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Efficacy of dexmedetomidine on postoperative analgesia & sedation in children undergoing adenotonsillectomy

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Abstract
Background: Adenotonsillectomy is a common surgical procedure in pediatric population, but post-operative pain management is a challenging concern for anaesthetist. The present study was designed to assess the efficacy of dexmedetomidine on post-operative sedation and analgesia in paediatric cases undergoing adenotonsillectomy.
Materials and methods: A total 80 pediatric cases undergoing adenotonsillectomy between age group 4-9 years belong to ASA grade I and II were recruited. Study consists of two groups i.e. group 1 with 1mcg/kg Dexmeditomidine and group 2 with 2 mcg/kg fentanyl. Parameters like heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), requirement of post-operative analgesia and sedation assessed by Ramsay sedation score & CHEOPS score and emergence agitation were assessed.
Results: The mean heart rate was significant between two study groups at the beginning, 5 min, 15 min, 20 min and at 25 min (p<0.005). The mean SBP in group 1 was high at the beginning, later the values were decreased when compared group 2. However, the mean DBP in group 1 was low when compared to the group 2 at all-time intervals. The mean Ramsay sedation score difference was statistically significant among two study groups at the beginning, 5 min, 10 min, 15 min and 45 min (p<0.005). The requirement of additional rescue doses were noticed more in group 2.
Conclusion: Dexmedetomidine was effective in maintaining intraoperative heart rate, systolic blood pressure and diastolic blood pressure. Dexmedetomidine is an effective and safe analgesic substitute to fentanyl intra-operatively and reduces the requirement of postoperative rescue opioid. Dexmedetomidine was more effective in preventing emergence agitation, avoiding severe pain and reducing incidence of postoperative nausea and vomiting.

Keywords: Adenotonsillectomy, dexmedetomidine, ramsay sedation score, emergence agitation, heart rate

Introduction
Adenotonsillectomy is a hasty, but agonizing surgical procedure carried out in children [1]. Posttonsillectomy pain management is a major challenging concern for anaesthetist because of post-operative pain affects analgesic consumption, duration of hospital stay and often associated with high incidences of anxiety, obstructive symptoms and hypoxemia [2].
Dexmedetomidine is a highly potent α2 adrenoceptoragonist, has sedative, analgesic, anxiolytic and opioid sparing properties with or without respiratory depression [3, 4]. Studies have shown that dexmedetomidine is an effective drug in the post-operative pain management in a pediatric population undergoing adenotonsillectomy [5]. Dexmedetomidine is an effective adjunct to reduce the incidence and severity post-operative emergence agitation/delirium and analgesic requirement [6, 7]. Studies have shown that dexmedetomidine is a safe and effective analgesic substitute to fentanyl intraoperatively and reduces analgesic requirements postoperatively [8, 9]. An intraoperative use of dexmedetomidine as a replacement for fentanyl has been shown to reduce opiate use in postoperative period in adults, but analgesic sparing effect in pediatric cases are conflicting and require more research [10, 11].
With the above context the present study was designed to assess the efficacy of dexmedetomidine on post-operative sedation and analgesia in paediatric cases undergoing adenotonsillectomy.

Materials and Methods

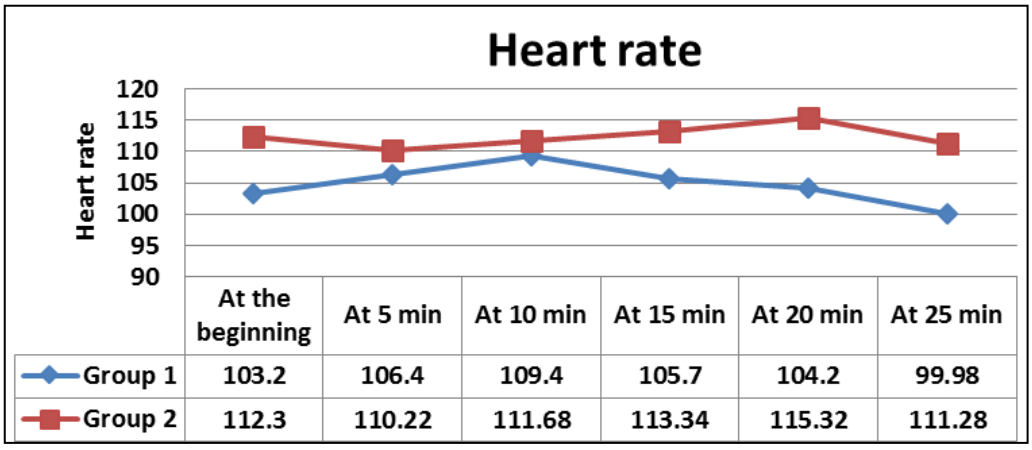
The present prospective study was conducted in the Department of Anesthesiology in association with Department of ENT at MNR Medical College and Hospital, Sangareddy during March 2019 to March 2020. A total 80 pediatric cases undergoing adenotonsillectomy between age group 4-9 years belong to ASA grade I and II were included. Cases with systemic disorders sleep disorders and congenital disorders were excluded. Informed consent was obtained from all study participants and study protocol was approved by institutional ethics committee. Study participants were randomly divided into 2 groups i.e. group 1 with 1mcg/kg Dexmeditomidine and group 2 with 2 mcg/kg fentanyl. All the participants were administered orally with syrup triclofos 75mg/kg before surgery. Cases were pre-oxygenated with 100% oxygen and induced with IV Propofol 2mg/kg followed by Inj succinycholine 1.5mg/kg. Patient is then intubated nasally with appropriate endotracheal tube and maintained with mask O2+N20 (1:1) + Sevoflurane 2% through closed circuit with atracurium 0.3 mg/kg loading dose and 0.1mg/kg as supplemental dose every 15 min. The time at which inhalational agent is stopped before end of procedure is noted. Parameters like heart rate, systolic blood pressure (SBP), Diastolic blood pressure (DBP), requirement of postoperative analgesia and sedation and postoperative complications were monitored. Ramsay sedation score and CHEOPS score (Children's Hospital of Eastern Ontario Pain Scale score) were noted during stay in post-operative recovery room at every 5 minute interval for the first 15 minutes and then for every 15 minutes. The SPSS version 23 software was used to carry out statistical analysis relevant to the study. A p-value of less than 0.05 was considered statistically significant.

Results

A total 80 pediatric cases undergoing adenotonsillectomy between age group 4-9 years belong to ASA grade I and II were included. The study participants were randomly divided in to 2 groups. Group 1 consists of 40 cases administered with 1mcg/kg Dexmeditomidine and group 2 consists of 40 cases administered with 2 mcg/kg fentanyl. Among the study participants males (60% in group 1, 55% in group 2) are more than females (40% in group 1, 45% in group 2).

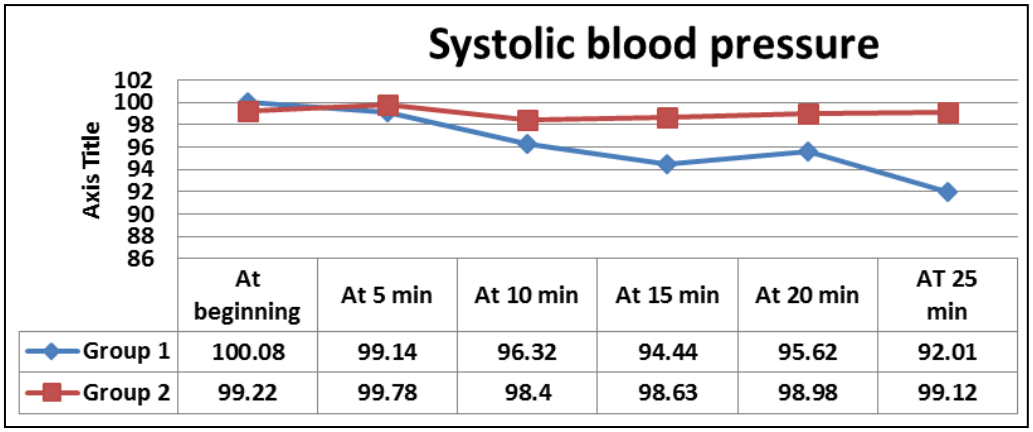
Table 1: Age wise distribution and duration for opening eye in study cases.

Parameters	Group 1	Group 2	p-value
	Mean ± SD	Mean ± SD	
Age	4.79 ± 1.01	4.86 ± 1.32	0.442
Duration for opening eye	6.23 ± 0.94	4.45 ± 1.18	0.002

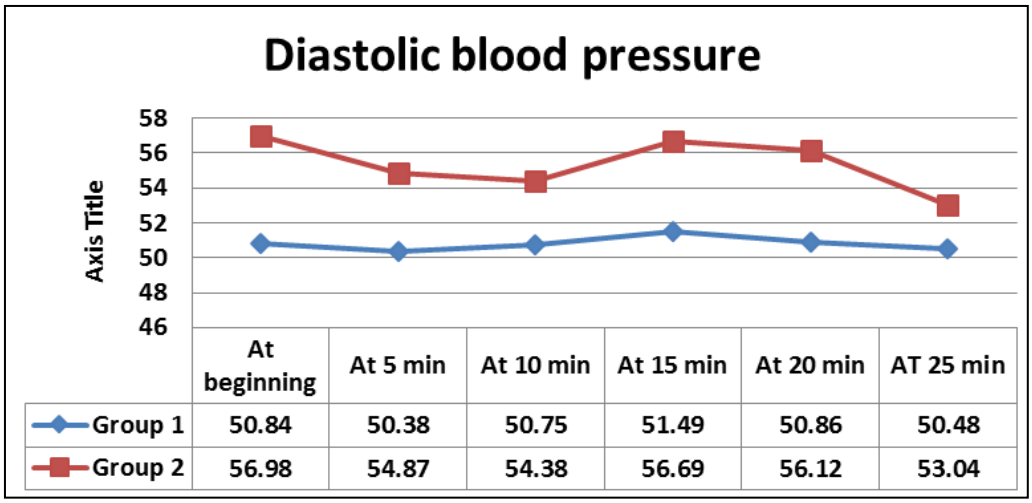


Graph 1: Mean heart rate of study participants.

The mean heart rate was significant between two study groups at the beginning, 5 min, 15 min, 20 min and at 25 min (p<0.005). The mean systolic blood pressure was significant between group 1 & 2 at 5 min, 15 min, 20 min and 25 min (p<0.005). The mean diastolic blood pressure was significant between group 1 & 2 during at all-time intervals (p<0.005).



Graph 2: Mean systolic blood pressure (SBP) in study participants.



Graph 2: Mean diastolic blood pressure (DBP) in study participants.

Table 2: Ramsay sedation score and CHEOPS score in study participants.

	Ramsay sedation score			CHEOPS score		
	Group 1	Group 2	p value	Group 1	Group 2	p value
	Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD	
At beginning	6.10 ± 0.68	5.14 ± 0.56	0.002	8.74 ± 0.64	9.08 ± 0.68	0.003
At 5 min	5.73 ± 0.56	4.58 ± 0.48	0.002	8.22 ± 0.53	8.65 ± 0.76	0.002
At 10 min	4.38 ± 0.52	3.74 ± 0.48	0.001	7.66 ± 0.28	7.97 ± 0.63	0.014
At 15 min	3.98 ± 0.44	3.04 ± 0.22	0.003	7.49 ± 0.28	7.63 ± 0.44	0.228
At 30 min	3.32 ± 0.18	2.66 ± 0.18	0.565	7.04 ± 0.34	7.54 ± 0.39	0.298
At 45 min	3.04 ± 0.20	2.31 ± 0.15	0.002	6.95 ± 0.28	7.38 ± 0.22	0.005
At 60 min	2.75 ± 0.12	2.08 ± 0.09	0.412	6.66 ± 0.42	7.19 ± 0.20	0.003
At 75 min	2.45 ± 0.12	2.01 ± 0.13	0.328	6.61 ± 0.36	7.08 ± 0.17	0.452
At 90 min	2.20 ± 0.08	1.89 ± 0.15	0.284	6.48 ± 0.48	6.86 ± 0.22	0.360
At 105 min	1.84 ± 0.18	1.72 ± 0.26	0.223	6.32 ± 0.18	6.72 ± 0.28	0.562
At 120 min	1.52 ± 0.20	1.66 ± 0.34	0.126	6.18 ± 0.22	6.48 ± 0.32	0.289

The mean Ramsay sedation score difference was significant between 2 study groups at the beginning, 5 min, 10 min, 15 min and 45 min (p<0.005) (Table 2). The mean CHEOPS score difference in the two study groups was statistically significant (Table 2). The requirement of additional rescue doses were noticed more in group 2. There were no severe adverse events in group 1, whereas in group 2, nausea and vomiting was observed in 10% cases.

Discussion

Adenotonsillectomy is a common surgical procedure in the paediatric age group where postoperative management is crucial due to severe pain affects analgesic consumption, duration of hospital stay and often associated with high incidences of anxiety, obstructive symptoms and hypoxemia [2, 12]. The present study was designed to assess the efficacy of dexmedetomidine on post-operative sedation and analgesia in paediatric cases undergoing adenotonsillectomy. A total 80 pediatric cases undergoing adenotonsillectomy between age group 4-9 years belong to ASA grade I and II were recruited. The mean age in group 1 was 4.79 years and in group was 4.86 years. The mean duration for opening eyes in group 1 was 6.23 and whereas in group 2 were 4.45. A study by Hala S *et al.* on 84 cases, aged from 5-12 years with mean age 8.26 years. There were significant differences between age, gender and duration of the surgery [14]. A study by Jun-Li Cao *et al.* found that the time to wake and time to extubation were prolonged in group dexmedetomidine group as compared with group administered with 0.9% saline (P<0.05) (18). A study by Sanaa M. Elfawal *et al.* stated that the time to awakening was significantly shorter dexmedetomidine group than fentanyl group [21]. A meta-analysis by Marco Aurelio Soares Amorim *et al.* stated duration for wakeup was high in dexmedetomidine group [22].

The mean heart rate was significant between two study groups at the beginning, 5 min, 15 min, 20 min and at 25 min (p<0.005). The mean heart rate was less in group 1 throughout the surgery than group 2 (Graph 1). A study by Sharma *et al.* found significant difference between heart rate and mean blood pressure at preincision and postintubation and every 5 min reading till 30 minutes [13]. The mean heart rates were significantly lower in DEX-IV group during and after intravenous infusion [14]. A study by Jun-Li Cao *et al.* found mean intraoperative heart rate was significantly lower in dexmedetomidine group (P<0.05), mean DBP and SBP was not statistically different between study groups [18]. The mean systolic blood pressure was significant between group 1 & 2 at 5 min, 15 min, 20 min and 25 min (p<0.005). The values of mean SBP in group 1 was high at the beginning, later the values were low compared group 2 (Graph 2). The mean diastolic blood pressure was significant between group 1 & 2 during at all-time intervals (p<0.005). The mean DBP was less in group 1 throughout the surgery than group 2 (Graph 3). A study by Sanaa M. Elfawal *et al.* found no significant difference in preoperative heart rate, but there was significantly lower heart rate in dexmedetomidine group than fentanyl group [21]. A study by Rabie Soliman and Ali Alshehri found that the mean heart rate and mean arterial blood pressure was decreased after

induction in both study groups. Dexmedetomidine decresed the incidence of postoperative nausea and vomiting, emergence agitation score [23].

The mean Ramsay sedation score difference was significant between 2 study groups at the beginning, 5 min, 10 min, 15 min and 45 min (p<0.005) (Table 2). The mean Ramsay sedation score in the first 240 minutes postoperative was decreased in all the study groups. However, the mean sedation scores were significantly higher in DEX.IV group [14]. The mean CHEOPS score difference in the two study groups was statistically significant (Table 2). The mean CHEOPS score was significantly increased from the beginning to 90th minute [14].

The requirement of additional rescue doses were noticed more in group 2. A study by Sharma *et al.* found no episodes of excessive sedation, desaturation and any drug related adverse events in dexmedetomidine group [13]. There were no severe adverse events in group 1, whereas in group 2, nausea and vomiting was observed in 10% cases. Post-operative pain was low in DEX group [14]. A study by Belleville JP *et al.* noticed few respiratory side effects and episodes of obstructive apnea in cases who received high doses of dexmedetomidine [15]. A randomized, placebo-controlled Study by Guler G *et al.* found better pain and agitation scores (p<0.005). However, mean heart rate, mean blood pressure, emergence time and time to extubation were significantly lower and longer respectively [16]. A study by Isik B *et al.* stated that dexmedetomine 1 µg/kg as a single dose was effective in reducing the incidence of agitation The mean agitation scores were also significantly lower in the dexmedetomidine group (p< 0.013) at 5, 10, 15, and 20 minutes after sevoflurane discontinuation [17]. A study by Jun-Li Cao *et al.* stated that objective pain score was lower in dexmedetomidine group at 15, 30, and 45minutes [18]. A study by Yuquan Rao *et al.* stated that compared with placebo, midazolam, and opioids, dexmedetomidine significantly decreased the incidence of post-anesthesia emergence agitation or delirium in pediatric patients [19]. A meta-analysis by Juan Ni *et al.* stated that dexmedetomidine decreased the incidence of severe pain (p<0.001) and need of rescue drug (p<0.001). However, it increased the time to eye open by 0.98 min compared to placebo (20). A meta-analysis by Marco Aurelio Soares Amorim *et al.* stated that the use of dexmedetomidine was useful in controlling postoperative agitation, nausea and vomiting [22].

Conclusion

The results of this study conclude that the addition of dexmedetomidine was effective in maintaining intraoperative heart rate, systolic blood pressure and diastolic blood pressure. Dexmedetomidine is an effective and safe analgesic substitute to fentanyl intra-operatively and reduces the requirement of postoperative rescue opioid. Dexmedetomidine was more effective in preventing emergence agitation, avoiding severe pain and reducing incidence of postoperative nausea and vomiting.

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