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Comparison of duration of postoperative analgesia in combined femoral sciatic nerve block using Clonidine and Dexmedetomidine as an adjuvant to Bupivacaine.

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Abstract

Background: Combined femoral and sciatic nerve block is as effective as or better than caudal analgesia for pediatric orthopedic surgeries. The present study aims at comparing clonidine and dexmedetomidine in bupivacaine for combined femoral and sciatic nerve block, for postoperative analgesia in children undergoing below knee surgery.

Methods: 80 ASA I & II children in the age group of 1-8 years scheduled for elective below knee surgery under general anaesthesia and combined femoral sciatic nerve block were randomly divided into 2 equal groups. Group C received 1µg/kg of clonidine & group D received 0.5µg/kg of dexmedetomidine added to 1ml/kg of 0.25% bupivacaine for the nerve blocks. The duration of postoperative analgesia, sedation scores and any complication occurring over 24 hours of surgery were recorded. The data was subjected to statistical analysis using SPSS version 19 technique.

Results: The duration of postoperative analgesia in dexmedetomidine group (16.59 ±4.84 hours) was significantly higher than in clonidine group (11.70 ± 2.14 hours) ($P \leq 0.001$). Children were well sedated in the immediate postoperative period, sedation scores being slightly higher in group D than in group C. This difference was statistically significant ($P \leq 0.05$). No sedation was observed in either group after 4th hour. None of the children had bradycardia or hypotension in either group.

Conclusion: Dexmedetomidine (0.5µg/kg) added to 0.25% bupivacaine in combined femoral and sciatic nerve block results in longer duration of postoperative analgesia as compared to clonidine (1µg/kg). Both dexmedetomidine (0.5µg/kg) and Clonidine (1µg/kg) are safe adjuvant to bupivacaine and not associated with significant side effects.

Introduction

Pain as well as pain relief, a psycho-neural experience is difficult to quantify, more so in pediatric age group. Hence the need for effective postoperative pain relief in children cannot be overemphasized. Regional analgesia when combined with general anaesthesia offers many advantages, such as potentiating intra-operative and post- operative analgesia, a substantial decrease in the need of post-operative systemic narcotic supplements and a smooth recovery without any nausea or vomiting[1].

Adjuvant such as narcotics and α2 receptor agonist like clonidine, added to local anesthetics further prolong the sensory blockade, thereby ensuring a pain free postoperative recovery2. Dexmedetomidine, a more recently introduced α2receptor agonist with higher affinity for the receptors is expected to be as good as or even better than clonidine3.

Methods: After the approval of the study by Lady Hardinge medical college IRB (LHMC/ECHR/2014/279); and an informed written consent from the parents, 80 children in the age group of 1-8 years, belonging to ASA physical status I – II; scheduled for elective below knee orthopedic surgery were recruited. The sample size was decided considering α equal to 0.05 and power of study as 80%, to detect a difference of 20% in mean duration of analgesia between the two groups. The study was not registered with any recognized body since it was a post-graduate clinical thesis work and prior permission and clearance for the study obtained from the institutional ethical committee. All patients were premeditated in the Operation theatre with intravenous fentanyl 1µg/kg, and standard anesthesia monitoring including ECG, pulse oximeter, EtCO2 and noninvasive blood pressure was instituted. General anesthesia was induced with intravenous administration of 1 % propofol in a dose of 2mg/kg and maintained with O2 and N2O (1: 2) and 1% sevoflurane using a pediatric circuit. Airway was secured using an appropriate sized Classic LMA.Forty slips each for group C and group D were prepared and the patients were then randomly divided into two equal groups (n=40) as per the slip selected. Both the groups received a total of 1ml/kg of 0.25% bupivacaine for combined femoral sciatic nerve block with half the volume injected at each site. Group C received 1µg/kg of clonidine whereas group D received 0.5 µg/kg of dexmedetomidine as an adjuvant to bupivacaine.Femoral nerve was blocked using the classic technique, below the inguinal ligament and lateral to femoral artery pulsations. Singelyn's technique 4 was adopted to block the sciatic nerve in popliteal fossa. The Stimuplex needle was used to identify the nerves. Elicitation of patellar kick/contraction of quadriceps group of muscles and plantar flexion of foot at 0.5 mA (milli-ampere) current was considered as the end point for locating the femoral and sciatic nerves respectively. The heart rate, ECG, SpO2 and EtCO2 were monitored continuously throughout surgery. The systolic, diastolic and mean blood pressures were recorded at regular intervals during surgery, every hour for the 1st 4 hours after surgery and there after every 4 hours till a score of 4 were recorded on the AIIMS pain scale. AIIMS Pain score5 (table no. 1) and Sedation score6 (table no. 2) were measured every hour for the 1st 4 hours after surgery and thereafter every 4 hours till AIIMS pain score of ≥ 4 was recorded, for 24 hours. The time lapse between injection of the drugs for the blocks and the need for rescue analgesia (AIIMS pain score of ≥ 4) was recorded as the duration of postoperative analgesia. Diclofenac suppository in a dose 1 mg/kg was administered as rescue analgesic at AIIMS pain score ≥ 4. A note was made of any untoward event such as nausea, vomiting, bradycardia, hypotension, numbness or tingling and persistent motor weakness occurring over 24 hours of surgery. The data collected was tabulated and subjected to statistical analysis using SPSS version 19 technique. Categorical variables were analyzed using Chi-square or Fischer exact test while quantitative data was analyzed with unpaired student t test or Mann – Whitney test. A P value ≤ 0.05 was taken as statistically significant.

AIIMS Pain Scale

Table No. 1

Parameter	Criteria	Score
Respiratory rate	+ 20 % of pre-op	0
	+ 20 — 50 % of pre-op	1
	> + 50 % of pre-op	2
Heart rate	+ 10 % of pre-op	0
	+ 20 % of pre-op	1
	+ 30 % of pre-op	2
Discomfort	Calm	0
	Restless	1
	Agitated	2
Cry	No cry / cry respond to water, food and parental presence	0
	Cry respond to tender loving care	1
	Cry not responding to tender loving care	2
Pain at site of operation	No pain	0
	States pain vague	1
	Can localize pain	2

Sedation Scale

Table no.2

Alert and awake	0
Asleep, arousable by verbal ontact	1
Asleep, arousable by physical contact	2
Asleep not arousable	3

Results

Both the groups were comparable in terms of age, gender and type of surgeries. Mean heart rate was found to be clinically and statistically comparable between the two groups during entire intra-operative period. (P > 0.05; Fig. 1)

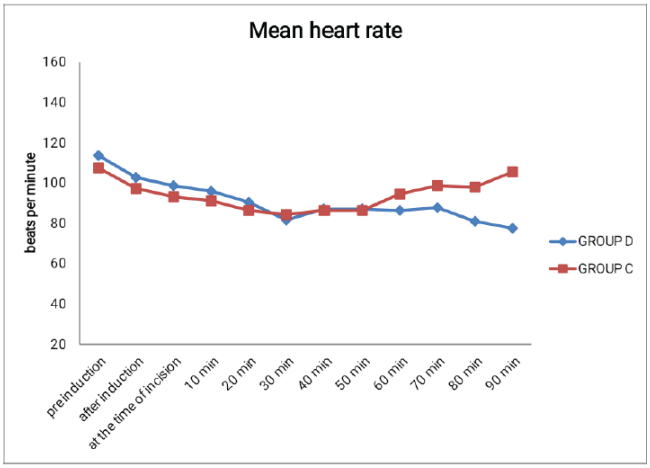

Figure 1: intra-operative mean heart rate

There was a noticeable decrease in mean systolic blood pressure after induction of GA in both groups. The mean systolic blood pressures in both the groups were within normal limits, but lower in group D as compared to group C. When statistically compared the difference was significant (P< 0.05; Fig.2).

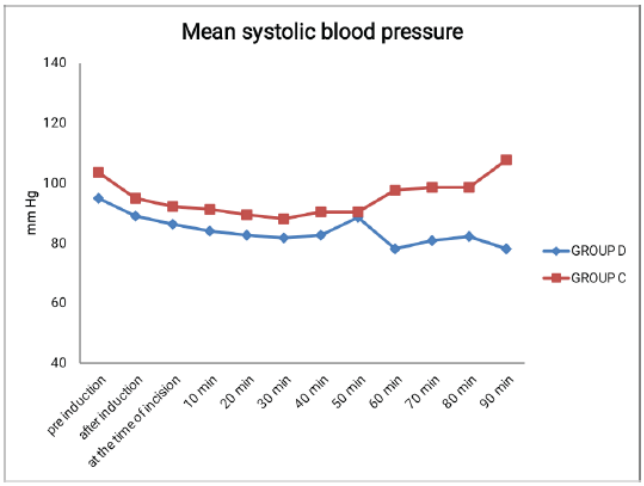

Figure 2: intra-operative mean systolic blood pressure.

The mean diastolic pressures also remained within normal limits in both the groups, but were maintained at lower levels in group D as compared to group C, and the difference was statistically significant (P<0.05; Fig.3).

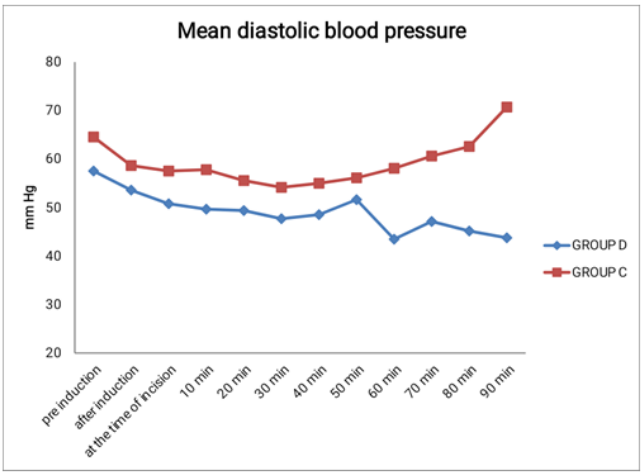

Figure 3: intra-operative mean diastolic blood pressure.

The trend observed with mean systolic and diastolic blood pressures was repeated in the mean blood pressures (Fig. 4).

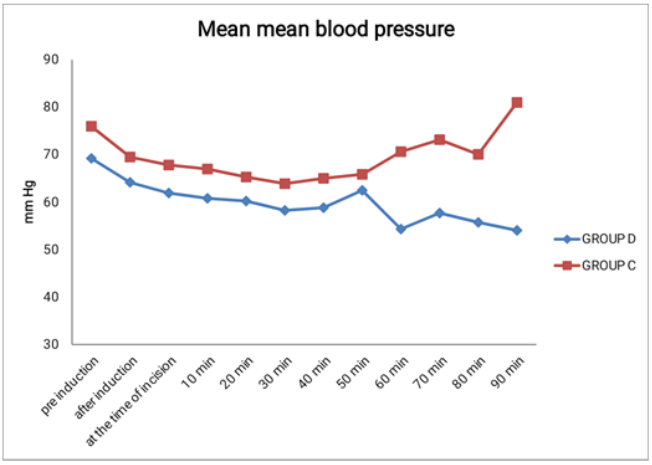

Figure 4: intra-operative mean blood pressure.

All children in both the groups remained pain free for the first 8 hrs after surgery. Pain scores started increasing in both the groups after completion of eighth hour, more in group C. In group D, pain score started increasing mainly after 12th hr. The difference in the mean AIIMS pain score between the two groups was clinically and statistically highly significant (P <0.05; Fig.5) from 8th to 16th hr in postoperative period.

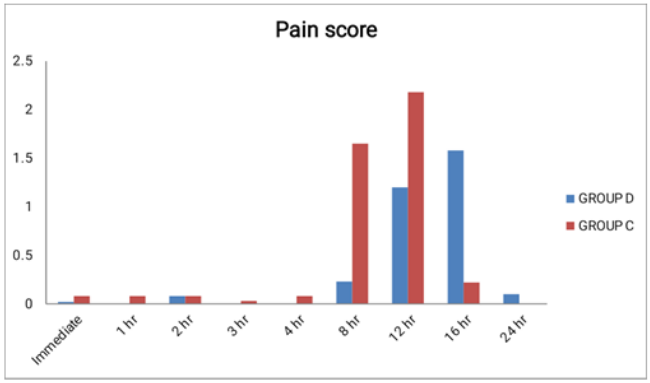

Figure 5: mean AIIMS pain score

The mean duration of postoperative analgesia was significantly longer in dexmedetomidine group 16.59 ± 4.84 hours as compared to clonidine group 11.70 ± 2.14 hours (P=0.000;Fig.6).

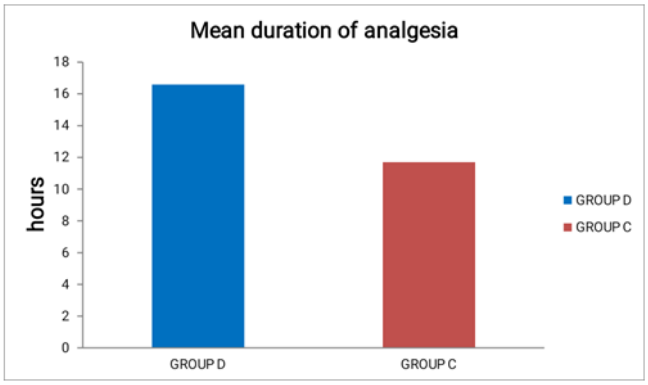

Figure 6: mean duration of postoperative analgesia

Children were well sedated for the first three hours after surgery, but were arousable. The sedation scores were slightly higher in group D (2.80 ± 0.68) than in group C (2.57 ± 0.78). This difference was statistically significant ($p \leq 0.05$; Fig.7). No sedation was observed in either group after 4th hr.

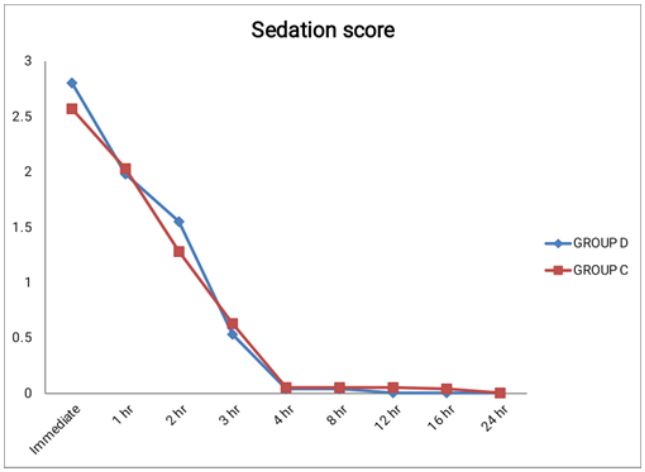

Figure 7: mean sedation score.

No bradycardia, hypotension, dryness of mouth or any persistent motor weakness were reported in either of the groups for first 24 hours. One episode of vomiting was seen in group D, 3 hours after surgery.

Discussion

Clonidine as an adjuvant to local anesthetic has been added in a variety of nerve blocks like infra-clavicular brachial plexus block, femoral nerve block, sciatic nerve block andlumbar plexus block in children by Giovanni Cucchiaro et al7. Kalliopi Petroheilou et al8 selected an age group of 5-14 years to study the effect of clonidine as an adjuvant to ropivacaine in combined femoral and sciatic lateral popliteal nerve block. Gihan M.Obayah et al9 used dexmedetomidine as an adjuvant to bupivacaine in children as young as 12 months old for greater palatine nerve block in cleft palate repair.Our study included children in the age group 1-8 years with 43.8% patients in the age group of 4-7 years. Hemodynamic parameters remained stable in both the study groups, and the mean duration of analgesia was found to be significantly longer in the dexmedetomidine group (16.59 ± 4.84 hours) as compared to clonidine group (11.70 ±2.14 hours).Hemodynamic stability has been reported with clonidine as an adjuvant to local anesthetics in doses ranging from 1-3 µg/kg by Andrea Casati et al10, Giovanni Cucchiaro et al7 and Kalliopi Petroheilou et al8. Mc Cartney C J et al11 concluded that side effects with use of clonidine as an adjuvant to local anesthetics were seen with doses exceeding 150µg only.Gihan M.Obayah et al9 reported stable hemodynamics with the use of dexmedetomidine in a dose of 1µg/kg in greater palatine nerve block in infants. A dose of 20µg dexmedetomidine as an adjuvant to ropivacaine for ulnar nerve block was also found to be associated with hemodynamic stability by D. Marhofer et al12.Bradycardia requiring treatment was observed in 23.3% of adults receiving 100µg of dexmedetomidine in 0.5% levobupivacaine for axillary brachial plexus block by Aliye Esmaoglu et al13. Rancourt MP et al14 reported significant fall in systolic and diastolicblood pressures from 60 min to 480 min with 1µg/kg of dexmedetomidine as an adjuvant to ropivacaine. Sarita S Swami et al15 have observed significant lower pulse rates and lower systolic and diastolic blood pressures lasting up to 120 minutes intra- operatively with 1µg/kg of dexmedetomidine in bupivacaine for brachial plexus block in adults.Duration of postoperative analgesia of 22 hours has been reported by Gihan M.Obayah et al9 with 1µg/kg of dexmedetomidine in bupivacaine for greater palatine nerve block in children.Sarita S Swami et al15 reported the mean duration of postoperative analgesia with1µg/kg dexmedetomidine to be 7.6 hours and 4.7 hours with 1µg/kg of clonidine, in bupivacaine.In the present study sedation was seen in both the groups for the initial 3 hours after surgery, but all children were arousable on touch or verbal command. Gihan M.Obayah et al9 have also noticed sedation for the first 4 postoperative hours with 1µg/kg of dexmedetomidine in children subjected to greater palatine nerve block. Mild, short lived sedation has been noted by Andrea Casati et al10 with 1µg/kg of clonidine in ropivacaine,

and by Kalliopi Petroheilou et al8 with 3µg/kg of clonidine in children.None of the children in the present study had dryness of mouth, bradycardia or hypotension requiring treatment in either group during intra-operative or postoperative period. 1 episode of vomiting was seen in the present study in dexmedetomidine group at 3rd post-operative hour. Vomiting has been reported in 4 out of 15 children receiving 1µg/kg of dexmedetomidine in greater palatine nerve block in infants by GihanM.Obayah et al9.

Conclusion

Both clonidine (1 g/kg) and dexmedetomidine (0.5 g/kg) are safe adjuvant to bupivacaine for combined femoral and sciatic nerve block in children. Hemodynamic stability is maintained, and no alarming sedation is noted with either drug in the doses used. Duration of postoperative analgesia is significantly longer with dexmedetomidine than with clonidine.

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