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A COMPARATIVE STUDY OF DEXMEDETOMIDINE AS AN ADJUVANT TO BUPIVACAINE WITH ONLY BUPIVACAINE IN SUPRACLAVICULAR BRACHIAL PLEXUS BLOCK

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ABSTRACT

Upper limb surgeries are mostly performed under peripheral blocks such as the brachial plexus block. Peripheral nerve blocks not only provide intraoperative anaesthesia but also extend analgesia in the post-operative period without any systemic side-effect. Alpha-2 adrenergic receptor agonists like clonidine and dexmedetomidine have been the focus of interest during anaesthesia for their sedative, analgesic, perioperative sympatholytic and cardiovascular stabilizing effects with reduced anaesthetic requirements **Objective**: The aims of present study were to compare the analgesic efficacy of dexmedetomidine as an adjuvant to bupivacaine with only bupivacaine in supraclavicular brachial plexus block in reference to:

- Onset and duration of sensory and motor block
- Duration of analgesia
- Hemodynamic changes
- Sedation score
- Any complication.

Method: The present study was carried out in 60 adult patients of ASA I/II posted for various elective upper limb surgeries after taking written inform consent. The patients were randomly allocated in two groups; each group was having 30 patients.

Group B – Inj. Bupivacaine 0.25% 40 ml + Inj. Normal saline O.9% 0.5ml

Group D – Inj. Bupivacaine 0.25% 40 ml + Inj. Dexmedetomedine 0.5ml (50mcg)

Result: Demographic data were comparable in both the groups. We found that onset of sensory block was 7.25 ± 0.50 min in Group D and 11.05 0.69 min in Group B ($p<0.0001$). The onset of motor block was 8.59 ± 0.63 min in group D and 14.42 ± 0.82 min in group B ($p<0.0001$). It shows that onset time of sensory and motor block had shortened in Group D compared to Group B. **Conclusion:** dexmedetomidine 50mcg when added to bupivacaine for supraclavicular brachial plexus block shortens the onset time, prolongs the duration of the block and postoperative analgesia. The added advantage of conscious sedation, hemodynamic stability, and lack of significant side effects like respiratory depression make dexmedetomidine an attractive choice as an adjuvant for peripheral nerve block.

KEYWORDS: Bupivacaine, Dexmedetomidine, Analgesic , Supraclavicular block.

INTRODUCTION

Upper limb surgery can be perform in regional or general anaesthesia. But, regional anaesthesia techniques provide important advantages compared with general anaesthesia and systemic analgesia, including excellent pain control, reduced side effects, and shortened stay in the post-anaesthesia care unit.

Upper limb surgeries are mostly performed under peripheral blocks such as the brachial plexus block. Peripheral nerve blocks not only provide intraoperative anaesthesia but also extend analgesia in the post-operative period without any systemic side-effect.

Brachial plexus block was first performed by Halsted in 1884.[1,2] Supraclavicular brachial plexus block is a very popular mode of anaesthesia for various upper limb surgeries. This approach gives the most effective block for all portion of upper extremity and is carried out at the level of trunks of brachial plexus. The plexus is blocked where it is most compact i.e. at the middle of brachial plexus, resulting in homogenous spread of anaesthetic

throughout the plexus with a fast onset and complete block.

However, these early advantages are short-lived and limited by the relatively brief duration of action of currently available local anaesthetics (LAs), which resultes in block resolution before the period of worst postoperative pain. Increasing the volume (dose) of local anaesthetics may prolong the duration of analgesia, but may also increase the risk of LAs systemic toxicity. Although continuous catheter-based nerve blocks can extend postoperative analgesia but, their placement requires additional time, cost and skill. A novel sustained-release encapsulated (liposomal) preparation of bupivacaine is presently undergoing investigation in phase III trials. So, Various adjuvants have been used to prolong the duration of analgesia of nerve block e.g. buprenorphine, fentanyl, magnesium, dexamethasone, midazolam etc, but they all are associated with more or less side effects. There has always been a search for adjuvant to the regional nerve block with drugs that prolong the duration of analgesia but with lesser adverse effects.

Alpha-2 adrenergic receptor agonists like clonidine and dexmedetomidine have been the focus of interest during anaesthesia for their sedative, analgesic, perioperative sympatholytic and cardiovascular stabilizing effects with reduced anaesthetic requirements.[3]

Dexmedetomidine, the pharmacologicaly active d-isomer of medetomidine imidazole, is a highly specific and selective α2 adrenoreceptor agonist, was first proposed as an adjuvant capable of prolonging duration of sensory and motor block produced by nerve block by Memis amd colleagues.[3] In various animal studies, dexmedetomidine has been reported to enhance sensory and motor blockade along with increased duration of analgesia. In human, dexmedetomidine has also shown to prolong the duration of block and post-operative analgesia when added to local anaesthetic in various regional block.[4] However, the reports of its use in supraclavicular brachial plexus block are limited. In this study, we have evaluated the dexmedetomidine as an adjuvant to bupivacaine in supraclavicular brachial plexus block for its effects on sensory and motor blocks with duration of analgesia.

Aims of study

The aims of present study were to compare the analgesic efficacy of dexmedetomidine as an adjuvant to bupivacaine with only bupivacaine in supraclavicular brachial plexus block in reference to:

- Onset and duration of sensory and motor block
- Duration of analgesia
- Hemodynamic changes
- Sedation score
- Any complication.

Anatomy of brachial plexus

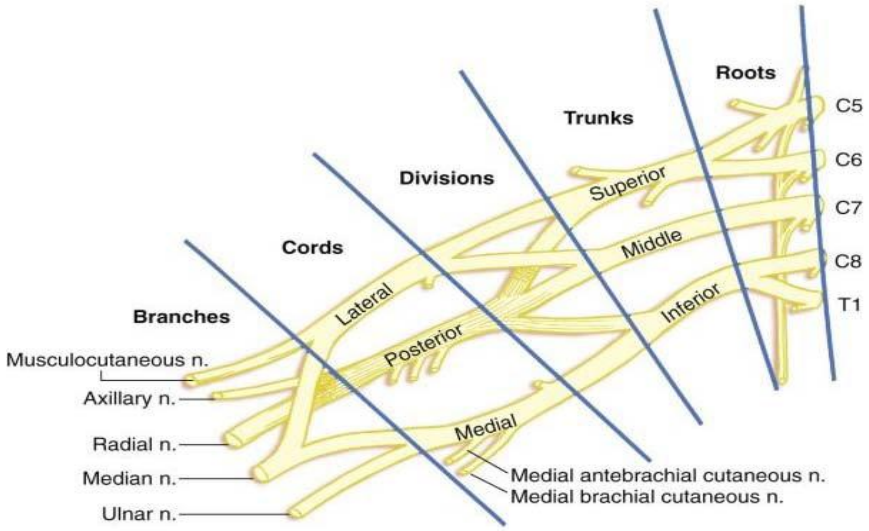


Figure- Roots, trunks, divisions, cords, and branches of the brachial plexus.

MATERIALS AND METHOD

The present study was carried out in 60 adult patients of ASA I/II posted for various elective upper limb surgeries after taking written inform consent. The patients were randomly allocated in two groups; each group was having 30 patients.

Group B – Inj. Bupivacaine 0.25% 40 ml + Inj. Normal saline O.9% 0.5ml

Group D – Inj. Bupivacaine 0.25% 40 ml + Inj. Dexmedetomedine 0.5ml (50mcg)

Pre – anaesthetic check up

All patients underwent a thorough pre – anaesthetic check up which included detailed history taking, general examination and systemic examination.

Routine investigations like Haemoglobin, blood urea, serum creatinine, random blood sugar, ECG, chest X-ray were carried out for all patients.

Special investigations pertaining to the particular case were done if indicated.

Inclusion criteria

- Age group :- 18 to 80 yrs of either gender
- ASA grade I or II
- Weight :- 40 – 70 kg
- Planned surgery
- Normal sensory and motor function in operating limb

Exclusion criteria

- Known hypersensitivity to local anaesthetics
- Known case of any major bleeding disorder
- Local infection
- Patient on anticoagulant
- Existing neurological disorder/ nerve palsy
- Patient not willing to participate in the study

Consent

Patients selected after pre – anaesthesia check up and investigations were explained in detail about the objective of the study, methodology, advantage and likely complications. Informed written consent was taken from those willing to participate in the study.

Pre – operative preparation

Drug preparation

- **Local anaesthetic solution:** Sterile vial containing - Inj. Bupivacaine Hydrochloride 0.5% - 20 ml
- **Inj. Dexmedetomidine Hydrochloride:** sterile preservative free 0.5 ml ampoule containing 50 mcg :

Group	Drugs and dose
B	Inj. Bupivacaine 0.25% 40 ml +Inj. NS 0.9% 0.5ml
D	Inj. Bupivacaine 0.25% 40 ml + Inj. Dexmedetomidine 0.5ml (50 mcg)

Patient preparation

Patient was kept Nil by mouth for 6 hours.

On the day of surgery: (in operation theatre)

Multipara monitor was attached and following base-line parameters were recorded: Pulse rate

- Blood pressure
- Respiratory rate
- SpO2
- IV line was secured and Inj. RL was started.
- Again patient was explained the procedure to be performed.

Study groups

Patients were randomly allocated into one of the two following groups:

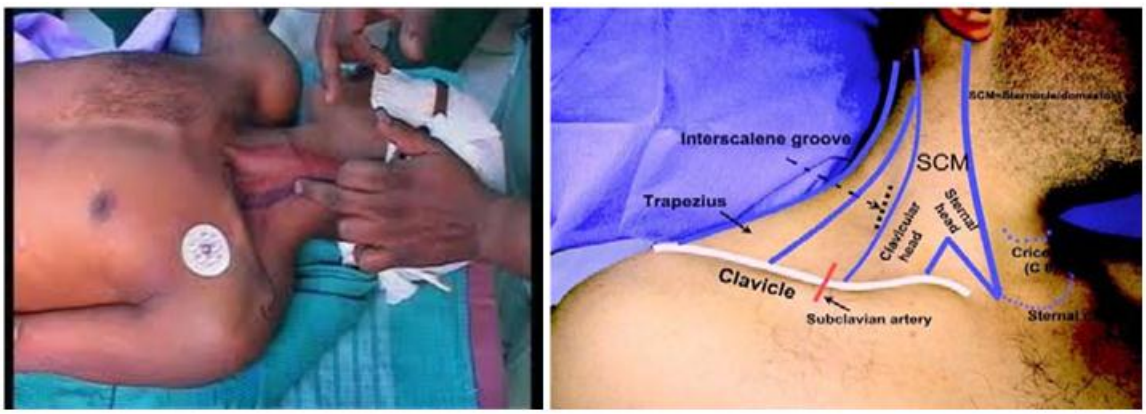
Group B (n=30): Patients received-

Inj. Bupivacaine 0.25% 40ml + Inj. Normal saline 0.9% 0.5ml

Group D (n=30): Patients received

Inj. Bupivacaine 0.25% 40ml + Inj. Dexmedetomidine 0.5ml (50mcg)

Patient position and technique of supraclaviculer brachial plexus block:



The block was performed in supine position with his/her head turned in the direction opposite the limb to beanesthetised. The arm to be anaesthetied should be place in neutral position along the side of body. The midpoint of clavicle should be identified and marked. Palpate the pulsation of subclavian artery which is always lateral to the outer border of sternocledomastoid muscle.

After appropriate preparation, a skin wheal was raised by 25 gauge 1inch needle with 5ml syringe using 2% 2ml lignocaine 1cm above the midpoint of clavicle. A 23gauge 1.5inch needle was inserted through a skin wheal and directed caudad, slightly medial and posterior direction until a paresthesia or motor response was elicited or first rib encountered. If first rib is encountered without elicitation of a paresthesia, the needle can be

systematically walked anterior or posterior along the rib until paresthesia or motor response was achieved. Location of the artery provides a useful landmark; the needle can be withdrawn and reinserted in a more posterolateral direction, which generally result in a paresthesia or motor response.

On localisation of the brachial plexus negative aspiration for blood is checked before injection of 40ml solution.

OBSERVATIONS AND RESULTS

The present study was carried out in 60 adult patients of ASA I/II posted for various elective upper limb surgeries after taking written inform consent. The patients were divided into two groups.

Group B – Inj. Bupivacaine 0.25% 40 ml + Inj. Normal saline 0.9% 0.5ml

Group D – Inj. Bupivacaine 0.25% 40 ml + Inj. Dexmedetomedine 0.5ml (50 mcg)

Table 1: Onset of sensory and motor block.

Parameter	Group D	Group B	P Value
Onset time for sensory block (min)	7.25± 0.50	11.05± 0.69	P < 0.0001
Onset time for motor block (min)	8.59± 0.63	14.42± 0.82	P < 0.0001

Onset of sensory and motor block was faster in Group D as compared to Group B which was statistically highly significant(p<0.0001).

Table 2: Duration of sensory and motor block.

Parameter	Group D	Group B	P Value
Sensory block(min)	701.43± 31.30	195.96 ±12.55	P < 0.0001
Motor block (min)	609.13± 20.18	154.0 ±11.91	P< 0.0001

Duration of sensory and motor blockade was significantly prolonged in Group D as compared to Group B which was statistically highly significant (p<0.0001).

Table 3: Duration of analgesia.

Parameter	Group D	Group B	P value
Analgesia (min)	948.66± 29.00	292.96± 42.84	P<0.0001

Duration of analgesia was significantly prolonged in Group D as compared to Group B which was statistically highly significant (p<0.0001).

Table 4: Sedation score.

Sedation score	Group -D	Group-B
0	2(6.67%)	25(83.33%)
1	20(66.67%)	5(16.67%)
2	8(26.66%)	0
3	-	-

83.33% of patients were awake in Group B compared to Group D (6.67%) during intraoperative period. Intraoperatively, mean pulse rate was gradually decreased in Group D compare to Group B which was statistically significant (p<0.0001).

Postoperatively, mean pulse rate was comparable in both groups (p>0.05).

Intraoperatively, systolic blood pressure was gradually decreased in Group D which was statistically significant.

Postoperatively, systolic blood pressure was comparable in both groups (p>0.05).

Intraoperatively diastolic blood pressure was decreased in Group D which was statistically significant.

Postoperatively, diastolic blood pressure was comparable in both groups and statistically not significant (p>0.05).

There was no significant difference observed in SpO2 between two groups (p>0.05).

In Group D, bradycardia was observed in 1 patient (3.33%), and hypotension was observed in 1 patient (3.33%).

DISCUSSION

One of the important roles of anaesthesiologist is to provide analgesia during surgery as well as in the post operative period. The effective management of postoperative pain is to ensure that the patient get relief at the appropriate time without any complication.

In our study, dexmedetomidine added to bupivacaine to assess the prolongation of postoperative analgesia. Pain relief after upper limb surgery can also be achieved by various other methods which include parental administration of opioids and non opioids analgesics, continuous infusion of local anaesthetic via catheter placement etc.

Peripheral nerve block with local anaesthetics provide excellent operative condition with good muscle relaxation but the duration of analgesia is rarely maintained for 4-5 hours even with the longest acting local anaethetics (Bupivacaine).

Various studies have shown that addition of several adjuvant like neostigmine, opioids, dexamethasone etc. to local anaesthetics prolonged the duration of analgesia, but the result have been inconclusive because of associated side effect or doubtful efficacy.

Total 60 adult patients of ASA I/II posted for various elective upper limb surgeries were randomly allocated in two groups, each group was having 30 patients.
Group B – Inj. Bupivacaine 0.25% 40 ml + Inj. Normal saline O.9% 0.5ml
Group D – Inj. Bupivacaine 0.25% 40 ml + Inj. Dexmedetomedine 0.5ml (50 mcg)

We used Bupivacaine 0.25% 40ml with Dexmedetomidine 50mcg and compared it with only Bupivacaine 0.25% 40ml for onset and duration of sensory and motor block, hemodynamic changes, sedation score and post operative analgesia.

Demographic data were comparable in both the groups.
We found that onset of sensory block was 7.25 ± 0.50 min in Group D and 11.05 ± 0.69 min in Group B ($p<0.0001$). The onset of motor block was 8.59 ± 0.63 min in group D and 14.42 ± 0.82 min in group B ($p<0.0001$). It shows that onset time of sensory and motor block had shortened in Group D compared to Group B.

Highly lipophilic nature of dexmedetomidine allows rapid absorption into the cerebrospinal fluid and binding to α2- adrenoreceptor of spinal cord for its analgesic action. It prolongs the duration of both sensory and motor blockade induced by local anesthetic irrespective of route of administration (e.g., epidural, caudal, spinal). Dexmedetomidine though enhances both central and peripheral neural blockade by local anesthetics; however, the peripheral neural blockade is due to binding to α2A-adrenoreceptor.[4] It shortened the onset time of both sensory and motor block, prolonged the duration of block and the duration of postoperative analgesia because peripheral α2 agonist produce analgesia by reducing release of norepinephrine leading to α2 receptor-independent inhibitory effect on nerve fibre Action potential.[4]

Our study findings are comparable to previous studies conducted by A Esmaoglu et al[7] and A Khade et al.[9]

Rachna Gandhi et al[8] shown the onset of sensory and motor block was 21.4 ± 2.5 mins and 11.2± 2.1 mins respectively. Onset time of sensory and motor block was shortened in our study because we have used higher dose of dexmedetomidine (50mcg).

Total duration of sensory block was 701.43 ± 31.30 min in group D and 195.96 ± 12.55 min in group B($p<0.0001$). Total duration of motor block was 609.13 ± 20.18 min in Group D and 154.0 ± 11.91min in Group B. It shows that duration of sensory and motor block was prolonged in Group D compared to Group B.

Duration of analgesia was 948.66 ±29.00 min in Group D and 292.96 ± 42.84 min in Group B which was significantly prolonged ($p<0.0001$). duration of analgesia was 1008.69 ± 164.04 mins. Which was more prolongred than our study because they had used higher concentration and dose of dexmedetomidine and local anesthetic (0.5% levobupivacaine and 1ml (100mcg) of dexmedetomidine).

Intraoperatively mean pulse rate gradually decrease in Group D compared to Group B. That was due to 1) sedation achieved by Dexmedetomidine which relieved the anxiety related to surgery and surrounding environment 2) effect of dexmedetomidine on pulse rate and 3) pain relief itself.

Intraoperatively systolic and diastolic blood pressures were significantly lower than baseline in Group D compared to Group B. That was due to pain relief and cardiovascular effect of Dexmedetomidine. All patients were sedated in Group D except 2 patients during intraoperative period. This can be explained on the basis that some amount of systemic absorption of drug could be present. As α2 agonist produce sedation by central action, they produce inhibition of substance P release in the nociceptive pathway at the level of the dorsal horn neuron and by activation of α2 adrenoreceptor in locus ceruleus 6.

Hypotension and Bradycardia were observed only in 3.33% patient that was not statistically significant and so treatment for that was not needed. Respiratory depression was not observed in any patients. There were no significant changes in oxygen saturation (SpO2).

SUMMARY AND CONCLUSION

In the present study of 60 adult patients of ASA grade I/II posted for elective upper limb surgeries selected randomly from our hospital. These patients were undertaken to evaluate and compare the analgesic efficacy and any side effects of dexmedetomidine with bupivacaine in supraclavicular brachial plexus block.

All patients were preoperatively assessed, procedure was explained and written inform consent was taken.

The patients were randomly divided in two groups. Each group included 30 patients.

Each patient was given supraclavicular brachial plexus block after taking all aseptic and antiseptic precautions.

The patients were monitored intraoperatively for pulse, BP, SpO2, RR, onset and duration of sensory and motor block, and duration of analgesia. Any side effect like bradycardia, hypotension, nausea, vomiting, headache, respiratory depression and sedation was documented.

In the postoperative period patients were also monitored for post operative analgesia and side effect.

The demographic data were comparable in both the groups.

The onset of sensory and motor block was faster in Group D compared to Group B ($p<0.0001$).

Total duration of sensory block (701.43 ± 31.30 min) and motor block (609.13 ± 20.18 min) was very much prolonged in group D compared to Group B.

Duration of analgesia was prolonged in Group D (948.66 ± 29.00 min) compared to Group B (292.96 ± 42.84 min).

Mean pulse rate and blood pressure were decreased upto 120 min in Group D which was statistically significant. There was no statically significant difference in PR, BP after 120min in postoperative periods.

All patients were sleepy but arousable in Group D compared to Group B. Thus dexmedetomidine produces sedation.

There was no significant change in oxygen saturation and RR in any patients. Hypotension and Bradicardia were noted in one- one patients.

Present study suggests that dexmedetomidine 50mcg when added to bupivacaine for supraclavicular brachial plexus block shortens the onset time, prolongs the duration of the block and postoperative analgesia. The added advantage of conscious sedation, hemodynamic stability, and lack of significant side effects like respiratory depression make dexmedetomidine an attractive choice as an adjuvant for peripheral nerve block.

REFERENCES

1. Halstead WS practical comments on use and abuse of coccaine NY Med. J, 1884; 40; 643.
2. Halstead, WS Surgical paper by William Stuward Halsopkins Press, 1924; 1: 37-39.
3. F.W abdallah and R. Brull: A systemic review and meta analysis on facilitatory effect of perineural dexmedetomidine on neuroaxial and peripheral nerve block. British journal of anaethesia, 2013; 110-6: 915-23.
4. Swami SS, Keniya VM, Ladi SD, Rao R: Compared Clonidine and Dexmedetomidine as an adjuvant to local anaesthetic agent in supraclavicular brachial plexus block, jornal of anaesthesiology, 2012; 56-3.
5. Varshall M Keniya, Sushma Ladi, Ramesh Naphade: Dexmedetomidine attenuate sympathoadrenal response to tracheal intubation and reduced perioperative anaesthetic requirement. Indian jounal of anaesthesia, 2011; 55(4): 352-357
6. Crile. GW anaesthesia of nerve root with cocaine, cleve med.J, 1897; 2: 355.
7. Esmaoglu A, Yegenoglu F, Akin A, Turk CY: Dexmedetomidine added to bupivacaine prolong the axillary brachial plexus block, anaesthesia analgesia, 2010; 111(6).
8. Gandhi R, Shah A et al: Dexmedetomidine along with bupivacaine for brachial plexus block in 70 patients. National J. of Med. Reserch, 2012; 2(1): 67-69.
9. Sandhya Agrawal, Ritu Agrawal, Praveen Gupta: Dexmedetomidine prolongs the effect of bupivacaine in supraclavicular brachial plexus block journal of anaesthesiology clinical pharmacology, 2014; 30-1.
10. Miller's anaesthesia 7th edition: anatomy of Brachial Plexus.