Original Article

Addition of clonidine or fentanyl with bupivacaine for supraclavicular brachial plexus blocks in upper limb surgery- a randomized comparative study

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Abstract:

Background *The popularity of supraclavicular brachial plexus block in upper limb surgery in recent years are due to better understanding of using adjuvant to local anaesthetics, its advantages and in avoidance of the hazards of general anaesthesia.*

Objective *To compare the quality of anaesthesia and duration of analgesia with clonidine-bupivacaine or fentanyl-bupivacaine in supraclavicular brachial plexus block.*

Method *A total number of 60 patients (ASA class 1 and II) were selected randomly into two groups, thirty in each group. Group-A (control group) received fentanyl (100μg) 2ml and bupivacaine (0.25%) 38ml, total of 40ml.Group-B (study group) received clonidine (150μg) 2ml and bupivacaine (0.25%) 38ml, total of 40ml.The parameters including pulse rate, non-invasive systolic and diastolic blood pressure, respiratory rate, SpO_2, onset and duration of motor and sensory block, post operative pain score in VAS, duration of analgesia, first analgesic demand, side effects were assessed and recorded.*

Result *Onset and duration of sensory block were significantly higher in group-B than in group-A (P<0.001) and motor block were quite prolonged in group-B than group-A (p<0.001), prevalence of sedation in group-B slightly higher than group-A. But intensity of pain measured by VAS in group-A expressed highest at 8 hours of postoperative period and group-B shows highest VAS at 12 hours. Duration of effective analgesia (time from supraclavicular block to first analgesic demand) in study group-B had significantly longer mean duration than that produced by control group-A (14.4 ± 1.3 vs 10.9 ± 1.5 hours; P<0.001).*

Conclusion *Clonidine and bupivacaine combination is a better alternative to fentanyl and bupivacaine in respect of quality of anaesthesia and duration of analgesia.*

Keywords *Supraclavicular, clonidine, fentanyl, brachial plexus block, bupivacaine*

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Introduction

Brachial plexus regional anesthesia has been a mainstay of the anesthesiologists armamentarium since Hall, first reported the use of cocaine directly to the upper limb nerves in 1884[1]. Regional nerve block avoids the unwanted effects of anaesthetic drugs used during general anaesthesia and the stress response of lanryngoscopy and tracheal intubation. Minimizing the stress response and using minimal anaesthetic drugs is always beneficial for the patients with various cardio-respiratory co-morbidities. The supraclavicular

approach to brachial plexus result in a more even distribution of local anaesthetics and can be used for procedures on arm, forearm and hand [2]. In this approach the plexus is blocked where it is most compactly arranged at the level of nerve trunks. As a result a block with rapid onset can be achieved, this approach also offers a high success rate for techniques to extend the duration of block. Clonidine appears to have significant analgesic benefit and to cause minimal adverse effects when added in a dose up to 150µg [7-8]. Fentanyl added to elbow, forearm and hand surgery because all the branches of brachial plexus can be reliably blocked[3]. Now-a -days different drugs have been used as an adjuvant with local anaesthetic in brachial plexus block to achieve quick, dense and prolonged block[4] .

Drugs like morphine, pethidine, fentanyl, clonidine, dexamethasone, midazolam are commonly used along with local anaesthetic for this purpose. However their use is limited because of side effects, like deep sedation respiratory depression and psychomotor effects. Drugs with minimal side effects are always looked for. Adding clonidine[5] or fentanyl[6] to bupivacaine produce analgesia, sedation with minimal side effects.Since 1980's clonidine has been used as an adjuvant to local anesthetic in various regional anaesthesia, bupivacaine prolongs anaesthesia and analgesia in axillary brachial plexus and supraclavicular block [9-10]. On the basis of studies of related literature and discussion made above, it may be thought that bupivacaine- clonidine is a better alternative to bupivacaine-fentanyl for supraclavicular brachial plexus block.

In this study we have evaluate the quality, onset, duration of anaesthesia and analgesic effects of clonidine in bupivacaine as compared to fentanyl in bupivacaine in supraclavicular block for upper limb surgery.

Methods

After approval by the hospital ethical committee this prospective randomized single-blind study involving 60 ASA I and II supraclavicular aged 18-60 years either sex undergoing bronchial plexus block for elective upper limb surgery.

This single blind, randomized prospective study of supraclavicular brachial block for upper limb surgery (elbow, forearm and hand) was carried out in Dhaka medical collage Hospital. Total numbers of patients were 60 and divided into two groups containing 30 in each. They were aged 18-60 years, ASA class 1&II. This prospective study was conducted after obtaining ethical clearance from ethical review committee (ERC). The written informed consent and assessment of all the selected patients were taken preoperatively.In Group-A, patients were received bupivacaine (0.25%) 38ml and fentanyl (100ìg) 2ml, total of 40ml. In group-B, patients were received bupivacaine (0.25%) 38ml and clonidine (150ìg) 2ml, total of 40ml for supraclavicular block. Patients refusal, coagulopathy or receiving anticoagulants therapy, history of allergy to study drugs, history of hypertension, peripheral neuropathy, inadequate block or any unsuitable local condition coere excluded from this study.

On arrival of patient at operating room base line pulse rate, blood pressure, respiratory rate and pain score were recorded. A peripheral IV line was established in the non-operated hand. Patients were hydrated with IV Hartman solution 500ml at rate of 30drops/min with all aseptic precaution, supraclavicular brachial plexus block were established using of paresthesia technique in the proposed operated hand. Patients were on supine position, head turned to the opposite side and arm placed medially towards the body, 2ml of 1% lignocaine was used for infiltration at mid-clavicular line half inch above the clavicle. Using stylets of 22G IV cannula, drugs were deposited with three plane aspiration techniques. The time of onset of block were noted. The onset of sensory block was assessed with application of cold spirit swab and response to pin prick by blank needle in different areas innervated by radial, ulnar, median, musculocutaneous nerves at 5min interval. The time of onset of complete sensory block was noted. The motor block was assessed every 5min by asking the patients to raise their ipsilateral hand and move their fingers. When patients could not move fingers or raise hand, it was considered as complete motor block (modified bromage scale), the time was noted. The duration of analgesia was noted according to 0-10 visual analog scale (VAS) for pain at every hour till 10 hrs then to 2 hrs for 24 hrs. Frequency of sedation, hypotension, nausea, and convulsion were recorded. All data were recorded on data sheet, after collection, data were checked meticulously and then compiled, analyzed for statistical significance using mean standard deviation, independent student 't'test, ANOVA, chi-

squared test or Fisher's exact test as appropriate using SPSS version 12.0 for windows. A p-value <0.05 was regarded as significant.

Results

Table I *Demographic characteristics of Group-A and Group-B*

Demographic variables	Group A (n=30)	Group B (n=30)	P value
Age (years)			
> 30	11 (36.7)	18 (60.0)	
< 30	19 (63.3)	14 (40.0)	
Mean±SD	33.1±13.2	29.5±11.2	0.256
Sex			
Male	23(76.6)	21(70.0)	0.559
Female	7(32.3)	9(30.0)	
Weignt (kg)	56.2±10.2	59.3±6.1	0.160

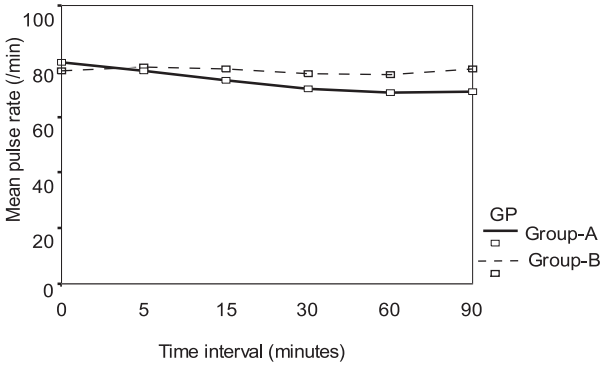

Fig 1 *Monitoring of pulse rate at different time interval.*

There was no significant differences between groups in respect of changes of pulse rate.

Table II *Comparison of timing of anesthesia events between Group-A and Group-B*

Timing of anesthesia	Group-A (n=30)	Group B (n=30)	P-value
Onset of sensory block (minutes)*	8.9 ± 2.9	11.9 ± 2.7	<0.001[s]
Duration of sensory block (minutes)*	364.5 ± 33.3	558.0 ± 66.4	<0.001
Onset of Motor block (minutes)*	8.3 ± 2.7	9.8 ±2.1	0.026[s]
Duration of Motor block	388.2 ± 34.8	574.3 ± 40.9	<0.001[s]

*Data were analysed using Student's t-Test and were presented as mean ± SD onset and duration sensory block were significantly higher in Group B than Group-A. Onset and persistence of motor block were significantly higher in Group B than Group-A.

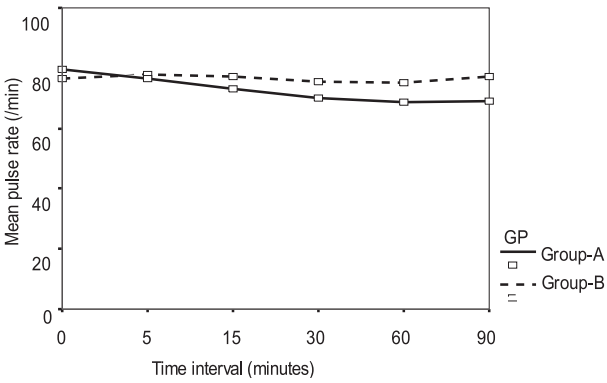

Fig 2 *Monitoring of systolic blood pressure at different time interval*

Table III *Comparison of quality of anesthesia between Group-A and Group-B*

Quality anesthesia	Group-A (n=30)	Group-B (n=30)	p-value
Quality of sensory block[#]			
Partial	00	1(3.3)	
Complete	30(100.0)	29(96.7)	0.500
Quality of motor block[#]			
Partial	0(0.0)	5(16.7)	0.026[s]
Complete	30(100.0)	25(83.3)	

Fisher's Exact Test was employed to analyze the data; S = Significant. Complete motor block was significantly less in Group-B (83.3%) than that in Group-A (100%) (p=0.026)

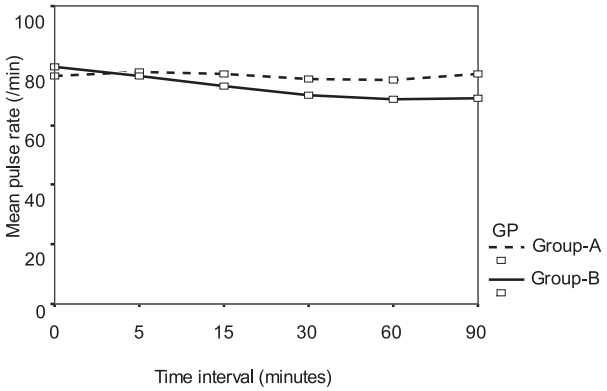

Fig 3 *Monitoring of SPO2 at different time intervals.*

Table IV *Comparison of post-operative pain VAS between Group-A and Group-B*

Pain VAS(cm)	Group-A (n=30)	Group-B (n=30)	p-value
Pain VAS at 0.5 hr	00	00	
Pain VAS at 1hr	0.3±0.2	00	
Pain VAS at 2hr	0.8± 0.4	00	
Pain VAS at 41hr	2.9±2.7	00	
Pain VAS at 6hr	4.4 ±2.7	00	
Pain VAS at 8hr	7.7±2.2	3.6±1.8	<0.001[s]
Pain VAS at 10hr	2.5±1.9	4.9±1.9	
Pain VAS at 12hr	1.2±1.1	7.5±2.3	
Pain VAS at 14hr	1.1±0.9	2.4±1.7	
Pain VAS at 16hr	0.9±0.7	0.9±0.8	

Repeated measure ANOVA statistics was employed to analyze the data 'P' refers to overall differences between groups. S=significant Intensity of post operative pain measured on VAS showed Group-A expressed highest VAS at 8 hrs of post operative. Period and Group-B Showed highest VAS at 12 hrs.

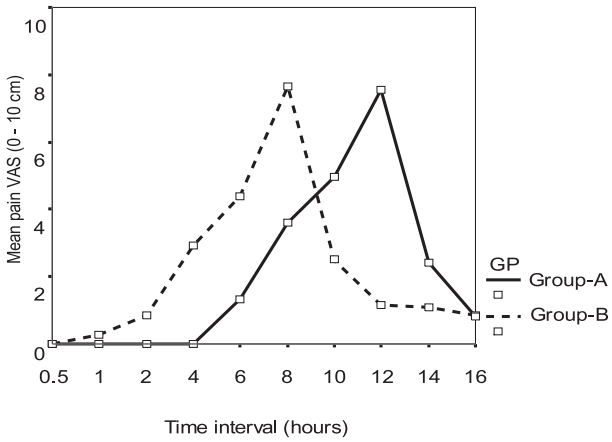

Fig 4 *Monitoring of postoperative pain VAS at different time interval.*

Table V *Comparison of effective analgesia between groups*

Group	Duration effective analgesia (hours)		P-value
	Mean	SD	
Group-A	10.9±1.5	1.5	<0.001[s]
Group-B	14.4±1.3	1.3	

Data were analysed using Unpaired t-Test and are presented as mean ± SD; S=Significant, duration of effective analgesia (time from supraclavicular block to first analgesic demand) Study group-B had significantly longer mean duration of analgesia (14.4+1.3hrs.) than that produced by control group-A (10.9+1.5hrs) (p<0.001).

Table VI *Comparison of analgesic demand between groups*

1st dose analgesic	Group-A (n=30)	Group-B (n=30)	p-value
No	26(86.7)	30(100.0)	0.056[NS]

Fisher's Exact Test was done to analyze the data; NS=Not significant

Discussion

Adjuvant improves analgesia, reduces systemic side effects and total dose of local anesthetics. Opioids like fentanyl, morphine, pethidine, non-opioid like dexamethasone, midazolam, and neostigmine have been studied as adjuvant to local anaesthetics[7]. However, there use is limited because of side effects like sedation, hypotension, purities[7], and sympatho-mimetic effects[6]. Fentanyl-bupivacaine combination used in spinal, epidural and in brachial plexus block. Their use has established because onset is rapid, anaesthesia more complete and prolonged analgesia[10]. Clonidine, a newer drug with selective agonist activity at alpha$_2$ adenoreceptor receptors have been used for many years as a centrally acting antihypertensive agent. Clonidine is second useful adjuvant after epinephrine for brachial plexus blockade.

Addition of clonidine with bupivacaine in the branial plexus block prolongs anaesthesia, analgesia and reduces side effects [12] . In this study fentanyl or clonidine was used as adjuvant in bupivacaine. Onset as well as duration of sensory and motor block were recorded along with quality. In Group-B (Clonidine-bupivacaine) the onset and duration of sensory and motor block block were significantly higher than that of Group-A In our study, intra and postoperative mean pulse rate, systolic, diastolic BP, respiratory rate and SPO_2 did not vary through out whole period of observation. There was no significant difference between two groups. The intensity of postoperative pain measured on VAS (visual analog scale) show that the subjects of Group-B had no pain from 0.5 hr to 4 hrs period. Then after it began to rise and reaches its peak at 12 hrs, when an analgesic dose was needed to reduce the intensity of pain. No pain was observed in Group-A at 0.5 hrs, thereafter it increased insidiously 2.9 cm at 4 hrs interval, 7.7cm at 8 hrs interval which then sharply decreased 2.5cm and 1.25cm at 10 hrs, 12 hrs interval

respectively following an analgesic dose. Regarding duration of analgesia, in our study it was demonstrated that mean duration of analgesia was significantly longer in Group-B (14.4± 1.3 hrs) than that produced by Group-A (10.9±1.5 hrs) (P<0.001) which was significant. Eledjam et al (1991) done a study to compare the quality and duration of analgesia in two groups, group-1 (received clonidine 150ìg in bupivacaine 0.25% 40ml) and group2 (received 200ìg epinephrine in bupivacaine 0.25% 40ml). Analgesia was prolonged with clonidine, 994.2± 34.2 min VS 728.3±35.8min) and superior to that of epinephrine (P<0.001)[13]. Duration of analgesia interms of hrs, was nearly matched with our study. EI Saied et al(2000) showed that addition of 150ìg clonidine to 40ml ropivacaine 0.75% for axillary plexus block resulted in increase in duration of both anaesthesia and analgesia which support our study because pharmacokinetic character of ropivacaine and bupivacaine are similar[14]. Regarding duration of analgesia between groups four (13.3%) of 30 patients in Group-A required first analgesic dose within 8 hrs period after operation while none of the patients in Group-B required analgesic within the same period (P=0.06) which was not significant. In our study 3 (10%) subjects in group-B had deep sedation which was not observed in group-A at all (P=0.837).

In a study by Shah Alam et al in 2008 showed that prevalence of sedation was higher in clonidine-bupivacaine group (40%) than fentanyl-bupivacaine group (33%) and they did not found any significanct change. The result of that study is matched with this study. From the discussion so far, it is evident that clonidine-bupivacaine combination is more effective than fentanyl-bupivacaine in reducing intensity of postoperative pain.

So concluded that clonidine and bupivacaine for supraclavicular brachial plexus block markedly improve intra-operative quality of anaesthesia, increased duration of postoperative analgesia and reduce incidences of side effects.

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