Section: Anaesthesia

Original Research Article

A PROSPECTIVE COMPARATIVE STUDY BETWEEN 0.5% LEVOBUPIVACAINE PLAIN VERSUS 0.5% LEVOBUPIVACAINE WITH DEXAMETHASONE AS AN ADJUVANT IN BRACHIAL PLEXUS BLOCK IN UPPER EXTREMITY SURGERY

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Abstract

Background: To assess the efficacy of Levobupivacine 0.5% with dexamethasone compared to Levobupivacaine 0.5% plain in brachial plexus block. **Materials and Methods:** A Randomised comparative study was done in patients undergoing upper extremity surgery with 30 patients in each group. Group LD patients received supraclavicular brachial plexus block with USG guidance with 30 ml of inj.Levobupivacaine 0.5% + inj. Dexamethasone 8mg(2ml) and Group LS patients received same block with inj.Levobupivacaine 0.5% 30 ml +inj. Normal saline(2ml). After the completion of block we monitored for onset, peak effect and duration of sensory and motor block, total duration of post-operative analgesia was assessed using Visual analogue scale(VAS score) and rescue analgesic administered if VAS score>4.Any haemodynamic parameter changes after block was noted and also looked for adverse effects post procedure. **Result:** In the LD Group the onset and peak effect of sensory blockade were 4.3±1.53 minutes (min) and 9.3±2.2 min whereas Group LS it was 4.57±1.41min and 9.07±1.07 min. The duration of sensory blockade in group LD was 10.17±1.13 hours (hrs) and group LS was 6.5±0.6 hrs respectively. In the LD Group the onset and peak effect of motor blockade were 6.66±1.26 min and 12.9±1.4 min whereas in Group LS it was 6.88±0.84 min and 13.1±1.52 min. The duration of motor blockade in group LD was 8.35±0.81 hrs and group LS was 7.42±0.78 hrs respectively. The total duration of post-operative analgesia was 21.2±3.23 hrs in Group LD and 10.24±1.57 hrs in Group LS. Rescue analgesic needed was from 6th hr post operatively in Group LS and by end of 12th hour 30 patients needed rescue analgesics in Group LS. In Group LD rescue analgesic was given from 18th hr and only 20 patients in the group received it in our 24 hrs observation. **Conclusion:** The duration of sensory and motor blockade was higher when dexamethasone was used as an adjuvant for block and also total duration of post-operative analgesia very significantly increased almost upto a day in few patients when adjuvant dexamethasone was added in block. Haemodynamic parameters were stable throughout. Hence Levobupivacine 0.5% along with dexamethasone gives a much better anaesthesia and analgesia in brachial plexus block.

INTRODUCTION

Supraclavicular nerve block is a good alternative to general anaesthesia for upper limb surgeries. This avoids the untoward effects of general anaesthetic drugs and upper airway instrumentation in patients. It achieves muscle relaxation, intraoperative hemodynamic stability and post-operative analgesia.[1] Considering the pharmacological profile of Bupivacaine, its clinical efficacy, long duration of action and favourable ratio of sensory to motor block it is used most frequently among local anaesthetics for brachial plexus block. However its major disadvantage is cardio toxicity, primarily

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triggered by its dextrogyrous enantiomer.[2] Levobupivacaine, a pure S- enantiomer of Bupivacaine has potentially reduced toxic profile compared to Bupivacaine.[3] Peripheral nerve blocks with local anaesthetics provide excellent operating conditions, facilitate early mobilisation and bypass the post anaesthesia care unit, but duration of analgesia is rarely maintained for more than 4-8 hours even with the longest acting local anaesthetics.[1] Different drugs have been used as adjuvants with local anaesthetics in brachial plexus block to achieve a quick, dense and prolonged block. Various studies have shown that addition of Dexamethasone to local anaesthetics prolongs duration of blockade in peripheral nerves. The purpose of this study is to compare the effectiveness, duration and quality of motor blockade and sensory blockade between patients receiving plain Levobupivacaine versus Levobupivacaine with Dexamethasone as an adjuvant in supraclavicular brachial plexus block. Levobupivacaine is a better drug for regional block due to its low cardio toxic profile compared to Bupivacaine. Levobupivacaine's efficacy proved similar or greater than Bupivacaine in regional blocks and could be used more safely in ASA grade 3 and 4 patients and cardiac patients in whom general anaesthesia is risky.

MATERIALS AND METHODS

Study group - Patients were randomly allocated using shuffled sealed opaque envelope technique into one of the following two groups depending upon the drugs they were to receive for brachial plexus block.

Group - LD: (n=30) Patients received inj. Levobupivacaine hydrochloride 0.5% 30 ml + 2 ml of inj. Dexamethasone 8 mg

Group - LS: (n= 30) Patients received inj. Levobupivacaine hydrochloride 0.5% 30 ml + 2 ml of inj. Normal saline.

Inclusion Criteria

1. Age group- 18 to 60 years of either sex undergoing orthopedic surgery
2. ASA 1 and 2
3. planned/emergency surgery
4. Patients able to give informed consent

Exclusion Criteria

1. Hypersensitivity to local anaesthetic drug
2. Bleeding disorders/ patients on anticoagulants
3. Cardiac, respiratory, renal and liver diseases
4. Neurological disorders, nerve palsy, neuromuscular disease

Procedure: Patient shifted to Operation theatre. Monitors were connected according to Standard ASA guidelines. Pre-operative heart rate, Blood pressure and oxygen saturation (SPO_2) were recorded. 18G intra venous cannula secured and fluids started. After explaining the procedure consent was taken from patient. He/she is made to lie in supine position, head turned away from the side to be blocked and shoulder depressed. The arm of the side to be blocked was kept adducted. After aseptic precaution high frequency linear probe placed above the clavicle and subclavian artery and brachial plexus typically seen as round or oval hyper echoic structures (such as bunch of grapes) lying postero lateral to subclavian artery is identified. A 50 mm needle is carefully advanced in plane (lateral to medial) maintaining needle visualization throughout and local anaesthetic deposited carefully between divisions of plexus using hydro dissection technique. The needle tip position adjusted to ensure entire plexus is bathed in local anaesthetic. After the block parameters are checked.

Sensory block is assessed by pin prick method using 24 G hypodermic needle every minute till peak effect occurs.

Grade 0:- normal sensation
Grade 1 :- blunted sensation
Grade 2 :- no pain perception
Assessment done along distribution of
Radial nerve - lateral side of dorsum of hand
Median nerve - Thenar eminence
Ulnar nerve - little finger
Musculocutaneous nerve - lateral border of forearm over the site of radial artery

Onset Time: Time to sensory onset was from injection time to blunted sensation

Peak Effect Time- Time to peak sensory effect was from injection time to complete loss of sensation

Duration of Sensory Block: was from injection time till patient regained grade 0 sensations in all areas supplied by 4 nerves.

Motor block was assessed by Bromage scale.
Grade 0 :- normal muscle tone
Grade 1 :- decreased muscle strength i.e. paresis
Grade 2 :- complete block inability to do movement
Radial nerve - extension of elbow and wrist
Median nerve - opposition of thumb and index finger
Ulnar nerve - opposition of thumb and small finger
Musculocutaneous nerve - flexion at elbow

Onset Time: Time was taken from injection of drug to attainment of grade 1 block

Peak Effect Time: From injection of drug to complete loss of motor power.

Duration of Motor Block- From injection of drug to return of grade 0 motor blocks of all muscles supplied by 4 nerves.

Heart rate, Blood pressure and SPO_2 regularly monitored every 3 minutes till 15 minute and every 5 minutes until end of surgery.

Post-operative period: Total duration of analgesia was measured from time of injection of drug to first requirement of rescue analgesic. The rescue analgesic was inj. Diclofenac 75 mg intra muscular when VAS score was above 4 and also number of rescue analgesics needed over 24 hours was noted.

Statistical Analysis: All the qualitative data were analysed using chi square test.

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The quantitative data were analysed using unpaired t test. Results were expressed as mean +/- SD. p values < 0.05 were taken as statistically significant.

RESULTS

The number of patients in either group were 30. The mean age of patients was 39.37+/-12.48 years in group LD and 37.34+/-11.55 years in group LS. The ratio of male to female was 17:13 in group LD and 18:12 in group LS. The mean weight of patients was 59.63+/-5.14 kg in group LD and 60+/-4.99 kg in group LS. Thus, both the groups were comparable to each other without significant difference.

Table 1: Demographic Data

Parameter	Group LD	Group LS	P value
Number of patients	30	30	
Age (in years, Mean±SD)	39.37±12.48	37.34±11.55	>0.05
Sex (Male:Female)	17:13	18:12	>0.05
Weight (in kg, Mean ± SD)	59.63±5.14	60±4.99	>0.05

In each group of 30 patients, both group LD and group LS had ASA grade 1- 60% and ASA grade 2 - 40% of patients and thus both groups were comparable.

Table 2: ASA physical status of patients

ASA Status	Group LD	Group LS	P value
I	18(60%)	18(60%)	>0.05
II	12(40%)	12(40%)	>0.05
Total	30 (100%)	30 (100%)	

The mean duration of surgery was 74.5+/-27.31 minutes in group LD and 77.17+/-28.43 minutes in group LS and so was comparable amongst both the groups.

Table 3: Duration of surgery

	Group LD (n)	Group LS(n)	P value
Total duration of surgery in min. (Mean±SD)	74.5±27.31	77.17± 28.43	>0.05

The onset time of sensory block were comparatively similar and statistically not significant.

Table 4: Onset Time of Sensory Block

Onset Time (in minutes)	Group LD(n)	Group LS(n)	P value
1—2	7	3	p>0.05
2-4	3	8	
4-6	18	18	
6-8	2	1	
8-10	0	0	
10-12	0	0	
12-14	0	0	
14-16	0	0	
Mean ± SD	4.3±1.53	4.57±1.41	

Table 5: Peak Effect Time of Sensory Block

Time (in minutes)	Group LD(n)	Group LS(n)	P value
4-6	0	0	p>0.05
6-8	0	8	
8-10	2	19	
10-12	13	3	
12-14	10	0	
14-16	5	0	
Mean±SD	9.3±2.2	9.07±1.07	

Table 6: Total Duration of Sensory Block

Time in hours	Group LD(n)	Group LS(n)	P value
4-6	0	10	p<0.001
6-8	0	15	
8-10	18	5	
10-12	10	0	
12-14	2	0	
Mean ± SD	10.17±1.13	6.5±0.6	

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Table 7: onset time of motor block

Time of Motor Block(in minutes)	Group LD(n)	Group LS(n)	P value
2-4	1	2	P >0.05
4-6	10	9	
6-8	18	18	
8-10	1	1	
10-12	0	0	
Mean ± SD	6.66±1.26	6.88±0.84	

Table 8: peak effect time of motor block

Time (in minutes)	Group LD(n)	Group LS(n)	P value
6-8	0	1	P >0.05
8-10	2	2	
10-12	11	9	
12-14	12	14	
14-16	6	4	
Mean±SD	12.9±1.4	13.1±1.52	

Table 9: total duration of motor block

Time in hours	Group LD(n)	Group LS(n)	P value
2-4	0	0	P <0.001
4-6	0	4	
6-7	2	7	
7-8	11	18	
8-9	9	1	
9-10	8	0	
10-11	0	0	
Mean ± SD	8.35±0.81	7.42±0.78	

Table 10: total duration of analgesia

Time in Hours	Group LD	Group LS	P value
6-8	0	2	P<0.001
8-10	0	15	
10-12	0	10	
12-14	0	3	
14-16	0	0	
16-18	2	0	
18-20	06	0	
20-22	05	0	
22-24	17	0	
Mean ± SD	21.2±3.23	10.24±1.57	

Table 11: rescue analgesic requirment in 24 hours.

No. of doses	Group LD (no of pts)	Group LS (no of pts)	Intergroup p value
0	10 (33.3%)	0	< 0.001
1	18(60.0%)	0	< 0.001
2	2(6.7%)	18 (60%)	< 0.001
3	0	12(40%)	< 0.001

Table 12: time for first rescue analgesia

TIME	GROUP LD		GROUP LS	
	No of patients received rescue analgesia at that hours	Total no of patients received rescue analgesia	No of patients received rescue analgesia at that hours	Total no of patients received rescue analgesia
0 min	0	0	0	0
60 min	0	0	0	0
3 hrs	0	0	0	0
6 hrs	0	0	8	8(26.66%)
8 hrs	0	0	10	18(60.00%)
10 hrs	0	0	9	27(90.00%)
12 hrs	0	0	3	30(100.00%)
14 hrs	0	0		
18 hrs	2	2(6.6%)		
20 hrs	6	8(26.6%)		
22 hrs	2	10(33.3%)		
24 hrs	10	20(66.66%)		

VAS SCORE>4

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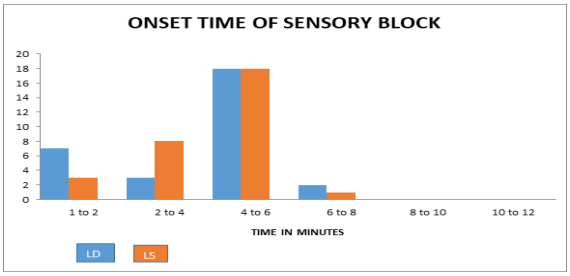

Figure 1: Onset time of sensory block in groups LD & LS in minutes.

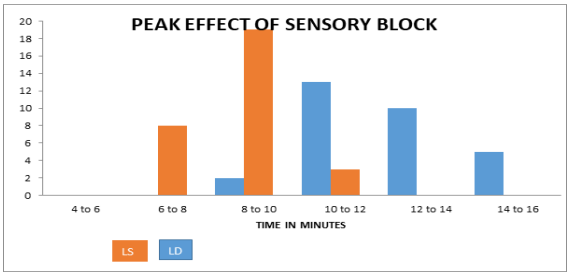

Figure 2: Peak effect time of sensory block in groups LD & LS in minutes

The peak effect time of sensory block for both groups were similar and not statistically significant. [Figure 1]

The total duration of sensory block was 10.17+/- 1.13 hours in group LD and 6.5+/- 0.6 hours in group LS, the p<0.001. Thus, the total duration of sensory block was significantly prolonged in group LD.

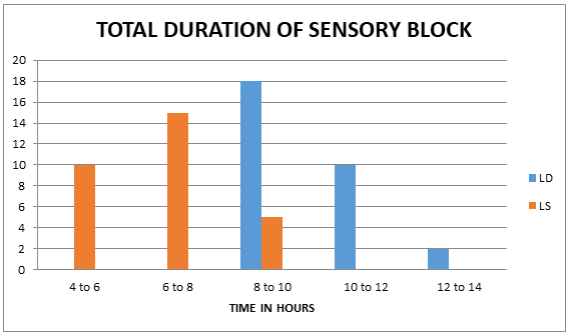

Figure 3: Duration of sensory block in groups LD & LS in hours

The onset time of motor block was relatively similar and not statistically significant.

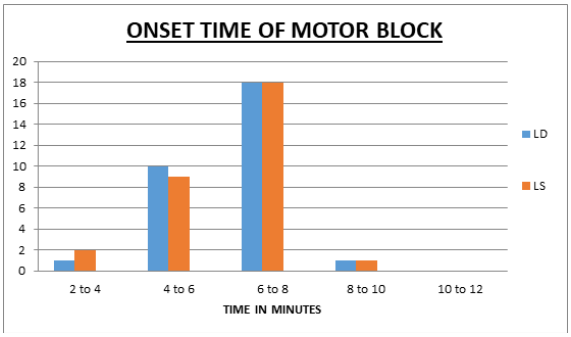

Figure 4: Onset time of motor block in groups LD & LS in minutes

The peak effect time of motor block of both the groups were likewise and thus not statistically significant.

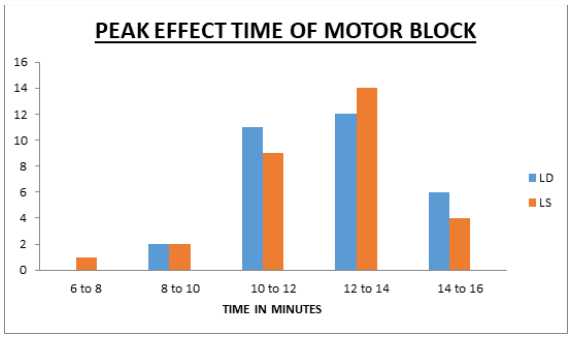

Figure 5: Peak effect time of motor block in groups LD & LS in minutes

The mean duration of motor block was 8.35+/-0.81 hours in group LD and 7.42+/-0.78 hours in group LS, the p value being <0.05. Thus, the total duration of motor block was significantly prolonged in group LD compared to group LS.

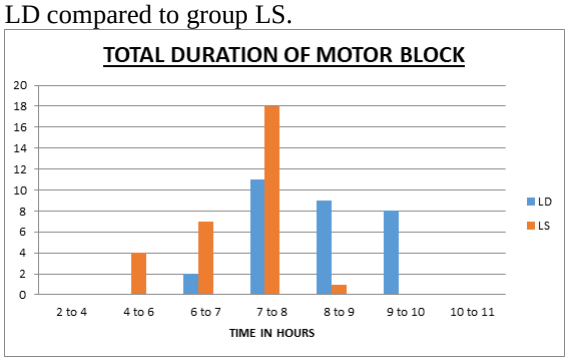

Figure 6: Total duration of motor block in groups LD & LS in hours

The total duration of postoperative analgesia was 21.2+/-3.23 hours in group LD and 10.24+/-1.57 hours in group LS, the p value being <0.001. Thus the total duration of post-operative analgesia was significantly longer in group LD patients compared to group LS patients.

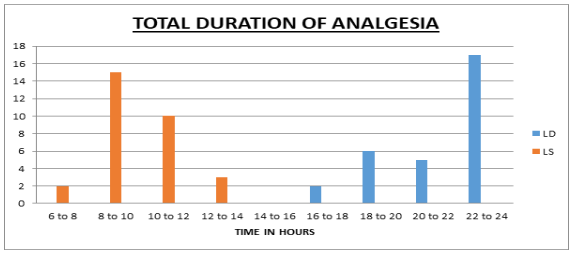

Figure 7: Total duration of analgesia in hours in groups LD & LS

In group LD, 33.3% of patients did not require any rescue analgesic in 24 hours post-operative duration, 60% patient's required one dose of rescue analgesia and rest 6.7% required 2 doses of rescue analgesia within 24 hours postoperatively.

Whereas in group LS, 40% patients required 3 doses of rescue analgesia and the rest 60% required 2

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doses of rescue analgesia in 24 hours post-operative duration. Thus, group LD patients had significantly longer duration of post-operative analgesia and the requirement of additional analgesics was significantly reduced (p< 0.001 highly significant).

DISCUSSION

Supraclavicular brachial plexus block is an effective, time-tested regional anaesthetic technique for surgeries of upper extremities. It is not only an excellent alternative but also offers several perioperative advantages over general anaesthesia like reduced stress response, providing superior surgical conditions, optimal post-operative analgesia, early ambulation and reduces the incidence of post-operative nausea and vomiting and reduced length of hospital stay, leading to satisfactory patient acceptance and improved clinical outcome.

Levobupivacaine has got relatively longer duration of action when compared with Lignocaine. It is relatively cardio stable local anaesthetic.

Perineural injection of steroids is reported to influence post-operative analgesia. Several authors like Shrestha BR et al,[4] (2003) Stan Tet al,[5] (2004), Movafegh A. et al,[6] (2006), Dr. Shridhar N V et al,[7] (2009), Persec et al,[8] (2014),Ghada F et al,[9] (2014) MP Golwalaet al,[10] (2016) have reported studies on steroids used as adjuvants have prolonged duration of post-operative analgesia.

Dexamethasone 8 mg was used by Akkaya et al,[11] (2014), El Hamid et al,[12] (2016) without any side effects hence dexamethasone 8 mg was chosen. In our study, we enrolled patients between 18-60 years of age. The mean age was 39.37+/-12.48 years in group LD and 37.43+/-11.55 years in group LS and was comparable in both groups. In sex distribution 56.66% of patients in group LD and 60% in group LS were males and it was statistically insignificant.

The mean weight was 59.63+/-5.14 kg in group LD and 60+/-4.99kg in group LS and was comparable amongst both groups.

Onset of sensory and motor blockade

The mean time for onset of sensory blockade was 4.3+/-1.53 minutes in group LD and 4.57+/-1.41 minutes in group LS and was thus statistically not significant(p>0.05). The mean time for onset of the motor block was 6.66+/-1.26 minutes in group LD and 6.88+/-0.84 minutes in group LS (p>0.5) and thus statistically not significant. This study showed that there was no significant difference in the onset time of sensory and motor blockade between two groups.

This study compares with Movafegh A et al,[6] (2006) and Pathak et al,[13] (2012) where there was no significant difference in the onset time of the sensory and motor blockade between groups. However, another study by Shrestha BR et al,[4] (2003), found that there was significant fast onset of action in the Dexamethasone group than in the other group. This could be due to usage of local anaesthetic mixture of Lidocaine 2% with 1:200, 000 Adrenaline and Bupivacaine 0.5% and definition of onset of action has not been mentioned clearly.

In Biradar et al,[14] (2013) study, the onset of sensory and motor blockade was significantly more rapid in the Dexamethasone group. This difference could be due to the reason that, the onset time of sensory and motor blockade was defined as the time between the last brachial injection of local anaesthetic to the total abolition of pinprick response and complete paralysis, respectively, in all nerve distributions.

Ritu Baloda et al,[15] used blind method for blockade and also the onset and peak effect has not been discriminated and explained. Hence there could be the difference in onset of blockade. My results are in consonance with Pathak et al,[13] (2012), Movafegh et al,[6] (2006), but Shrestha BR,[4] (2003), Biradar et al,[14] (2012) and Ritu Baloda et al,[15] (2016) has noted early onset of sensory and motor block.

Peak effect time of sensory and motor blockade: The mean time for peak effect of sensory blockade was 9.3+/- 2.2 minutes in group LD and 9.07+/- 1.07 minutes in group LS and was thus statistically not significant.

The mean time for peak motor blockade was 12.9+/- 1.4 minutes in group LD and 13.1+/- 1.52 minutes in group LS and was thus statistically not significant. Thus, in group LD (Dexamethasone group) patients had similar onset and peak effect of sensory and motor blockade compared to group LS.

Duration of sensory and motor blockade: The mean duration of sensory block in group LD was 10.17+/- 1.13 hours and in group LS was 6.5+/-0.6 hours and was statistically significant (p<0.01). The duration of motor block was 8.35+/- 0.81 hours in group LD and 7.42+/- 0.78 hours in group LS (p<0.05). Thus, the total duration of sensory and motor block was significantly prolonged in group LD compared to group LS. In Movafegh A et al,[6] (2006), Pathak et al,[13] (2012), Biradar et al,[14] (2013), Persec et al,[8] (2014) studies, they evaluated the effect of Dexamethasone added to local anaesthetic mixture, concluded that duration of sensory and motor blockade was signficantly longer in the Dexamethasone group. These studies are comparable with the present study.

Total duration of Analgesia: Rescue analgesia started from 6th hour post operatively in group LS and at the end of 12th hour all patients in group LS had received their rescue analgesia with 75 mg Diclofenac intramuscular.

While in group LD, rescue analgesia started from 18th hour post operatively and even at the end of 24 hours only 20 patients required rescue analgesia. The rest 10 patients did not require any rescue analgesic in the first 24 hours post operatively. Thus, requirement of rescue analgesia was much earlier in group LS as compared to group LD (p<0.001: highly significant). Thus, Dexamethasone

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produced significantly prolonged duration (16-24 hours) of post-operative analgesia. My study was in consonance with the studies of Shrestha BR et al,[4] (2003), Youn Jin Kim et al,[16] (2012), Persec et al,[8] (2014) and Ritu Baloda et al,[15] (2016) reported significantly prolonged duration of post-operative analgesia and decreases the requirement of rescue analgesics in the first 24 hours post-operative period in Dexamethasone group.

CONCLUSION

We conclude from my study that, Levobupivacaine 0.5% with Dexamethasone (8 mg) when compared to Levobupivacaine 0.5% alone in supraclavicular brachial plexus block showed.

1. Prolonged duration of sensory and motor block
2. Prolonged duration of post-operative analgesia
3. No difference in onset and peak effect time of both sensory and motor block between the groups.

Levobupivacaine along with Dexamethasone can be used in brachial plexus blockade where there is necessity of prolonged post-operative analgesia and thus avoids the ill effects of polypharmacy for control of pain.

With advent of ultrasound guided block which is more precise for administration of drugs, success rate of blockade is high, thus reducing complications such as pneumothorax, intravascular injection, diaphragmatic paralysis and Local anaesthetic toxicity (lesser volume of drug used in ultra sound guided block).

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