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ORIGINAL ARTICLE

COMPARATIVE EVALUTION OF CLONIDINE WITH LIGNOCAINE VERSUS DEXMEDETOMIDINE WITH LIGNOCAINE IN BIER'S BLOCK

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ABSTRACT: Present study was conducted to compare the effects of adding clonidine vs dexmedetomidine to lignocaine in Bier`s block. It was prospective randomised double-blinded. 40 patients of ASA I or II posted for upper limb surgery under Bier`s block were included. Bier`s block was given with lignocaine with either dexmedetomidine 1µg/kg or clonidine 1µg/kg. There was no significant difference between the two groups in onset or regression of sensory and motor blockades. There was a significant decrease in number of patients requiring analgesia and its consumed amount in the Dexmedetomidine group (0% and 0µg, respectively) as compared to the Clonidine group (40% and 27±43µg, respectively) intraoperatively. There was a decrease in number of patients requiring analgesia and its consumed amount in Dexmedetomidine group (5% and 2.5±11µg, respectively) compared to the Clonidine group (35% and 32±24.5µg, respectively) post-operatively. The quality of anaesthesia was significantly better in Dexmedetomidine group than to Clonidine group. Patients were more sedated in the Dexmedetomidine group for brief post-operative period. This study concludes, adding dexmedetomidine to lignocaine in Bier`s block is more beneficial than adding clonidine.

KEYWORDS: Bier's block; Lignocaine; Clonidine; Dexmedetomidine.

INTRODUCTION: Bier`s block is simple to administer, reliable, cost-effective and is ideal for short operative procedures on the upper limb and avoids the hazards of general anaesthesia in patients with severe systemic diseases,[1] e.g., liver impairment in whom regional anaesthesia is particularly useful provided coagulation profile is acceptable.[2]

Bier`s block was first described in 1908 for anaesthesia of the hand and forearm and the earliest agent injected into the isolated vascular space was procaine.[3] The technique became popular in the 1960`s when Holmes used lignocaine.[4] Lignocaine remains the standard Local Anaesthetic (LA) agent for surgical procedures in many countries,[5] and prilocaine is used widely in Europe.[6]

Adverse effects of Bier's block are about LA toxicity, slow onset, poor muscle relaxation, tourniquet pain and minimal postoperative pain relief. The ideal drug for Bier`s block should have: rapid onset, reduced dose of LA, reduced tourniquet pain and prolonged post-op analgesia. No currently available local anaesthetics fulfill these qualities and hence we need adjuvant in LA.

Several adjuvants have been used but their use was limited by side effects, e. g., mivacurium,[7] or limited efficacy, e.g., opioids and acetylsalicylate.[8,9]

α_2-adrenergic receptor (Adrenoceptor) agonists have been used for their sedative, analgesic and peri-operative sympatholytic and cardiovascular stabilizing effects in addition to their general anaesthetic sparing effect and their ability to prolong LA-induced analgesia when used in regional blocks.[10,11]

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Addition of clonidine to lignocaine during Bier`s block improve tourniquet pain tolerance but do not increase speed or quality of Bier`s block.[12] Its effect on prolonging post-operative analgesia is controversial.[12,13,14] Reported side-effects include post-cuff deflation hypotension and sedation.[8,12,13]

Dexmedetomidine, a potent α_2 adrenoceptor agonist, is almost 8 times more selective toward the α_2 adrenoceptors than clonidine.[15] Dexmedetomidine-lignocaine mixture was used to provide Bier's block and it improved the quality of anaesthesia, tourniquet pain and reduce post-operative analgesic requirement.[16,17] Its effect on the speed of onset of Bier`s block is improved.[16,17] These studies have shown that it is better adjuvant to lignocaine in providing Bier`s block in comparison to clonidine. No study is conducted to compare directly these two agents. So, this study was designed to compare the effects of adding either clonidine or dexmedetomidine to lignocaine during Bier`s block.

MATERIAL AND METHODS[17]: Forty adult American Society of Anaesthesiologists (ASA) Class I or II patients posted for upper limb surgery at SRTR Govt Medical College, Ambajogai were included during the period from June, 2012 to August 2013. Written informed consent to participate in this prospective randomised double-blind study was obtained. Ethical committee approval was taken for study. Patients with history of allergy to drug, Raynaud's disease, sickle cell anaemia were excluded from the study. No sedation was given preoperatively. Monitors including ECG, non-invasive Blood Pressure (NIBP) and pulse oximeter were used. Patients were allocated randomly into two groups using sealed envelope technique.

Two intravenous (IV) cannulae were inserted, one (22G) in operative hand and the other (20G) in the other hand for i.v. fluids and drug administration. A double tourniquet was positioned on the operative arm. The operative limb was exsanguinated by elevation and wrapping it with Esmarch bandage. The proximal tourniquet was inflated to 100 mmHg more than systolic BP to a minimum of 250 mmHg and the Esmarch bandage was removed. Circulatory isolation of the operative arm was confirmed by the absence of the radial pulse.

The Bier`s block was achieved using 3mg/kg lignocaine diluted with saline to a total volume of 40 mL to which either clonidine 1µg/kg (Group I) or dexmedetomidine 1µg/kg (Group II) was added. Drugs were given slowly over 1min in the operative limb. Assistant not participating in the study prepared drug while the anaesthesiologist was not aware of drug used.

Sensory block was assessed at 30 sec intervals using a 26-G needle. Sensory testing was done atthenar eminence (Median nerve), hypothenar eminence (Ulnar nerve) and first web space (Radial nerve). Sensory regression was assessed at same nerve sites at 30sec intervals after tourniquet deflation. Motor function was assessed by asking the patient to flex and extend his/her wrist and complete motor block was noted when no voluntary movement was possible. After achieving sensory and motor blocks distal tourniquet was inflated to 250mmHg, the proximal tourniquet was released and surgery commenced.

Mean Arterial Pressure (MAP) and Heart Rate (HR) were recorded every 10 min. A 20% decrease of mean arterial pressure compared to the preoperative values was regarded as hypotension and Inj. Mephentermine 6mg IV increments was then injected until BP returned to within the accepted 20% of baseline value. HR lowers than 50beats/min was regarded as bradycardia and atropine 0.6mg IV was given.

Pain (Tourniquet or post-operative) was assessed using a visual analogue scale (VAS) where 0 equals no pain while 10 equals the worst pain possible. An IV bolus of fentanyl 25µg was

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administered if supplemental analgesia was required (VAS score >3) either intra- or post-operatively. Intra-operative and post-operative fentanyl consumption was recorded.

At the end of the operation, the quality of anaesthesia was assessed according to the following numeric scale: excellent,(4): no complaint from patient; good,(3): minor complaint with no demand for supplemental analgesics; moderate,(2): complaint which required supplemental analgesics; unsuccessful,(1): patient was given general anaesthesia. After completion of surgery, tourniquet deflation was performed by the cyclic deflation-inflation technique. Sensory and motor blocks were then tested every 30 sec as during induction of Bier`s block and the regression times were noted.

Sedation was assessed on a 1-5 numeric scale where,(1) completely awake,(2) awake but drowsy,(3) asleep but responsive to verbal commands,(4) asleep but responsive to tactile stimuli and (5) asleep and not responsive to any stimulus. The VAS for pain and the sedation score were measured during surgery (0, 5, 10, 15, 20 and 40min. after the injection of anaesthetics) and after tourniquet deflation (at 0, 15, 30, 60 and 120min).

All measurements were recorded by a blinded anaesthesiologist not participating in study. Any complications were recorded.

STATISTICAL ANALYSIS: Patient`s characteristics data, duration of surgery, tourniquet times, sensory and motor blocks onset and regression time, and analgesic consumption were analysed using t-test. Gender distribution was analysed with Chi square-test. The Quality of anaesthesia, pain and sedation scores were analysed using the Mann-Whitney U-test. A $p<0.05$ was considered as statistically significant.

RESULTS: There was no significant difference in the demographic data, duration of surgery or the tourniquet time between the two groups (Table 1). There was no significant difference between the two groups regarding the onset or regression of both the sensory and motor blockades (Table 1).

Parameter	Group I	Group II
Age (yrs.)	36±14	40±4
Sex (M/F)	4/8	5/7
Weight (Kg.)	69±17	71±9
Duration of surgery (min.)	38±16	35±11
Tourniquet time (min.)	45±10	43±13
Onset of sensory block (min.)	3.9±2.9	5.1±2.5
Onset of motor block (min.)	9.9±3.9	10.9±2.2
Recovery of sensory block (min.)	5.8±2.1	6.8±1.7
Recover of motor block (min.)	6.1±1.4	5.7±3.0

Table 1: Demographic Data, Duration of Tourniquet and Surgery and Block Characteristics (Mean + S. D.)

There was a statistically significant reduction in the visual analogue score for both the tourniquet pain and the early post-operative pain in the dexmedetomidine group (Group II) compared to the clonidine group (Group I) throughout the operative period (Table 2).

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Timing (min)											
	After tourniquet inflation						After tourniquet deflation				
Groups	0	5	10	15	20	40	0	15	30	60	120
I	0 (0-0)	2 (1-3)	4 (1-7)	4 (2-6)	4 (2-7)	5 (3-7)	0 (0-4)	2 (0-6)	3 (0-7)	3 (0-7)	3 (0-7)
II	0 (0-0)	0 (0-0) *	0 (0-1)*	0 (0-1)*	1 (0-1)*	3 (0-5)*	0 (0-3)	0 (0-2)*	0 (0-3) *	0 (0-3)*	0 (0-5)*

Table 2: Visual Analogue score (VAS) during Intra and post operative period. Data are presented as median (Range)

*: P < 0. 05.

During both the intra-operative and early post-operative periods, there was a statistically significant reduction in the number of patients requiring rescue analgesia, as well as, in the amount of analgesia consumed in the dexmedetomidine group (Group II) compared to the clonidine group (Group I) (Table 3). The quality of anaesthesia was significantly better in the dexmedetomidine group (Group II) compared to the clonidine group (Group I) (Table 3).

Parameters	Group I	Group II
Quality of anaesthesia	3(2-5)	4 (3-5) *
No of patient required intraop fentanyl (%)	7(35%)	0*
Intraop fentanyl consumption (µg)	25(41)	0*
No. of patients requiring fentanyl in recovery room (%)	6(30%)	1 (5%) *
Fentanyl consumption in recovery room (µg)	30(22.5)	2.5 (10) *

Table 3: Quality of Anaesthesia and Perioperative Analgesic Consumption

Quality of anaesthesia data are presented as median (range).
No. of patients data are presented as number (%).
Fentanyl consumption data are presented as Mean±SD.
*: P < 0.05

Post-operatively, there was a statistically significant increase in the sedation score at 15, 30 and 60 min after tourniquet release in the group II compared to the group I (Table 4). None of the patients developed significant bradycardia or hypotension requiring rescue medications or other side effects apart from the fore-mentioned sedation.

Time					
Group	0	15	30	60	120
I	1(1-2)	2(1-3)	1(1-2)	1(1-2)	1(1-2)
II	1(1-2)	3(1-3) *	2(2-3) *	1(1-3) *	1 (1-2)

Table 4: Postoperative Sedation Score

Data are presented as median (range).
*: P < 0. 05

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DISCUSSION: The onset and regression times for both the sensory and motor block of Bier`s block using either clonidine-lignocaine or dexmedetomidine-lignocaine mixtures, are similar in this study, while the dexmedetomidine-lignocaine mixture provided better quality of anaesthesia and tourniquet tolerance, has longer post-deflation analgesia with reduction in operative and early post-operative analgesic consumption. These improvements were associated with more post-operative sedation that is short-lived.

Although both groups have similar sensory and motor onset and recovery times. The mixture of dexmedetomidine and lignocaine, provides better anaesthetic conditions as evidenced by the better quality of anaesthesia, better tourniquet tolerance leading to fewer patients requiring operative rescue analgesia and less analgesic consumption in those who actually required it.

The analgesic sparing effect of dexmedetomidine were not limited to the operative period but extended to the early post-operative period much more than clonidine as evidenced by the lower pain VAS scores, reduction in the percentage of patients requiring rescue analgesia in addition to reduction of analgesic consumption in those who had significant pain scores (VAS>3) in the dexmedetomidine group. The limited post-operative analgesic sparing effects of clonidine observed in this study confirm the findings of other investigators.[12,13,17] The post-operative analgesic sparing effect of dexme-detomidine during Bier`s block observed in the present study is similar to other investigators.[16,17,18]

The mechanism by which α_2-adrenergic receptor agonists produce analgesia and sedation is not fully understood but is likely to be multi-factorial. Peripherally, α_2-agonists produce analgesia by reducing release of nor-epinephrine,[19] and/or causing α_2-receptor independent inhibitory effect on nerve-fibre action potentials.[20] Centrally, α_2-agonists produce analgesia and sedation by inhibition of substance P release in the nociceptive pathway at the level of the dorsal root neuron and by activation of α_2-adrenoceptors in the locus coeruleus. α_2-adrenoceptors are coupled via a pertussis toxin-sensitive G protein to potassium ion channel. Stimulation of α_2-adrenergic receptor results in an increase in the potassium ion channel conductance.[11]

It is therefore, hardly surprising that dexmedetomidine, that has 8 times the affinity of clonidine for α_2-Adrenergic receptors, caused more post-cuff deflation sedation compared to clonidine in the present study.[11,15] There was significant post-deflation sedation using the same dose of dexmedetomidine used in the present study.[18] While, other investigators using half the dose used in this study did not observe increased post-deflation sedation.[16]

CONCLUSION:

Hence we conclude that:

1. The onset and regression times for both the sensory and motor block of Bier`s block using either clonidine-lignocaine or dexmedetomidine-lignocaine mixtures, at the doses used in this study, are similar.
2. thedexmedetomidine-lignocaine mixture provided better quality of anaesthesia, tourniquet tolerance and operative and early post-operative analgesia at the expense of short- lived increased post-deflation sedation.
3. The addition of dexmedetomidine compared to clonidine to lignocaine for the performance of Bier`s block is more effective than clonidine, but further studies are needed to find optimum dose of dexmedetomidine with Lignocaine in Bier's block.

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