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Original Research Article

A retrospective study of the effect of dexmedetomidine infusion in cochlear implant surgery among pediatric patients

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ABSTRACT

Introduction: Cochlear implantation surgery is usually performed in paediatric patient of 1 to 7 years of age with congenital deaf-mutism. Good results in this surgery are obtained by providing bloodless surgical field with controlled hypotension and postoperative smooth outcome. To anaesthetize these patients, we are using Inj Propofol, Inj fentanyl, Sevoflurane, Dexmedetomidine infusion and muscle relaxants. Dexmedetomidine is an active isomer of medetomidine and an agonist at $\alpha 2$ –adreno receptors. Medetomidine provides perioperative sedation and analgesia thus decreasing other general anaesthetic drug requirement, reduced postoperative pain score, postoperative delirium and other complications.
Aim: To determine that inj. Dexmedetomidine infusion is a suitable agent for haemodynamic stability, decreases need of other general anesthetic drug requirement intraoperatively and improves post-operative outcome in cochlear implant surgery.
Materials and Methods: This study was conducted at a rural tertiary care center, which included 100 samples of pediatric patients (1-7 years of age group) who went through cochlear implant surgeries in last 3 years.
Results: Among all patients, heart rate (HR) remained stable and there was no significant difference between baseline HR and intra-op HR (P=0.3098). The systolic blood pressure (SBP) was decreased significantly compared to baseline reading (P value < 0.0001), but the diastolic blood pressure was not decreased significantly (P= 0.0612).
Conclusions: Dexmedetomidine provides stable haemodynamics, acceptable hypotensive state, good surgical field and excellent analgesia in pediatric patients undergoing cochlear implant surgery.

1. Introduction

Cochlear implantation is considered one of the greatest advances in ENT surgery.[1] A cochlear implant is an electronic device which is used to restore hearing in patients with bilateral severe sensorineural deafness in order to provide improved communication abilities.[2] These electronic devices have an ability to transform speech and other sounds into electrical signals used to stimulate the existing fibers of auditory nerve in the inner ear. It needs special anesthetic management such as providing bloodless surgical field, adequate airway management, limited use of muscle relaxation to facilitate assessment of facial nerve by peripheral nerve stimulator, adequate head positioning to avoid venous congestion which may obscure the surgical field, and finally, smooth recovery without nausea and vomiting and with adequate analgesia.[1] As such role of the anesthesiologist is crucial during such expensive surgical procedures for a better outcome. Total intravenous anesthesia, locoregional anesthesia, newer

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induced hypotension techniques, and advent of newer drugs in anesthesia practice including newer sedative agents and many other techniques and drugs have allowed even complicated surgical procedures to be performed with a great ease.[3] Dexmedetomidine is a selective and potent α2-adrenoreceptor agonist that is used for its anxiolytic, sedative, and analgesic properties. Compared with clonidine, an α2-agonist that has been used for several decades, dexmedetomidine has a greater selectivity for α2-receptors (α2:α1 ratio of 1620:1 vs. 220:1).[3] It can augment anesthesia by providing dose-related sedation, anxiolysis without respiratory depression, decreased upper airway secretions, perioperative hemodynamic stability, and analgesia.[3–5]

2. Materials and Methods

This retrospective study was conducted at rural tertiary care center, which included total 100 samples of pediatric patients (1-7 years of age group) who underwent through cochlear implant surgeries in last 3 years. The data regarding these patients were collected from ENT department and Anaesthesia department which includes the effects of bolus dose of dexmedetomidine for quality of hypotensive anaesthesia with hemodynamic stability, other general anaesthetic drug requirements intra operatively, post-operative pain score and incidence of postoperative complications in paediatric age group particularly emergence delirium with sevoflurane.

1. Patients were given premedication with Inj Ondansetron 100mcg/kg and Inj Glycopyrrolate 4mcg/kg.
2. In induction, Inj Propofol 2 mg/kg, Inj. Fentanyl 2mcg/kg and Inj. Succinylcholine 1mg/kg were given. Intubation done with appropriately sized cuffed ET tube.
3. Total dose of inj. Dexmedetomidine infusion (solution of 4mcg/ml made by adding 200mcg of Dexmedetomidine in 48ml of 0.9% nacl) 1mcg/kg i.v in 10 min. followed by Dexmedetomidine infusion 0.4-0.5 mg/kg/hr in maintenance.
4. For maintenance, O2, N2O, Sevoflurane and in muscle relaxation, Atracurium (induction with 0.5mg/kg and maintenance with 0.1 mg/kg) were given.
5. Patients received intra operative fluids according to 4-2-1 formula. Inj Dexmedetomidine infusion was stopped before reversal. Reversal was done with Inj Myopyrolate (Glycopyrrolate 8mcg/kg and Neostigmine 30-70mcg/kg). Extubation was done when patient started breathing spontaneously. Diclofenac suppository was given for post-operative analgesia.

Data regarding intra operative monitoring of heart rate, non-invasive blood pressure (both systolic and diastolic), SPO2 done. Post-operative pain score and post-operative delirium emergence will be studied.

2.1. Ethics

Ethical clearance was obtained by institution's Human Research Ethics Committee. A study protocol was set before undertaking this study and it was approved by institutional Human Research Ethical Committee. All the departments in the study were explained clearly about the purpose and the nature of the study. The data were included only after obtaining a written and informed consent from the respective departments.

2.2. Statistical analysis

Means and standard errors for various parameters were calculated. Differences between means were tested by Student 't' test. P value <0.05 was considered as statistically significant. Analysis was performed using SPSS – 22.0 version, Microsoft office excel 2016 and MedCalc version 12.5.

3. Results

Out of 100 cases, 59 were males and 41 were females. There was no significant difference between age of both genders (P = 0.2046).

Table 1: Age distribution and gender distribution

Age Group	No.	M	F
1-<=3	49	31	18
>3-6	43	25	18
>6	8	3	5
Total	100	59	41

Fig. 1:

Table 2:

Parameter	Baseline	Intraoperative	P Value	95% CI of difference
Heart Rate	97 ± 4.5	96 ± 1.9	0.3098	-1.1775 to 0.3775
Systolic BP	107.5 ± 12.8	91.7 ± 2	< 0.0001	-18.3622 to -13.2578
Diastolic BP	73.3 ± 8	71.9 ± 3.9	0.0612	-2.8876 to 0.06763
SPO_2	99± 0.2	99 ± 0.1	0.2075	-0.02256 to 0.1026

P value<0.05 was considered as statistically significant

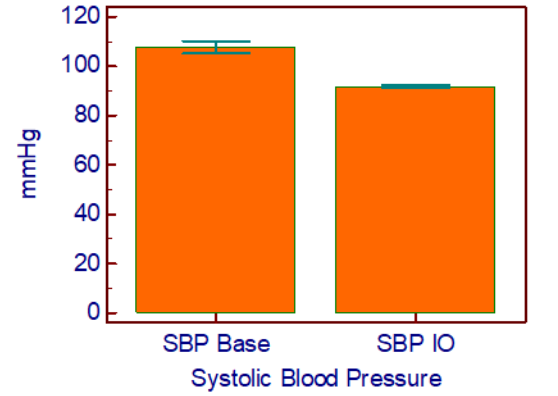

Fig. 2:

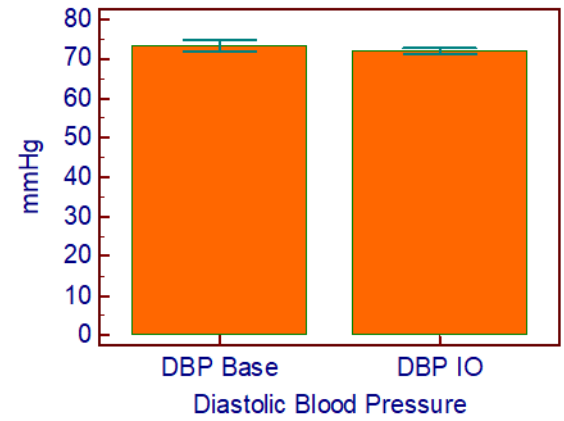

Fig. 3:

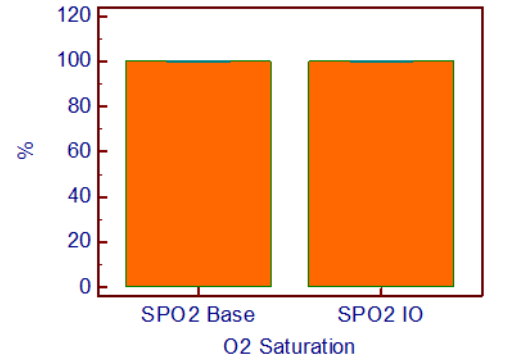

Fig. 4:

4. Discussion

In our observational study, we have found that throughout the surgery, HR remained stable and there was no significant difference between baseline HR (Mean= 97 ± 4.5) and intra-op HR (Mean=96 ± 1.9) (P=0.3098). The systolic blood pressure (SBP) was decreased significantly compared to baseline reading (baseline SBP mean= 107.5 ± 12.8, intra-op SBP mean= 91.7 ± 2, P value < 0.0001), but the diastolic blood pressure was not decreased significantly (baseline DBP mean= 73.3 ± 8, intra-op SBP mean= 71.9 ± 3.9, P= 0.0612).

Dexmedetomidine is a highly selective α2-adrenergic agonist. It has an α2:α1 selectivity ratio of 1620:1, making it eight times more selective than clonidine for the α2-receptor.[6] Dexmedetomidine is able to achieve its effects without causing respiratory depression. Dexmedetomidine induces sedation by decreasing activity of noradrenergic neurons in the locus ceruleus in the brain stem, thereby increasing the downstream activity of inhibitory gamma-aminobutyric acid (GABA) neurons in the ventrolateral preoptic nucleus.[7] It has a biphasic effect on blood pressure with lower readings at lower drug concentrations and higher readings at higher concentrations and Bradycardia can be a limiting factor with infusions especially in higher doses.[8]

Hassan PF et al.[1] who did comparative study between dexmedetomidine and MgSO4 in cochlear implant surgery and found that subjects receiving dexmedetomidine had bradycardia, our findings suggesting stable heart rate compared to baseline are in dispute but same study found that there was significant hypotension in patient receiving dexmedetomidine and our findings are in line with them. Mohamed Hafez El Saied et al.[9] also found that compared to fentanyl, the dexmedetomidine had lower heart rate and hypotension. Both studies reported clean surgical field because of less bleeding, which we couldn't report because the nature of our study.

Chrysostomou C et al.,[10] Phan, H.,[11] Priye, S.[11] reported good post-operative Visual Analogue Score (VAS) which is in line with our study (at 0 min= 2.3± 0.47, 15 min= 2.3± 0.46).

5. Limitations

As this is a retrospective study, we couldn't modify any setting and any additional data collection, we could only collect the data recorded during the perioperative period.

6. Conclusion

Cochlear implant surgery is a microscopic surgery which requires a clean surgical field, also the patients being deaf and mute are not able to express stimulations normally. Our data suggests that using dexmedetomidine in cochlear implant surgery keeps the patient in acceptable hypotensive state which reduces the bleeding and provides clean surgical field, we couldn't report it because of the nature of our study, but we can firmly say that dexmedetomidine causes acceptable hypotension during intra operative period. Our data regarding the VAS score during post-op period shows excellent analgesia provided by dexmedetomidine. Therefore, we can conclude that dexmedetomidine provides stable haemodynamics, good surgical field and excellent analgesia in pediatric patients undergoing cochlear implant surgery.

7. Conflict of Interest

The authors declare no conflict of interest.

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