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Intravenous versus Perineural Dexamethasone in Interscalene Nerve Block with Levobupivacaine for Shoulder and Upper Arm Surgeries

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ABSTRACT

Background: Interscalene brachial plexus block (IBPB) has gained importance for surgical purposes and pain management. It provides effective postoperative pain relief essential for patient comfort and early ambulation.

Objective: To evaluate the effect of dexamethasone as adjuvant to levobupivacaine in ultrasound-guided IBPB in shoulder and upper arm surgeries, and which route, the perineural or the intravenous was more effective.

Patients and methods: Ninety patients randomly allocated into 3 equal groups: **Group L:** received IBPB with 20 ml of 0.5% levobupivacaine plus 2 ml normal saline (NS) with intravenous (iv) 10 ml NS. **Group LD_P:** received IBPB with 20 ml of 0.5% levobupivacaine plus dexamethasone 4 mg diluted in 2 ml NS with iv 10 ml NS. **Group LD_{IV}:** received IBPB with 20 ml of 0.5% levobupivacaine plus 2 ml NS with iv dexamethasone 4 mg diluted in 10 ml NS.

Results: Patients in group LD_P took prolonged time to ask for the first request for analgesia compared with patients in group L and group LD_{IV} (15.57±3.89 vs 13.23±2.65 and 13.57±3.22, respectively) ($p=0.007$ and $p=0.02$, respectively), but no significant difference between group L and group LD_{IV} ($p=0.696$). Pethidine consumption was significantly increased in patients of group L compared with patients in group LD_P and group LD_{IV} ($p<0.001$ and $p<0.001$, respectively), but no significant difference in pethidine dose between group LD_P and group LD_{IV} ($p=0.283$).

Conclusion: This study concluded that the addition of dexamethasone as an adjuvant to perineural levobupivacaine for IBPB prolonged the duration of analgesia, decreased the postoperative pain score, decreased pethidine consumption and improved patient satisfaction.

Keywords: Dexamethasone, Interscalene block, Levobupivacaine, Upper arm Surgeries.

INTRODUCTION

Pain management after shoulder procedures poses a challenge to both anesthesiologists and orthopedic surgeons. In an effort to improve analgesia and facilitate mobilization, regional anesthesia in the form of IBPB is often used, either as an adjunct to general anesthesia or as the primary anesthetic [(1)].

The addition of regional analgesia can shorten the postoperative recovery period and provide the ability to perform open and arthroscopic shoulder surgery on an outpatient basis. IBPB is commonly used for these purposes as it can effectively control acute postoperative pain that occurs approximately 8-10 hours after surgery, and has a high success and low complication rate. It provides safe and effective patient care that is associated with a high degree of satisfaction to the patient and health care providers [(2,3)].

Ultrasound guidance for IBPB significantly reduces the number of needle passes, required local anesthetic volume, and postoperative pain compared with a nerve stimulator-guided technique [(4)]. Levobupivacaine is the latest local anesthetic introduced in clinical practice. It is the pure S (-) - enantiomer of the racemic formulation bupivacaine. Whereas both the R- and S- enantiomers of bupivacaine have anesthetic activity, preclinical studies suggested that levobupivacaine might be less cardiotoxic than the racemic mixture [(5)].

Dexamethasone had been shown to prolong the duration of postoperative analgesia when given as an adjuvant for peripheral nerve blocks. It has multiple systemic effects, such as reducing postoperative nausea, vomiting, and postoperative pain. In this study low dose was chosen to minimize the possibility of side effects of dexamethasone as hyperglycemia [(6)].

The mechanisms behind the beneficial effect of dexamethasone and the route of administration remain to be determined. It has been suggested that the effect is mediated by direct blockade of nociceptive c-fibers, reducing the release of inflammatory mediators and ectopic neuronal discharge, and upregulation of potassium channels [(7)].

The purpose of this study was to compare perineural versus intravenous dexamethasone on prolongation of the action of levobupivacaine in ultrasound-guided IBPB for shoulder and upper arm surgeries. Hemodynamic stability, analgesic requirement and patient satisfaction were evaluated.

PATIENTS AND METHODS

This double blinded randomized comparative controlled trial was conducted at Mansoura University Hospitals. The clinical part of the study was conducted from the first of April 2018 to the first of May 2020.

Ethical approval:

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The study was approved by the Institutional Review Board (IRB) of Mansoura University (Code number MS/18.03.65), and registered to Clinical Trials.gov with registry ID: NCT04284007. Patients signed an informed written consent for acceptance of the procedure. This work has been carried out in accordance with The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans.

Inclusion Criteria:

Ninety patients of either sex, aged between 20 and 60 years, ASA grade I and II were scheduled for elective shoulder and upper arm surgeries.

Exclusion Criteria:

Patients with neuromuscular diseases, coagulation disorders, psychiatric diseases, local skin infection at the site of the block, known hypersensitivity to the study drugs, body mass index > 35 kg/m^2, patients with contraindication to interscalene block as phrenic palsy, pneumothorax or severe pulmonary disease and patients refusing to participate in the study were excluded from the study.

Randomization:

Patients were randomly allocated by computer-generated randomization table using the Statistical Package for the Social Sciences (SPSS) version 22 for Windows® (IBM SPSS Inc, Chicago, IL, USA), and group assignments were concealed in sequential number sealed opaque envelopes into 3 equal groups:

Group L (n=30): patients received IBPB with 20 ml of 0.5% levobupivacaine plus 2 ml normal saline (NS) with intravenous (iv) 10 ml NS (placebo group).

Group LD$_P$ (n=30): patients received IBPB with 20 ml of 0.5% levobupivacaine plus dexamethasone 4 mg diluted in 2 ml NS with iv 10 ml NS.

Group LD$_{IV}$ (n=30): patients received IBPB with 20 ml of 0.5% levobupivacaine plus 2 ml NS with administration of iv dexamethasone 4 mg diluted in 10 ml NS.

Anesthetic Management:

Preoperative management:

All patients were assessed preoperatively by: history taking, physical examination and laboratory evaluation (complete blood picture, coagulation profile, liver function and renal function tests). The day before the surgery, the study protocol had been explained to all patients. All patients were familiar with the use of 10-cm visual analogue scale (VAS) identifying 0 as no pain and 10 as worst imaginable pain [(8)].

Intraoperative management:

Routine monitoring including electrocardiography, non-invasive blood pressure and pulse oximetry were conducted to the patient and basal heart rate (HR), mean arterial pressure (MAP) and SpO_2 were recorded. Peripheral iv cannula (18 G) was inserted and acetated Ringer was started to be infused. All patients had been lightly sedated using iv midazolam 0.03 mg/kg before the procedure.

Technique of ultrasound guided IBPB:

Standard precautions for the US guided nerve blocks performance were followed that included standard monitoring, the skin overlying the injection site was prepped with an antiseptic solution and the probe surface in contact with the skin was covered with a sterile adhesive dressing. The patient was placed in the supine position and the head was slightly elevated and turned away from the side to be blocked.

Medial to lateral approach to IBPB was done. In this approach, a linear transducer (8-12 MHZ) attached to US machine (Philips Clearvue350, SN: C512130007, Mexico) was placed in a transverse orientation across the neck at the level of cricoid cartilage with the probe marker facing medial to identify the carotid artery. Once the artery has been identified, the transducer was moved slightly laterally across the neck. The goal was to identify the anterior and middle scalene muscles and the elements of the brachial plexus that was located between them. Then the skin at the site of needle introduction was anesthetized via subcutaneous injection of 2-3 ml lidocaine 2%. Under ultrasonographic guidance, 22 gauge spinal needle was inserted in-plane toward the brachial plexus, typically in a lateral to medial direction. The needle was always be aimed in between the roots instead of directly at them in order to minimize the risk of accidental nerve injury. As the needle passed through the prevertebral fascia, a certain "pop off" was appreciated.

After careful aspiration to rule out intravascular needle placement, 1-2 ml of local anesthetic was injected to verify proper needle placement. It was necessary to ensure that high resistance to injection is absent to decrease the risk of intra fascicular injection. When injection of the local anesthetic does not appear to result in a spread around the brachial plexus, additional needle repositioning and injections may be necessary [(9)].

Assessment of blockade:

Patients were closely observed 30 minutes after the end of local anesthetic injection. Block success was assessed by loss of sensation to pinprick at C4 and C5 sensory dermatome measured 30 minutes after the end of local anesthetic injection. Sensory block was assessed by pin prick test using a 3 point scale: Grade 0 = normal sensation. Grade 1 = loss of sensation to pin prick (analgesia). Grade 2 = loss of sensation to touch (anesthesia). Onset time for sensory block was defined

as the time interval between the end of local anesthesia administration and complete sensory block (grade 2). Motor block was determined according to the 3 point modified Bromage scale for upper limb**:** Grade 0 = normal motor function with full flexion and extension of elbow. Grade 1 = decrease motor power. Grade 2 = complete motor block.

Onset time of motor block was defined as the time interval between the end of local anesthetic administration and complete motor block (grade 2). Onset of sensory and motor block was recorded. Duration of sensory block was defined as the time interval between complete sensory block (grade 2) and complete resolution of anesthesia on all nerves (grade 0). Duration of motor block was defined as the time interval between complete motor block (grade 2) and complete recovery of motor function of the arm (grade 0). Duration of sensory and motor block was recorded. Patients who did not experience complete sensory block (grade 2) and complete motor block (grade 2) were excluded from the study. HR, MAP and SPO_2 were monitored and recorded till end of the surgery.

Postoperative assessment:

Patients were monitored in the post anesthesia care unit (PACU). Pain was assessed using VAS at 1, 2, 6, 12 and 24 hours (hrs) postoperatively. Intravenous paracetamol (1 gm) was given regularly every 8 hrs as standard analgesic for all patients. When the patient experienced pain (VAS≥4), a bolus dose of iv pethidine 25 mg was administered as rescue analgesic and was repeated till VAS score ≤ 4 was attained. The time to the first request for rescue analgesic (duration of analgesia) was recorded.

The total dose of pethidine (mg) consumed in the first postoperative 24 hrs was calculated and registered. Unwanted postoperative events like hypotension, bradycardia, nausea and vomiting were recorded. Patient satisfaction concerning the anesthetic procedure was assessed using 2-point scale: 1= satisfied, 2= unsatisfied [(10)].

Outcomes of the study:

The primary outcome was the onset and duration of sensory and motor block. Secondary outcomes included the total analgesia consumption, pain score using VAS, time to the first rescue analgesia, hemodynamic stability and patient satisfaction.

Sample size calculation:

A priori G power analysis was done to estimate the sample size. With an effective size of 0.4 and power 90% and alpha error of 0.05 to evaluate the effect of adding dexamethasone to levobupivacaine as an adjuvant in interscalene nerve block. It yields a sample size of 84 cases. There was a predicted drop of 5% thus the total sample size was 90 patients (30 in each group).

Statistical analysis

The collected data were coded, processed and analyzed using the SPSS (Statistical Package for the Social Sciences) version 22 for Windows® (IBM SPSS Inc, Chicago, IL, USA). Data were tested for normal distribution using the Shapiro Wilk test. Qualitative data were represented as frequencies and relative percentages. Chi square test (χ^2) and Fisher exact was used to calculate difference between qualitative variables as indicated. Quantitative data were expressed as mean ± SD (Standard deviation) or median (minimum-maximum) when appropriate.

One way analysis of the variance (ANOVA) test was used to compare between more than two independent groups of normally distributed variables (parametric data), while Kruskal Wallis test was used for non-normally distributed data (non-parametric data) with Mann Whitney U test was used for pairwise comparison. Post-hoc Tukey test was used to calculate the significance between each two independent groups with parametric quantitative data. Paired samples t-test was used to calculate the level of significance within the same group at different time points. P value < 0.05 was considered significant.

RESULTS

One hundred patients who underwent shoulder and upper arm surgeries were assessed for eligibility. Five patients refused the block, and 5 patients due to failed blockade, all were excluded from the study. A total of 90 patients were ultimately included to the study and the recruitment was halted once the desired patients were enrolled in the study (Figure 1).

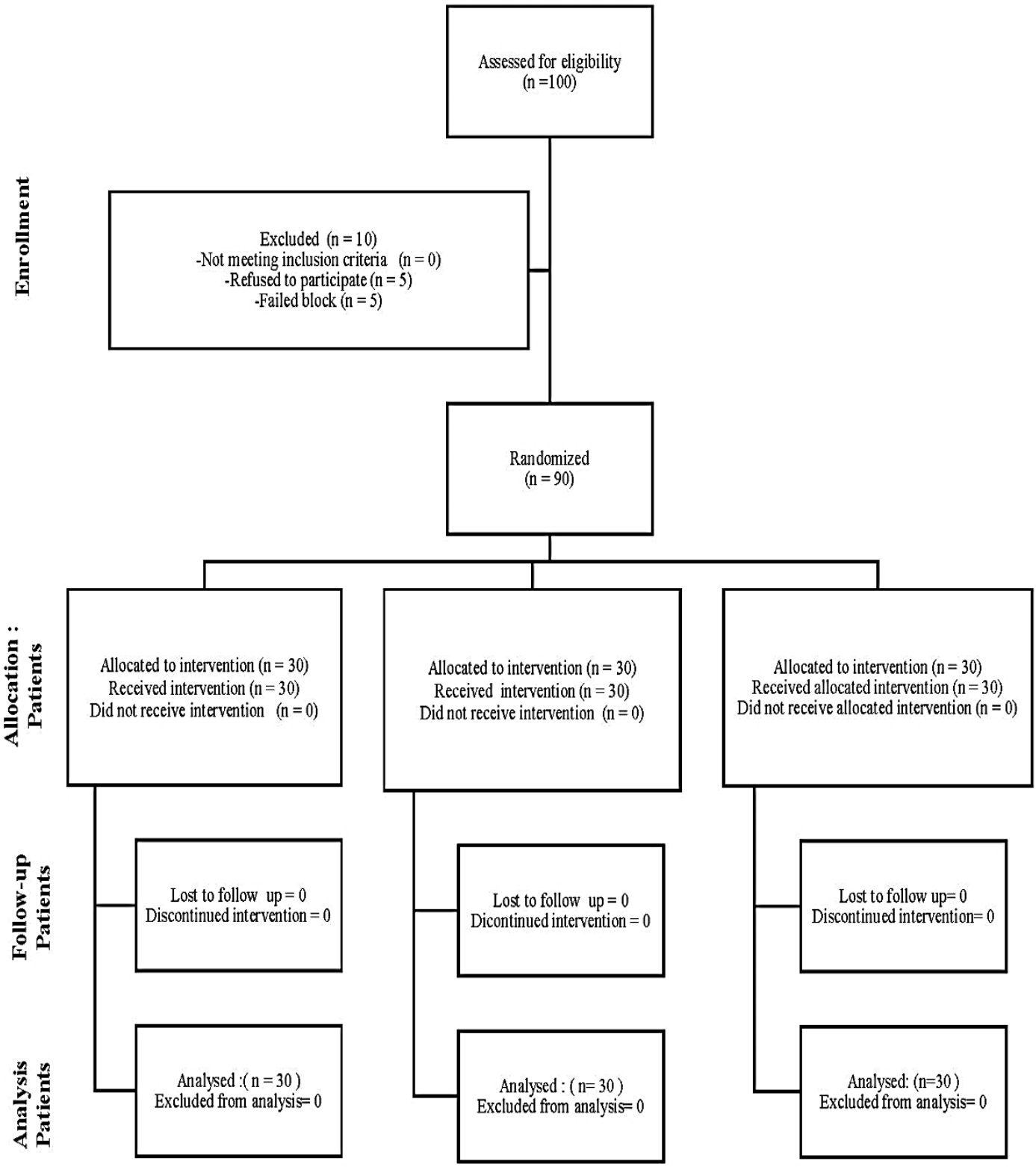

Figure (1): CONSORT flow chart

There were no statistically significant differences between the three groups regarding demographic data and duration of surgery (Table 1).

Table (1): Demographic data in the studied groups. Continuous data are expressed as mean ± SD. Categorical data are expressed as number and percentage (%)

Items	L group n=30	LD_P group n=30	LD_{IV} group n=30	p-value
Age (years)	41.46±11.62	38.1± 9.96	40.81± 9.51	P=0.418
Sex: -Male -Female	 20 (66.7%) 10 (33.3%)	 19 (63.3%) 11 (33.3%)	 22 (73.3%) 8 (26.7%)	 P=0.354
BMI (kg/m^2)	29.27± 3.71	29.80±3.24	30.36 ± 3.31	P=0.464
ASA: I II	 22 (73.3%) 8 (26.7%)	 23 (76.7%) 7 (23.3%)	 23 (76.7%) 7 (23.3%)	 P=0.942
Duration of surgery (hours)	2.49± 0.40	2.62 ± 0.35	2.54± 0.38	P=0.415

- L group: Levobupivacaine group, LD_P group: Levobupivacaine with perineural dexamethasone, LD_{IV} group: Levobupivacaine with intravenous dexamethasone.

The onset of sensory block started significantly earlier in group LD_P compared with group L. Motor block started significantly earlier in group LD_P compared with group L and group LD_{IV}. The duration of both sensory and motor block was significantly prolonged in group LD_P when compared with group L and group LD_{IV}. Patients in group LD_P took prolonged time to ask for the first request for analgesia compared with patients in group L and group LD_{IV}. Pethidine consumption was significantly increased in patients of group L compared with patients in group LD_P and group LD_{IV} (Table 2).

Table (2): Criteria of anesthesia in the three study groups. Data are expressed as mean ±SD

Items	L group n=30	LD_P group n=30	LD_{IV} group n=30	p-value
Onset of sensory block (min)	3.47 ± 1.36	2.43 ± 1.22	3.07 ± 1.02	P=0.005*
Onset of motor block (min)	12.53±2.08	10.10± 2.20	11.93± 1.79	P<0.001*
Duration of sensory block (hours)	12.10±1.97	14.26±2.26	12.907±1.56	P<0.001*
Duration of motor block (hours)	8.77±1.79	10.90±1.65	9.10±1.54	P<0.001*
Time to first request for rescue analgesia (hours)	13.23±2.65	15.57±3.89	13.57±3.22	P= 0.01*
Pethidine dose (mg)	50.33±8.84	21±2.1	26.33± 8.47	P= 0.001*

- P: intergroup significance, *: significant
L group: Levobupivacaine group, LD_P group: Levobupivacaine with perineural dexamethasone, LD_{IV} group: Levobupivacaine with intravenous dexamethasone.

VAS score showed significant reduction at 6 and 24 hr postoperatively in group LD_P and group LD_{IV} compared with group L. Also, VAS score showed a significant reduction at 12 hours postoperatively in LD_P group compared with group L and group LD_{IV} (Table3).

Table (3): Visual analogue scale (VAS) score (0-10) in the three study groups. Data are expressed as median and range (minimum- maximum)

Time	L group n=30	LD_P group n=30	LD_{IV} group n=30	p-value
At 1 hour	1 (0-3)	1 (0-2)	1 (0-1)	P=0.725
At 2 hours	1 (0-3)	1 (0-3)	1 (0-1)	P =0.120
At 6 hours	4 (1-5)	3 (1-4)	3 (1-4)	P=0.006*
At 12 hours	6 (5-8)	5 (2-7)	6 (4-8)	P=0.001*
At 24 hours	6 (4-6)	**4** (1-6)	**4** (2-6)	P=0.001*

- P: intergroup significance , *: significant
L group: Levobupivacaine group, LD_P group: Levobupivacaine with perineural dexamethasone, LD_{IV} group: Levobupivacaine with intravenous dexamethasone.

As regard intraoperative hemodynamic changes, there was statistically significant decreased in HR inside each group compared with basal value, but no significant changes in between the three studied groups (Table 4).

Table (4): Intraoperative heart rate (beats /min) in the studied groups. Data are expressed as mean ±SD

Time	L group n=30	LD_P group n=30	LD_{IV} group n=30	P-value
Basal	67.77±8.29	67.23±6.90	69.07±6.37	0.602
At 10 min	67.07±9.56	65.97±6.91	68.10±6.27	0.566
P#	0.288	< 0.001*	< 0.001*	
At 20 min	65.93±8.91	65.6± 6.69	67.57±6.36	0.548
P#	0.005*	< 0.001*	< 0.001*	
At 30 min	65.40±8.68	64.70±6.77	67.43±6.21	0.326
P#	< 0.001*	< 0.001*	< 0.001*	
At 45 min	65.17±7.97	64 ± 6.48	66.83±6.23	0.288
P#	< 0.001*	< 0.001*	< 0.001*	
At 60 min	64.93±7.39	63.57±6.53	64.17±12.55	0.848
P#	< 0.001*	< 0.001*	0.024*	
At 75 min	64.03±6.79	63.13± 6.76	65.90±6.35	0.263
P#	< 0.001*	< 0.001*	< 0.001*	
At 90 min	63.60±7.83	62.77±6.73	65.30±6.43	0.367
P#	< 0.001*	< 0.001*	< 0.001*	
At 105 min	63.33± 6.84	62.73±6.92	63.37±12.72	0.956
P#	< 0.001*	< 0.001*	0.006*	
At 120 min	63.83±7.18	62.63±6.61	63.87±12.93	0.845
P#	< 0.001*	< 0.001*	0.016*	

- P: overall significance between groups, - P#: significance in relation to basal value, *: significant
L group: Levobupivacaine group, LD_P group: Levobupivacaine with perineural dexamethasone, LD_{IV} group: Levobupivacaine with intravenous dexamethasone.

MAP showed no significant changes either between the studied groups or inside each group during the intraoperative period (Tables 5).

Table (5): Intraoperative MAP (mmHg) in the study groups. Data are expressed as mean ±SD

Time	L group n=30	LD_P group n=30	LD_{IV} group n=30	P-value
Basal	86.73 ± 16.558	83.93 ± 15.912	85.27 ± 14.73	0.270
At 10 min	85.69 ± 16.376	83.18 ± 14.581	84.08 ± 15.635	0.444
P#	0.568	0.854	0.625	
At 20 min	83.38 ± 14.593	80.96 ± 12.930	82.62 ± 13.06	0.407
P#	0.137	0.124	0.294	
At 30 min	84.20 ± 14.564	82.98 ± 17.103	86.07 ± 14.332	0.113
P#	0.262	0.216	0.538	
At 45 min	81.11 ± 13.955	82.36 ± 14.272	84.18 ± 13.37	0.279
P#	0.072	0.321	0.885	
At 60 min	82.28 ± 13.093	83.33 ± 13.019	84.28 ± 12.87	0.505
P#	0.106	0.833	0.816	
At 75 min	84.47 ± 12.191	84.40 ± 12.133	82.55 ± 14.51	0.717
P#	0.229	0.482	0.273	
At 90 min	83.11 ± 12.158	79.71 ± 11.876	80.49 ± 13.58	0.529
P#	0.162	0.84	0.094	
At 105 min	84.82 ± 12.525	83.47 ± 12.118	83.29 ± 14.09	0.805
P#	0.285	0.771	0.472	
At 120 min	85.17 ± 16.062	80.76 ± 17.492	86.13 ± 15.37	0.438
P#	0.573	0.131	0.527	

- P: overall significance between groups, - P#: significance in relation to basal value
L group: Levobupivacaine group, LD_P group: Levobupivacaine with perineural dexamethasone, LD_{IV} group: Levobupivacaine with intravenous dexamethasone.

There were no statistically significant differences between the studied groups regarding postoperative complication. Patients in group LD_P showed more satisfaction about their pain management in comparison with patients in group L and group LD_{IV} (Table 6).

Table (6): Patient's satisfaction in the studied groups. Data are expressed as Number (%).

Satisfaction	L group n=30	LD_P group n=30	LD_{IV} group n=30	p-value	Within group significance
Satisfied patients	19 (63.3%)	27 (90%)	20 (66.7%)	0.039*	P1=0.01*
Unsatisfied patients	11 (36.7%)	3 (10%)	10 (33.3%)		P2=0.786
					P3=0.02*

- P: overall significance between groups
- P1: significance between L group and LD_P group
- P2: significance between L group and LD_{IV} group
- P3: significance between LD_P group and LD_{IV} group

*: significant

L group: Levobupivacaine group, LD_P group: Levobupivacaine with perineural dexamethasone, LD_{IV} group: Levobupivacaine with intravenous dexamethasone.

DISCUSSION

Prolongation of analgesia after surgery under regional anaesthesia is an attractive goal for anesthesiologists. Many investigators have sought the "holy grail" of an analgesic adjuvant that both prolongs pain relief and avoids side effects after a single shot peripheral nerve block. The perineural addition of dexamethasone to local anaesthetic agents has been shown in several studies to prolong the analgesic effect, and its use has become common in clinical practice around the world [(11)].

This randomized, study showed that the addition of perineural dexamethasone to a levobupivacaine for IBPB prolonged the duration of analgesia and decreased the postoperative pain after upper limb surgery.

In this study, the onset of sensory and motor blocks was significantly faster in patients who received perineural dexamethasone with levobupivacaine. The rapid onset of sensory block with perineural dexamethasone was supported by a previous study by **Jadon *et al.***, who found that addition of dexamethasone 8 mg to 30 mL of 0.5% ropivacaine in patients undergoing shoulder arthroscopic surgeries under IBPB speeds the onset of sensory block. They also found that the onset of motor block was significantly faster in ropivacaine with dexamethasone group [(12)].

This study also demonstrated that a low dose (4 mg) of perineural dexamethasone added to levobupivacaine significantly prolonged the duration of interscalene sensory and motor blocks. In a study done by **Vasconcelos *et al.*** [(13)], found that perineural dexamethasone significantly prolonged the sensory blockade promoted by levobupivacaine in IBPB, reduced pain intensity and rescue analgesia needs in the postoperative period, which is parallel with results of the current study.

In the present study perineural dexamethasone was superior to intravenous dexamethasone as an adjuvant to levobupivacaine. This was demonstrated by the time of the first request for analgesia, which was prolonged in group LD_P compared to the other two groups. The results of this study were in agreement with the study done by **Kataria *et al.*** [(6)], who found that greater postoperative analgesia and opioid sparing effect was observed in patients receiving 8 mg dexamethasone as an adjunct to ropivacaine in ultrasound guided IBPB.

In contrary to this study regarding the effect of intravenous dexamethasone on the duration of analgesia, **Desmet *et al.*** [(14)], found that addition of 10 mg intravenous dexamethasone to 30 ml ropivacaine 0.5% in patients scheduled for shoulder rotator cuff repair or subacromial decompression with IBPB significantly prolonged the time to first postoperative analgesia request. Our study showed different results that may be attributed to the low dose of iv dexamethasone (4 mg). Another study was done by **Chalifoux and his colleague** [(15)] on the effect of intravenous dexamethasone as adjuvant to ropivacaine. They found that, addition of 4 mg and 10 mg intravenous dexamethasone to 20 ml ropivacaine 0.5% in patients scheduled for shoulder arthroscopy under single-shot IBPB, prolonged the time to first postoperative analgesic request, which is not consistent with the results of the current study regarding the effect of intravenous dexamethasone on the duration of analgesia.

In the current study, pethidine requirement was significantly lower in groups LD_P and LD_{IV} when compared with group L. In parallel to this study, **Tandoc and coworkers**[(16)], found that addition of dexamethasone 4 mg (low dose group) and 8 mg (high dose group) to 40 mL of 0.5% bupivacaine in patients undergoing shoulder surgery under IBPB significantly reduced postoperative analgesic consumption in the first 48 hrs.

Regarding the VAS score, **Sakae and coworkers**, found that addition of 4 mg perineural dexamethasone (1 ml) to 20 mL of 0.75% ropivacaine in patients undergoing arthroscopic rotator cuff repair under IBPB showed lower levels of VAS score at 12 and

24 hrs with significant difference between perineural and intravenous dexamethasone groups at 12 and 24 hrs. These results passed in agreement with the current study results [17].

Regarding hemodynamic (HR and MAP) changes in this study, there were no statistically significant differences between the three studied groups. In a study evaluating the effect of dexamethasone dose and route of administration on the duration of IBPB for shoulder surgery, **Holland and his colleague**, reported no significant hemodynamic changes between the study groups, which is parallel with results of present study [18].

The mechanisms behind the beneficial effect of dexamethasone and route of administration remain to be determined. It has been suggested that the effect is mediated by direct blockade of transmission in nociceptive C-fibres, reducing the release of inflammatory mediators and ectopic neuronal discharge, and upregulation of potassium channels. Recently, the route of dexamethasone administration has been debated and several studies have reported that intravenous dexamethasone can produce opioid sparing effects under various situations, and there is no difference in the analgesic effect between perineural and systemic administration [7].

The safety of dexamethasone use in a nerve sheath may raise some concerns. Dexamethasone rarely causes nerve injury, and when it does, it usually occurs in the context of needle trauma. However, in the present study, the occurrence of needle trauma is unlikely, as ultrasound was utilized with direct visualization during performance of the block [13].

In this study, there was no significant difference in the incidence of intraoperative or postoperative complications between the groups due to lower dose of dexamethasone, and low opioid consumption that was correlated with **McHardy *et al.* [19],** who studied the effect of perineural and intravenous dexamethasone on low volume IBPB, and found that there was no significant difference between the study groups in the incidence of complication.

In this study, patients in group LD_P were more satisfied about their pain management compared with patients in the other two groups. This is parallel to the studies done by **Kataria *et al.* [6] and Sakae *et al.* [17]**, who found that patient satisfaction was statistically significant in patients received perineural dexamethasone.

CONCLUSION

This study concluded that the addition of dexamethasone as an adjuvant to perineural levobupivacaine for IBPB in shoulder and upper arm surgeries, prolonged the duration of analgesia, decreased the postoperative pain score, decreased pethidine consumption, prolonged the time to the first rescue analgesia, and improved patient satisfaction.

RECOMMENDATION:

We recommend the use of perineural dexamethasone as adjuvant to a levobupivacaine for IBPB in shoulder and upper arm surgeries. More studies are needed to determine the optimal dose and to examine the safety profile of dexamethasone before its routine use as perineural adjuvant.

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