local anesthetics in locoregional anesthesia and analgesia (Memis et al. 2004).

Adding dexmedetomidine to lidocaine for intravenous regional anesthesia causes an improvement in the quality of intraoperative anesthesia (Memis et al. 2004), and the intra-articular administration of dexmedetomidine decreases the need for postoperative analgesia after arthroscopic knee surgery (Al-Metwalli et al. 2008). As regards caudal anesthesia (El-Hennawy et al. 2009) and sciatic nerve blockade, the addition of dexmedetomidine to the local anesthetic increases the duration of anesthesia and analgesia.

Magnesium has an analgesic effect as it is a physiological Ca++ antagonist and also a noncompetitive *N*-methyl-D-aspartate receptor antagonist (Begon et al. 2002; Kara et al. 2002). Intravenous magnesium sulfate decreases intraoperative and postoperative analgesic requirements and prolongs neuromuscular blockade (Owezarzak and Haddad 2006; Pickering et al. 2002).

Table 2 Types of hernia surgeries

Operations	Group I ($n = 15$)	Group II ($n = 15$)	Group III ($n = 15$)
Incisional hernia	5/15	4/15	6/15
Umbilical and paraumbilical hernia	6/15	5/15	4/15
Oblique inguinal hernia	4/15	6/15	5/15

Table 3 Intraoperative heart rate in study times

Intra operative HR (beat\min)\groups	Group I ($n = 15$)	Group II ($n = 15$)	Group III ($n = 15$)	*P* value
0 min	90.07 ± 11.72	87.53 ± 10.99	83.73 ± 9.64	0.25
15 min	77.47 ± 12.33	74.07 ± 8.90	72.07 ± 13.06	0.43
30 min	77.07 ± 12.33	73.13 ± 12.92	72.00 ± 15.14	0.56
45 min	76.93 ± 15.80	72.73 ± 9.72	70.93 ± 15.80	0.47
60 min	73.73 ± 11.20	72.60 ± 11.28	71.87 ± 9.8	0.89
75 min	74.20 ± 9.7	75.27 ± 10.2	71.71 ± 7.7	0.56
90 min	80.44 ± 11.01	75.30 ± 9.41	73.00 ± 10.91	0.25
105 min	78.78 ± 10.63	74.10 ± 10.26	71.18 ± 7.02	0.21
120 min	82.86 ± 10.71	72.78 ± 6.24	70.33 ± 8.73	0.10
135 min	78.40 ± 9.86	74.25 ± 7.34	69.83 ± 4.5	0.19

Data expressed as mean ± (SD). *P* value > 0.05 = non-significant

Magnesium was used as a co-analgesic for peripheral blocks: two studies showed prolongation of peripheral nerve blocks in axillary plexus block and interscalene block (Gunduz et al. 2006).

Till the beginning of this study, no other study had compared the analgesic effect of wound infiltration with bupivacaine alone, magnesium sulfate with bupivacaine, and dexmedetomidine with bupivacaine. So, the aim of the present study is to compare wound infiltration with either bupivacaine 0.25% alone, or a mixture of bupivacaine 0.25% and magnesium sulfate (1 g), or a mixture of bupivacaine 0.25% and dexmedetomidine (1 μg/kg) before skin incision as regards intraoperative and postoperative analgesic properties in patients undergoing hernia repair surgeries.

Methods

This prospective randomized, comparative clinical study included 45 patients of both sex, American Society of Anesthesiologists physical status I and II, aged 18–60 years, who were scheduled for hernia surgeries. The study was conducted in Cairo University Teaching Hospital from August 2014 to March 2015 after obtaining ethics committee approval and informed consents from patients. Exclusion criteria were patient refusal, age less than 18 or more than 60 years, American Society of Anesthesiologists III and IV, allergy to local anesthetics, pregnant patient, cardiovascular problems, and liver and renal impairment.

All patients meeting the inclusion criteria were randomly assigned to one of the following groups to receive wound infiltration (n = number of patients):

(1) Group I: bupivacaine 0.25% alone (20 ml) ($n = 15$)
(2) Group II: bupivacaine 0.25% + magnesium sulfate (1 g) (20 ml) ($n = 15$)

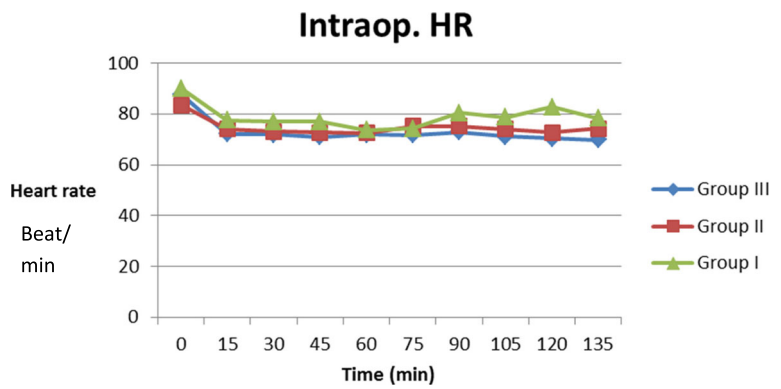

Fig. 1 Intraoperative heart rate (beats/min). Data expressed as mean values

(3) Group III: bupivacaine 0.25% + dexmedetomidine 1 μg/kg (20 ml) ($n = 15$)

The dose of dexmedetomidine was based on a previous study done by Cheung et al. (2011).

The dose of magnesium sulfate was based on a previous study done by Razavi et al. (2015).

So, these doses were set on the grounds that this was adequate to produce local analgesia in the first 6 h postoperatively.

Randomization was done by computer-generated numbers and concealed by serially numbered, opaque, and sealed envelopes. The details of the series were unknown to the investigators and the group assignments were kept in sealed envelopes, each bearing only the case number on the outside prior to surgery; the appropriate numbered envelopes were opened by the nurse; and the card inside determined whether the patient belonged to groups I, II, or III. The drugs were prepared by the nurse in the form of a syringe 20 ml labeled with the case number. Group I received 10 ml bupivacaine 0.5% + 10 ml normal saline 0.9%, group II received (10 ml bupivacaine 0.5% + magnesium sulfate 15 mg/kg (1000 mg in 10 ml), and group III received [10 ml bupivacaine 0.5% + 1 ml dexmedetomidine (1 μg/kg) + completed to 20 ml by normal saline 0.9%]. The patients of each group were infiltrated by one of the three syringes 2 min prior to skin incision. All the parties involved including the patient, the surgeon, the anesthesiologist, and the investigator collecting the data were unaware of the study drugs or the patient group assignment.

Preoperatively, full history and investigations were taken in the form of complete blood count, blood sugar, liver function tests, kidney function tests, serum electrolytes, and coagulation profile. The patients were taught how to express their pain using 10 cm visual analog scale (VAS) where 0 = no pain and 10 = severe worst pain.

Preoperative VAS scores were obtained from all patients by asking the average intensity of pain at the pre anesthetic checkup.

After securing intravenous access by 20-G cannula, all patients received 0.05 mg/kg midazolam for anxiety, ranitidine 50 mg, and metoclopramide 10 mg intravenously

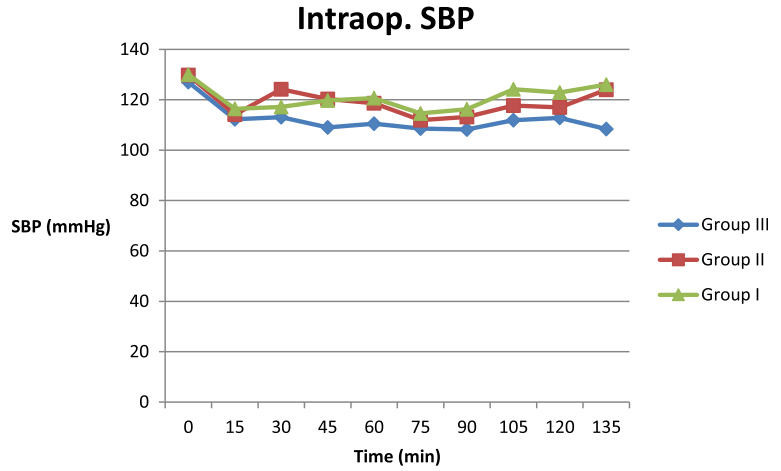

Fig. 2 Intraoperative systolic blood pressure. Data expressed as mean values

Table 4 Intraoperative systolic blood pressure in all study times

Intra operative SBP(mmHg)\ Groups	GroupI (*n* = 15)	GroupII (n = 15)	GroupIII (n = 15)	*P* value
0 min	130 ± 12.34	129.8 ± 14.90	127 ± 11.00	0.77
15 min	116.40 ± 13.30	114.13 ± 9.69	112.27 ± 16.73	0.70
30 min	117.20 ± 16.07	124.20 ± 19.85	113.07 ± 15.68	0.21
45 min	119.73 ± 19.6	120.33 ± 18.1	109.00 ± 12.14	0.13
60 min	120.67 ± 22.02	118.60 ± 14.98	110.53 ± 12.25	0.23
75 min	114.60 ± 12.38	111.93 ± 16.68	108. 57 ± 11.77	0.50
90 min	116.27 ± 11.95	113.21 ± 11.84	108.22 ± 10.39	0.27
105 min	124.20 ± 18.06	117.73 ± 10.18	111.89 ± 15.60	0.21
120 min	122.89 ± 13.52	117.00 ± 12.92	112.86 ± 14.65	0.35
135 min	126.00 ± 17.86	124.00 ± 10.45	108.40 ± 10.55	0.09

Data expressed as mean ± (SD)
P value > 0.05 = non-significant

15 min before induction. Standard monitors were applied: ECG, noninvasive arterial blood pressure, and pulse oximetry. Induction of anesthesia in all groups was done by intravenous 2 mg/kg propofol, 1 μg/kg fentanyl, and 0.5 mg/kg atracurium. Maintenance was achieved with an endotracheal tube of suitable size, then a capnogram was connected; isoflurane inhalation started with 1.2 MAC, top-up doses of atracurium. Volume-controlled positive pressure ventilation was adjusted at a tidal volume of 6 ml/kg and respiratory rate to keep ETCO2 at 35 mmHg with continuous monitoring. During surgery, the patients received an intravenous infusion of Ringer's solution according to the fluid requirement. Fentanyl 0.5 μg/kg intravenously was given if the heart rate (HR) and systolic blood pressure (SBP) increased 20% from the baseline.

Before skin incision by 2 min, the wound was infiltrated according to the type of surgery and site of incision (the incisions were different in site but nearly of the same size, so we used the same volume) in all layers covering the skin and subcutaneous tissues by one of the three syringes (20 ml); each one has a serial number corresponding to each group as mentioned before.

The following parameters were followed: HR and SBP at the baseline (before induction) and every 15 min till the end of the surgery, the need for supplemental fentanyl, and the concentration of inhalational anesthetic according to the hemodynamic values.

By the end of surgery, anesthesia was discontinued and reversal was given (when full muscle power has been regained) as neostigmine 0.05 mg/kg and atropine 0.02 mg/kg. Extubation was done, and the patient was transferred to the postanesthesia care unit.

The following parameters were assessed postoperatively: Ramsay sedation scale was assessed 10 min after extubation and every 30 min for 6 h. VAS was assessed at the first 30 min after recovery and every 30 min for 6 h postoperatively (0 score corresponds to no pain and 10 to the worst pain), the time to the first request of analgesia (the time interval between the onset of local wound infiltration done before skin incision and the first request to postoperative analgesia).

When patients first complained of pain, intramuscular ketorolac 30 mg was given if VAS is more than or equal to 4. Persistent or breakthrough pain was managed with incremental intravenous morphine 0.07 mg/kg to maintain a resting VAS at less than or equal to 4. Cumulative analgesic consumption was recorded. Postoperative hemodynamics were assessed (HR and SBP) every 30 min for 6 h.

Ramsay scale (Ramsay et al. 1974) sedation level description:

(1) Anxious and agitated
(2) Cooperative, tranquil, oriented
(3) Responds only to verbal commands
(4) Asleep with brisk response to light stimulation
(5) Asleep without response to light stimulation
(6) Nonresponsive

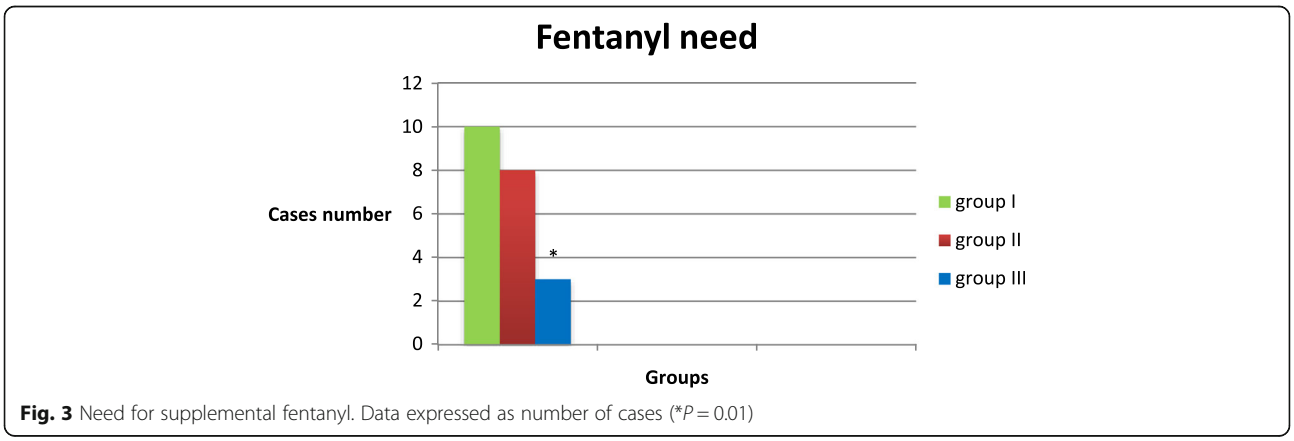

Fig. 3 Need for supplemental fentanyl. Data expressed as number of cases (*$P = 0.01$)

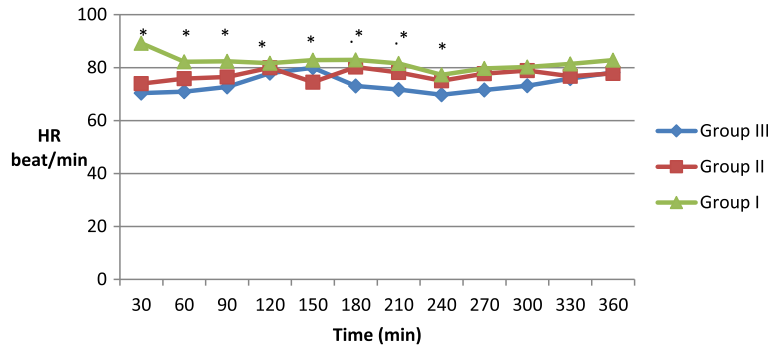

Fig. 4 Postoperative heart rate (beats/min). Data expressed as mean (*$P < 0.05$)

The incidence of complications of the studied drugs was assessed postoperatively: nausea, vomiting, bradycardia, hypotension, loss of knee jerk, and respiratory depression for 6 h postoperatively.

Statistical analysis

A previous study showed that the SD of sensory block was about 28 min with a mean of 119 min in the magnesium group. Based on the assumption that the mean duration in the control group is 100 min and in dexmedetomidine group with 40% increase 140 min and taking power to be 0.8 and α error to be 0.05, a minimum sample size of 11 patients was calculated for each group. A total of 15 patients in each group were included to compensate for possible dropouts. Data were statistically described in terms of mean ± SD, frequencies (number of cases), and relative frequencies (percentages) when appropriate. Comparison of quantitative variables between the study groups was done using Student's t test. For comparing categorical data, χ^2 test was performed. Exact test was used instead when the expected frequency is less than 5. A P value of less than 0.05 was considered statistically significant. All statistical calculations were done using computer programs Microsoft Excel 2010 (Microsoft Corporation, New York, USA) and SPSS (statistical package for social sciences; SPSS Inc., Chicago, IL, USA) version 21 for Microsoft Windows.

Results

Forty-five patients had completed the study, 15 in each group.

Table 5 Concentration of inhalational isoflurane

	Group I ($n = 15$)	Group II ($n = 15$)	Group III ($n = 15$)	P value
Isoflurane %	1.13 ± 0.22	1.07 ± 0.17	0.96 ± 0.083*	0.03*

Data presented as mean ± SD
*p value <0.05 statistically significant

There was no statistically significant difference in age and sex between groups (Tables 1 and 2).

HR in group III was lower in comparison to groups I and II, but it was not statistically significant at all the study times ($P > 0.05$) (Table 3).

SBP in group III was lower in comparison to groups I and II in all study times, but it was statistically non-significant (Figs. 1 and 2) ($P > 0.05$).

The concentration of inhalational isoflurane was significantly lower in group III when compared with groups I and II ($P < 0.05$) (Table 4).

The number of patients who needed supplemental fentanyl intraoperatively was significantly lower in group III in comparison to groups I and II ($P = 0.01$) (Fig. 3).

As regards postoperative HR, group III showed significantly lower HR in comparison to groups I and II,

Table 6 Mean ± SD and P values of postoperative systolic blood pressure

Postoperative SBP (mmHg)\groups	Group I ($n = 15$)	Group II ($n = 15$)	Group III ($n = 15$)	P value
30 min	135.60 ± 7.99	125.53 ± 18.01	115.47 ± 11.01*	0.001*
60 min	131.60 ± 14.79	130.07 ± 8.90	119.27 ± 12.27*	0.017*
90 min	131.40 ± 5.66	126.80 ± 10.03	120.20 ± 10.29*	0.005*
120 min	131.13 ± 10.41	129.80 ± 9.72	117.27 ± 9.89*	0.001*
150 min	130.00 ± 10.54	123.33 ± 11.30	128.53 ± 13.20	0.274*
180 min	125.47 ± 7.86	124.00 ± 17.89	118.93 ± 12.44	0.382
210 min	124.07 ± 10.66	122.73 ± 14.98	117.60 ± 12.44	0.361
240 min	127.20 ± 12.68	128.53 ± 13.56	123.33 ± 14.06	0.551
270 min	124.87 ± 11.06	119.27 ± 11.30	122.87 ± 7.12	0.31
300 min	123.27 ± 9.92	121.53 ± 9.02	119.93 ± 11.51	0.67
330 min	129.73 ± 10.22	122.87 ± 10.50	122.80 ± 9.54	0.11
360 min	127.47 ± 9.00	123.20 ± 12.16	120.67 ± 11.05	0.23

*p value <0.05 statistically significant

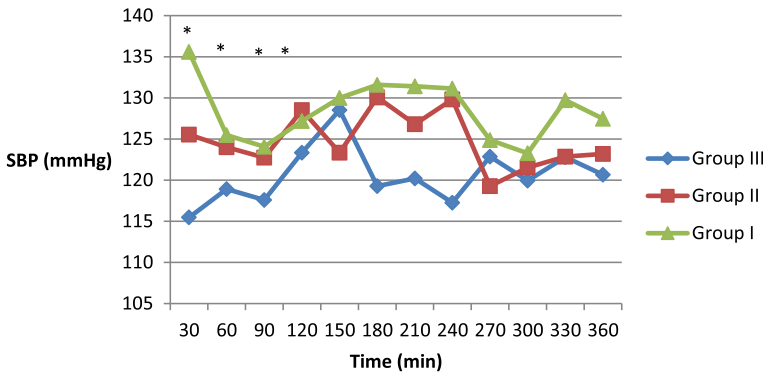

Fig. 5 Postoperative systolic blood pressure. Data expressed as mean (*$P < 0.05$)

except at 270, 300, 330, and 360 min which were statistically non-significant (Fig. 4 and Table 5).

As regards postoperative SBP, group III showed significantly lower SBP in comparison to groups I and II at 30, 60, 90, and 120 min (Table 6 and Fig. 5).

Ramsay sedation score values were significantly higher in group III in comparison to groups I and II at 30, 60, 90, and 120 min. P values were < 0.001 (30 min, 60 min, and 90 min) and $P = 0.03$ (120 min) after recovery, but they were non-significant at the remaining time periods (Fig. 6).

VAS was significantly lower in group III in comparison to groups I and II ($P < 0.05$) at all study times (Fig. 7 and Table 7).

Group III showed significantly longer time for the first request of analgesia in comparison to groups I and II ($P < 0.05$) (Fig. 8).

The number of patients who required postoperative opioids was significantly lower in group III in comparison to groups I and II ($P < 0.05$) (Table 8).

There was no statistically significant difference among groups as regards nausea and vomiting. There was reported respiratory depression ($P > 0.05$) (Table 9).

None of the patients experienced loss of knee jerk. There was no reported hypotension or bradycardia.

Discussion

Pain is one of the most important postoperative complications worldwide, which in turn impairs normal body performance and increases postoperative morbidities. It also increases hospital stay and susceptibility to infections, and if not managed early, it will progress to chronic pain (Rawal 2008).

Also, pain after abdominal surgeries can affect respiratory movements leading to a decrease in functional residual capacity and retention of secretions increasing the incidence of postoperative bronchopneumonia (Kim and Hahn 2000).

Postoperative pain is usually treated with non-steroidal anti-inflammatory drugs or opioids which can induce

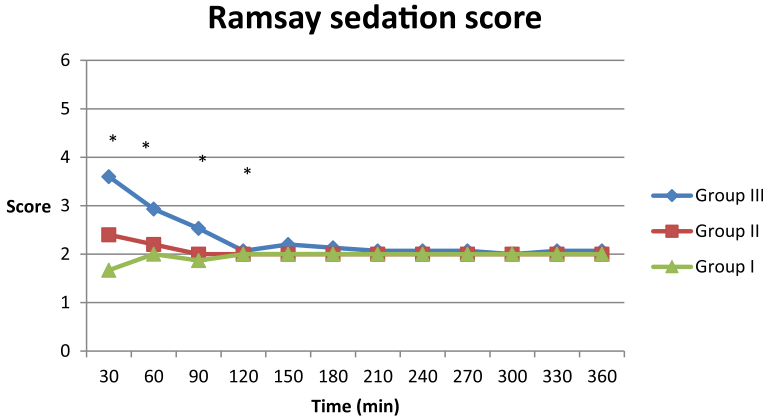

Fig. 6 Ramsay sedation score after recovery in the three groups. Data expressed as mean (*$P < 0.05$)

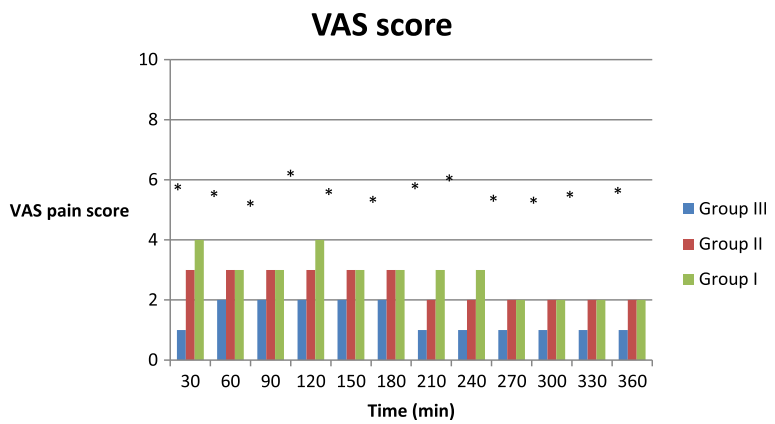

Fig. 7 Visual analog scale after recovery in the three groups. Data expressed as median (*$P < 0.05$)

hazardous side effects such as gastrointestinal adverse events, postoperative bleeding, vomiting, respiratory depression, and sedation (Maund et al. 2011).

Wound infiltration was developed to provide intra- and postoperative analgesia either with local anesthetics alone or with other analgesic regimens. The interest in this technique has increased widely due to its simplicity, safety, and reduction in opioid consumption.

Wound infiltration with local anesthetics provides analgesia by several mechanisms. It can block transmission of pain from the nociceptive afferents of the wound surface. Also, it can inhibit local inflammatory response to injury, which is responsible for pain and hyperalgesia (Hahnenkamp et al. 2002).

Chander et al. (2011) had tried adding opioids to local anesthetics during wound infiltration. They compared the efficacy of wound infiltration with bupivacaine alone or bupivacaine with fentanyl to provide postoperative analgesia in patients undergoing any abdominal surgery. The patients were randomized into two equal groups of 30 patients each: group A received wound infiltration with a solution containing 0.5% bupivacaine (2 mg/kg) and group B received infiltration with a solution containing fentanyl 25 μg added to 0.5% bupivacaine (2 mg/kg). Their results showed significant tachycardia and higher blood pressure in group A compared with patients in group B.

Eldaba et al. (2013) had compared postoperative analgesia for cesarean section after continuous wound infiltration with bupivacaine or lower dose bupivacaine and magnesium versus normal saline. They concluded that continuous wound infiltration with bupivacaine and magnesium sulfate produced effective analgesia and reduced postoperative patient-controlled analgesia requirements as compared with continuous wound infiltration with local anesthetic only or placebo with decreased incidence of opioid side effects.

This study demonstrated that the addition of dexmedetomidine to wound infiltration with local anesthetics improves postoperative pain and reduces the need for analgesics which can be explained by different mechanisms: inhibition of pain conduction in C-fibers (Gaumann et al. 1994), decreased in the production of inflammatory cytokines, the vasoconstrictive effect of 2 on vascular smooth muscle prolongs the time of analgesia, inhibition of tetrodotoxin-sensitive Na+ channels (Kim and Hahn 2000), and the absorption of dexmedetomidine to systemic circulation resulting in supraspinal analgesia.

In our study, regarding intraoperative hemodynamics, group III (dexmedetomidine group) showed a decrease in intraoperative HR and SBP in comparison to groups I and II but it was not statistically significant. The concentration of inhalational isoflurane and the need for

Table 7 Visual analog scale after recovery in the three groups

VAS\groups	Group I ($n = 15$)	Group II ($n = 15$)	Group III ($n = 15$)	*P* value
30 min	4.0 ± 0.00	3.0 ± 0.92	0.87 ± 0.91*	0.000
60 min	3.13 ± 0.99	3.0 ± 0.00	1.67 ± 0.97*	0.000
90 min	3.33 ± 0.48	3.0 ± 0.00	2.07 ± 1.10*	0.000
120 min	3.60 ± 0.50	3.40 ± 0.50	2.53 ± 0.74*	0.000
150 min	3.07 ± 0.70	3.0 ± 0.00	2.60 ± 0.50*	0.03
180 min	3.27 ± 0.59	2.73 ± 0.59	2.67 ± 0.72*	0.027
210 min	3.0 ± 0.65	2.33 ± 0.48	2.20 ± 0.41*	0.000
240 min	2.73 ± 0.70	2.13 ± 0.64	2.07 ± 0.25*	0.004
270 min	2.20 ± 0.41	2.00 ± 0.42	1.80 ± 0.56*	0.03
300 min	2.07 ± 0.25	1.73 ± 0.59	1.72 ± 0.70*	0.01
330 min	2.00 ± 0.00	1.53 ± 0.74	1.93 ± 0.25*	0.01
360 min	2.00 ± 0.00	1.40 ± 0.63	1.87 ± 0.35*	0.001

Data expressed as mean ± (SD)
*P value < 0.05

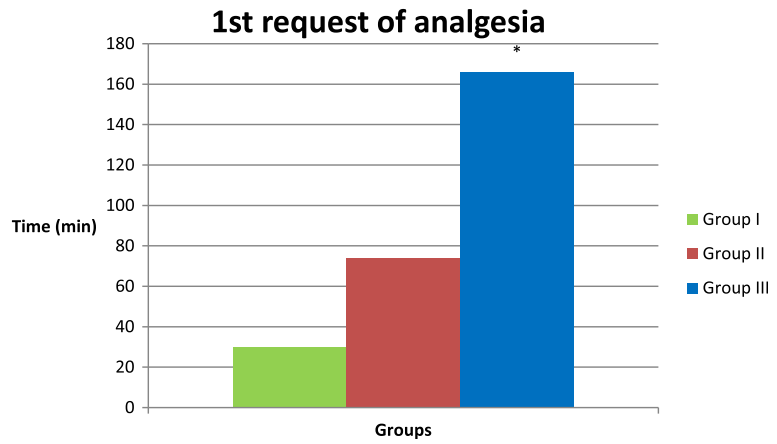

Fig. 8 Time to first request of analgesia. Data expressed as mean (*$P < 0.001$)

supplemental fentanyl intraoperatively were significantly lower in group III in comparison to groups I and II. As regards postoperative hemodynamics, the dexmedetomidine group showed a statistically significant lower HR and SBP than groups I and II. Ramsay sedation score was significantly higher in group III when compared with groups I and II during the early postoperative period (2 h postoperatively), and patients in group III were significantly more sedated compared with patients in groups I and II.

This is in agreement with Cheung et al. (2011) who studied patients undergoing bilateral third molar surgery under general anesthesia. Patients were randomized into three equal groups. Group D received preincision intravenous dexmedetomidine (1 μg/kg) and direct infiltration of the surgical wound with normal saline at the end of surgery. Group P received preincision intravenous normal saline and direct infiltration of the surgical wound with dexmedetomidine (1 μg/kg) at the end of the surgery. A control group N received normal saline at both time points. They found that patients from groups D and P were more sedated than patients from group N.

As regards VAS score postoperatively, our study found that the VAS score was significantly lower in group III when compared with groups I and II. So, a remarkable synergistic property of bupivacaine with dexmedetomidine was obvious as the duration of postoperative analgesia was significantly prolonged in patients in whom dexmedetomidine was administered as adjuvant to local anesthetics. This was correlated with Hyun (2012) who studied 52 male patients undergoing inguinal herniorrhaphy under general anesthesia. They were divided into two groups: one group received 10 ml of 0.2% ropivacaine and the other group received a 10 ml mixture of 0.2% ropivacaine and 1 μg/kg dexmedetomidine both applied via local wound infiltration 2 min prior to skin incision. The VAS score was significantly lower in the group that received a mixture of ropivacaine–dexmedetomidine up to 24 h after surgery.

In our study, the time for the first request of analgesia was significantly longer in group III (166.00 56.54 min) when compared with group II (74.00 35.61 min) and group I (30.00 0.00 min), and postoperative opioid consumption was significantly lower in group III than groups I and II. Also, the incidence of nausea and vomiting was not statistically different between groups and there were no other reported complications. This was correlated with the study done by Hyun (2012).

Limitations of the study include the small sample size which can be increased.

For future studies, we recommend continuous wound infiltration with dexmedetomidine or magnesium sulfate with or without local anesthetics and follow-up of patients for more than 24 h.

Table 8 Postoperative opioid requirement

	Group I ($n = 15$)	Group II ($n = 15$)	Group III ($n = 15$)	*P* value
Number of patients	12/15	9/15	0/15*	0.001*

Data presented as numbers of patients
*p value <0.05 statistically significant

Table 9 Postoperative complications

	Group I ($n = 15$)	Group II ($n = 15$)	Group III ($n = 15$)	*P* value
Nausea	2/15	1/15	3/15	0.56
Vomiting	2/15	1/15	3/15	0.56

Data presented as number of patients

Conclusions

Pre-skin incision wound infiltration with dexmedetomidine–bupivacaine mixture provides prolonged local anesthetic effect, decreases the need for rescue analgesics, and provides better sedation than bupivacaine–magnesium sulfate mixture or bupivacaine alone in patients undergoing surgeries for hernia repair.

Abbreviations

ASA: American Society of Anesthesiology; HR: Heart rate; Mg: Magnesium; NSAIDS: Non-steroidal anti-inflammatory drugs; SBP: Systolic blood pressure; VAS: Visual analog scale

Authors' contributions

HEA conceived of the study and participated in the design of the study. AHS participated in the design of the study and drafted the manuscript. NNM participated in the data collection. ANY performed the statistical analysis and data interpretation and helped draft the manuscript. AHS participated in the data collection. NNM helped draft the manuscript. All the authors read and approved the final manuscript.

Ethics approval and consent to participate

Ethics approval is not applicable. Informed written consent has been obtained from all participants.

Consent for publication

Not applicable

Competing interests

The authors declare that they have no competing interests.

Publisher's Note

Received: 15 August 2018 Accepted: 30 September 2018
Published online: 23 November 2018

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