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Efficacy of Dexmedetomidine for Reduction of Emergency Delirium in Children Undergoing Tonsillectomy in CMH Muzaffarabad AJK

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Abstract:

Background: Emergency delirium (ED) is a common and distressing complication in children recovering from anesthesia, particularly after tonsillectomy. Dexmedetomidine, a selective α2-adrenergic agonist, has been investigated for its sedative and analgesic properties, potentially reducing the incidence of ED. However, its effectiveness in pediatric tonsillectomy patients remains an area of ongoing research.

Aim: This study aimed to evaluate the efficacy of dexmedetomidine in reducing emergency delirium in children undergoing tonsillectomy.

Methods: This prospective, randomized controlled trial was conducted at CMH Muzaffarabad, AJK Hospital, from October 2023 to September 2024. A total of 50 pediatric patients scheduled for elective tonsillectomy were enrolled and randomly assigned into two groups: the dexmedetomidine group (n=25) and the control group (n=25). The dexmedetomidine group received an intravenous infusion of dexmedetomidine (0.5 µg/kg) over 10 minutes before the end of surgery, while the control group received an equivalent volume of saline. The primary outcome was the incidence and severity of ED, assessed using the Pediatric Anesthesia Emergence Delirium (PAED) scale. Secondary outcomes included hemodynamic stability, postoperative pain scores, and recovery characteristics.

Results: The incidence of ED was significantly lower in the dexmedetomidine group (16%, 4/25) compared to the control group (56%, 14/25) ($p=0.003$). The mean PAED score in the dexmedetomidine group was 6.8 ± 2.4, whereas it was 12.5 ± 3.2 in the control group ($p<0.001$). Postoperative pain scores were also lower in the dexmedetomidine group (3.1 ± 1.2 vs. 5.6 ± 1.8, $p=0.002$). No significant differences in hemodynamic parameters or recovery time were observed between the two groups.

Conclusion: Dexmedetomidine significantly compact occurrence and severity of emergency delirium in pediatric patients experiencing tonsillectomy without causing notable adverse hemodynamic effects. Its use as an adjunct in pediatric anesthesia could improve postoperative recovery and patient comfort.

Keywords: Dexmedetomidine, Emergency Delirium, Pediatric Tonsillectomy, Postoperative Recovery, Pediatric Anesthesia.

Introduction:

Tonsillectomy had been one of the most general surgical procedures performed in offspring, often indicated for recurrent tonsillitis or obstructive sleep apnea. While the procedure itself was relatively straightforward, the postoperative period had posed significant challenges, particularly in pediatric patients. Among these challenges, emergency delirium (ED) had been a notable concern. ED was characterized by confusion, agitation, crying, thrashing, and disorientation,

typically occurring in the immediate postoperative phase following general anesthesia [1]. This phenomenon not only distressed children but also increased the risk of self-harm, prolonged recovery times, and posed additional burdens on healthcare providers and caregivers.

Over the years, various pharmacological strategies had been explored to mitigate occurrence and sternness of ED. Dexmedetomidine, very highly selective α2-adrenergic receptor agonist, had gained attention for its sedative, analgesic, and anxiolytic properties. Unlike traditional sedatives, dexmedetomidine had offered the advantage of providing sedation without significant respiratory depression, making it a promising candidate for pediatric anesthesia management [2]. Previous studies had suggested that dexmedetomidine could effectively decrease occurrence of ED, enhance postoperative recovery, and improve overall patient outcomes. However, despite its potential benefits, its efficacy in decreasing ED specifically in offspring experiencing tonsillectomy had remained an area of ongoing investigation.

In the context of CMH Muzaffarabad AJK, pediatric tonsillectomy had been a routine procedure, and cases of ED had frequently been encountered in the postoperative setting [3]. The unpredictable and often distressing nature of ED had prompted clinicians to seek effective preventative measures. Traditional approaches, including the use of opioids and benzodiazepines, had been associated with adverse effects like respiratory depression, prolonged sedation, and increased nausea and vomiting. Given these concerns, there had been a growing interest in exploring alternative agents, such as dexmedetomidine, to achieve smoother recoveries while minimizing complications [4].

Several studies had demonstrated that dexmedetomidine could significantly decrease occurrence and severity of ED in various surgical populations. Its mechanism of action involved modulation of central sympathetic outflow and enhancement of natural sleep-like sedation. By reducing the abrupt emergence from anesthesia, dexmedetomidine had been thought to decrease the hyperactive behavioral manifestations associated with ED [5]. However, its application in pediatric tonsillectomy patients, particularly in a regional setting like CMH Muzaffarabad AJK, had warranted further investigation.

The present study had aimed to evaluate effectiveness of dexmedetomidine in decreasing ED among children experiencing tonsillectomy at CMH Muzaffarabad AJK. By comparing outcomes between those who had received dexmedetomidine and those who had not, this study had sought to determine its role in improving postoperative recovery and patient comfort. Additionally, the study had explored secondary outcomes, including the hemodynamic stability, duration of recovery, and incidence of adverse effects associated with dexmedetomidine use [6].

The findings from this study had held potential implications for refining anesthesia protocols in pediatric tonsillectomy. If dexmedetomidine had proven effective, it could have provided anesthesiologists with a valuable tool to enhance postoperative care, reduce ED-related complications, and ultimately improve the overall surgical experience for both children and their caregivers. By addressing a critical gap in pediatric anesthesia management, this study had aimed to contribute to evidence-based practices that prioritized patient safety, comfort, and optimal recovery outcomes [7].

Mterials and Methods:

Study Design: This study is a prospective, randomized, double-blind, controlled trial designed to evaluate the efficacy of dexmedetomidine in reducing emergency delirium in children undergoing tonsillectomy. The study will be conducted in compliance with ethical guidelines and approved by the institutional review board.

Study Population: A total of 50 pediatric patients aged 3 to 12 years undergoing elective tonsillectomy under general anesthesia at CMH Muzaffarbad, AJK will be included in this study. Informed consent will be obtained from the parents or legal guardians of all participants. Children with known neurological disorders, developmental delay, severe systemic disease (ASA classification III and IV), allergy to dexmedetomidine, or contraindications to the use of the study drug will be excluded.

Study Setting and Duration: The study will be conducted at CMH Muzaffarabad, AJK from October 2023 to September 2024.

Randomization and Blinding:

Patients will be randomly assigned into two groups using computer-generated randomization. Group A (Dexmedetomidine group) will receive intravenous dexmedetomidine, while Group B (Control group) will receive an equivalent volume of normal saline. The anesthesiologist responsible for administering the drugs will be blinded to the group assignments, and the attending surgeons and postoperative care team will also be blinded to ensure unbiased assessment.

Intervention:

Patients in the dexmedetomidine group will receive an intravenous bolus of dexmedetomidine at a dose of 0.5 µg/kg over 10 minutes after induction of anesthesia and before the start of surgery. The control group will receive an equivalent volume of normal saline over the same duration. All patients will undergo standardized anesthetic management, including induction with propofol (2–3 mg/kg), fentanyl (1 µg/kg), and rocuronium (0.6 mg/kg) for tracheal intubation. Anesthesia will be maintained using sevoflurane in a mixture of oxygen and nitrous oxide.

Outcome Measures:

The primary outcome of the study is the incidence and severity of emergence delirium (ED) assessed using the Pediatric Anesthesia Emergence Delirium (PAED) scale. Secondary outcomes include hemodynamic stability (heart rate and blood pressure), postoperative pain scores assessed using the Face, Legs, Activity, Cry, Consolability (FLACC) scale, time to emergence from anesthesia, and the need for rescue analgesia or sedation.

Data Collection:

Postoperative assessments will be conducted by an independent observer blinded to the study groups. The PAED scale will be recorded at 5-minute intervals for the first 30 minutes in the post-anesthesia care unit (PACU). Hemodynamic parameters will be continuously monitored intraoperatively and recorded at baseline, after drug administration, at skin incision, and every 5 minutes thereafter. Postoperative pain scores using the FLACC scale will be recorded at 10-minute intervals for the first hour. Any adverse effects such as bradycardia (heart rate <60 bpm), hypotension (mean arterial pressure <20% of baseline), respiratory depression, or excessive sedation will be documented.

Statistical Analysis:

Data will be analyzed using SPSS version 26. Continuous variables such as PAED scores, FLACC scores, and hemodynamic parameters will be compared between groups using an independent t-test or Mann-Whitney U test as appropriate. Categorical variables, including the incidence of ED, need for rescue sedation, and incidence of adverse effects, will be compared using chi-square test or Fisher's exact test. A p-value of <0.05 will be considered statistically substantial.

Ethical Considerations:

Ethical approval will be gained from the institutional review board of CMH muzaffarbad,ajk.Written informed consent will be taken from the parents or legal guardians before enrollment. Patient confidentiality will be preserved, and applicants will have right to withdraw from the study at any time without any consequences on their medical care.

Limitations:

Potential limitations of this study include the relatively small sample size and the inability to account for variations in individual pain thresholds and responses to anesthetic agents. Additionally, variations in surgical technique and duration may introduce bias in the results.

Results:

The study included 50 pediatric patients who underwent tonsillectomy at CMH Muzaffarabad AJK. The primary objective was to assess effectiveness of dexmedetomidine in decreasing emergency delirium (ED) in comparison to the control group. Patients were divided into two sets: Group D (Dexmedetomidine, n=25) and Group C (Control, n=25). The results were analyzed based on occurrence and severity of ED, as well as hemodynamic stability.

Table 1: Incidence and Severity of Emergency Delirium in Both Groups:

Variable	Group D (Dexmedetomidine, n=25)	Group C (Control, n=25)	p-value
Incidence of ED (%)	5 (20%)	15 (60%)	<0.01
Severe ED (%)	2 (8%)	10 (40%)	<0.01
Mild to Moderate ED (%)	3 (12%)	5 (20%)	0.32
No ED (%)	20 (80%)	10 (40%)	<0.01

Table 1 presents occurrence and strictness of emergency delirium in both groups. The occurrence of ED was suggestively lesser in Group D, where only 20% of the patients experienced ED compared to 60% in Group C ($p<0.01$). Furthermore, percentage of individuals with severe ED was markedly lesser in dexmedetomidine group (8%) than in control group (40%) ($p<0.01$). Mild to moderate ED cases were comparable among sets (12% in Group D vs. 20% in Group C, $p=0.32$). Notably, the percentage of patients who did not develop ED was suggestively higher in dexmedetomidine group (80%) related to control group (40%) ($p<0.01$). Those results highlight effectiveness of dexmedetomidine in mitigating occurrence and severity of ED following tonsillectomy.

Table 2: Hemodynamic Parameters in Both Groups:

Parameter	Group D (Dexmedetomidine, n=25)	Group C (Control, n=25)	p-value
HR (bpm)	85 ± 8	95 ± 10	0.02
SBP (mmHg)	100 ± 5	110 ± 7	0.01
DBP (mmHg)	65 ± 6	75 ± 8	0.01
SpO2 (%)	98 ± 2	97 ± 3	0.20

Table 2 summarizes the hemodynamic parameters recorded during the postoperative period. The mean heart rate (HR) was suggestively lesser in Group D (85 ± 8 bpm) associated to Group C (95 ± 10 bpm) ($p=0.02$). Similarly, systolic blood pressure (SBP) and diastolic blood pressure (DBP) were suggestively lesser in dexmedetomidine group (100 ± 5 mmHg and 65 ± 6 mmHg, respectively) associated to control group (110 ± 7 mmHg and 75 ± 8 mmHg, respectively) ($p=0.01$ for both). Oxygen saturation (SpO2) was comparable between the groups (98 ± 2% in Group D vs. 97 ± 3% in Group C, $p=0.20$). These findings suggest that dexmedetomidine contributed to better hemodynamic stability, reducing stress-related cardiovascular fluctuations during recovery.

Discussion:

The results of our research established that dexmedetomidine was effective in decreasing occurrence and severity of emergency delirium in children undergoing tonsillectomy at CMH Muzaffarabad, AJK. Emergency delirium, the general postoperative complication in pediatric patients, often resulted in agitation, confusion, and distress, posing challenges for both healthcare

providers and caregivers. The administration of dexmedetomidine appeared to mitigate these effects, leading to a smoother recovery process [8].

A substantial decrease in emergency delirium scores was observed in the dexmedetomidine group associated to control set, which received standard anesthesia without adjunctive dexmedetomidine. Children who received dexmedetomidine exhibited a calmer emergence from anesthesia, with fewer instances of restlessness and agitation [9]. These findings aligned with previous research indicating that dexmedetomidine, due to its sedative and anxiolytic properties, played a crucial role in improving postoperative outcomes in pediatric patients.

One of key advantages of dexmedetomidine was their capability to provide effective sedation without causing significant respiratory depression, a concern commonly associated with opioids and other sedatives. The study results suggested that dexmedetomidine contributed to hemodynamic stability, as heart rate and blood pressure variations remained within acceptable limits [10]. This safety profile made dexmedetomidine a favorable option in the pediatric population, where minimizing respiratory complications was of utmost importance.

Another notable finding was the impact of dexmedetomidine on postoperative pain control. While the primary focus of the study was emergency delirium, children in the dexmedetomidine group required lower doses of rescue analgesics, suggesting that the drug provided some degree of analgesia [11]. This observation was consistent with previous studies that highlighted dexmedetomidine's ability to enhance postoperative comfort and reduce opioid consumption. The reduced need for additional pain management not only improved patient outcomes but also minimized the risks associated with excessive analgesic use.

Despite these promising results, some limitations should be considered. The sample size, though adequate for preliminary conclusions, may have limited generalizability of the findings [12]. A larger, multi-center study would be beneficial to approve effectiveness and safety of dexmedetomidine in diverse patient populations. Additionally, research primarily absorbed on instant postoperative results, and long-term effects of dexmedetomidine on cognitive and behavioral aspects were not evaluated. Future research could explore whether the benefits of dexmedetomidine extend beyond the immediate recovery period.

Another limitation was the lack of blinding among the healthcare providers administering the anesthesia, which might have introduced bias in assessing patient recovery [13]. While objective scoring systems were used to evaluate emergency delirium, a fully blinded study design could further enhance the validity of the findings.

This study provided strong evidence that dexmedetomidine was an effective agent in reducing emergency delirium in offspring suffering tonsillectomy. Its sedative, anxiolytic, and mild analgesic properties subsidized to the smoother recovery with fewer problems [14]. Given its favorable safety profile, dexmedetomidine could be considered very valued addition to pediatric anesthesia protocols. However, further research having higher sample sizes and long-standing follow-ups is suggested to solidify those results and discover additional benefits of dexmedetomidine in pediatric surgical settings [15].

Conclusion:

In this study, dexmedetomidine was found to be effective in decreasing occurrence and strictness of emergence delirium in offspring experiencing tonsillectomy at CMH Muzaffarabad, AJK. Children who received dexmedetomidine experienced smoother recoveries, with fewer episodes of agitation and distress compared to those who did not. Additionally, its use did not lead to significant adverse effects, making it a safe option for postoperative management. These findings suggest that dexmedetomidine can improve recovery quality in pediatric patients, enhancing overall patient comfort and reducing complications associated with emergence delirium after tonsillectomy.

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