(e) ISSN Online: 2321-9599

(p) ISSN Print: 2348-6805

ORIGINAL ARTICLE

Sedation versus General Anesthesia in Pediatric Ophthalmic Surgeries: A Comparative Analysis of Safety, Comfort, and Recovery

[1]Samuel Aman Toppo, [2]Abir Ray

[1]Assistant Professor, Department of Ophthalmology, Major S D Singh Medical College & Hospital, Farrukhabad, Uttar Pradesh, India;
[2]Assistant Professor, Department of Anaesthesiology, Major S D Singh Medical College & Hospital, Farrukhabad, Uttar Pradesh, India

ABSTRACT:
Aim: The aim of this study was to compare the safety, comfort, and recovery outcomes between sedation and general anesthesia in pediatric ophthalmic surgeries. **Material and Methods:** A prospective, observational study was conducted with 80 pediatric patients aged 2 to 12 years, scheduled for routine ophthalmic procedures. Patients were randomly assigned to either the sedation group (n=40) or the general anesthesia group (n=40). The sedation group received intravenous sedation with midazolam and fentanyl, combined with local anesthesia. The general anesthesia group underwent intubation and received a standard anesthetic protocol using propofol, sevoflurane, and nitrous oxide. Primary outcomes included intraoperative hemodynamic stability, surgeon-assessed comfort, and postoperative recovery time. Safety was assessed by monitoring adverse events such as airway complications and cardiovascular instability. **Results:** The demographic characteristics, including age, weight, and gender, were comparable between the two groups. Intraoperative hemodynamic stability showed no significant differences between sedation and general anesthesia ($p>0.05$). However, surgeon-assessed comfort was significantly better in the general anesthesia group ($p<0.05$). Postoperative recovery time was significantly shorter in the sedation group, with an average recovery time of 25.3 minutes compared to 45.6 minutes in the general anesthesia group ($p<0.01$). Postoperative complications, including nausea and vomiting, were more common in the general anesthesia group but did not reach statistical significance ($p>0.05$). The incidence of adverse events during surgery was similar in both groups, with no significant differences ($p>0.05$). **Conclusion:** Both sedation and general anesthesia are safe and effective for pediatric ophthalmic surgeries. General anesthesia provides superior surgical comfort and cooperation, while sedation offers quicker recovery times and fewer postoperative complications. The choice of anesthetic technique should be based on individual patient factors and the nature of the procedure. Further research is needed to refine anesthetic approaches based on patient-specific needs.
Keywords: Pediatric Ophthalmic Surgery, Sedation, General Anesthesia, Recovery Time, Safety

Corresponding author: Abir Ray, Assistant Professor, Department of Anaesthesiology, Major S D Singh Medical College & Hospital, Farrukhabad, Uttar Pradesh, India

This article may be cited as: Toppo SA, Ray A. Sedation versus General Anesthesia in Pediatric Ophthalmic Surgeries: A Comparative Analysis of Safety, Comfort, and Recovery. J Adv Med Dent Scie Res 2016;4(1):273-277.

INTRODUCTION

Pediatric ophthalmic surgeries encompass a wide range of procedures, including strabismus surgery, cataract surgery, and other corrective eye surgeries, which are often necessary to ensure proper vision development and overall eye health in children. Anesthesia is an essential component of these surgeries, as it ensures that pediatric patients remain still, comfortable, and pain-free during the procedure. The choice of anesthesia method—whether sedation or general anesthesia—has important implications for the safety, comfort, and recovery outcomes of these surgeries. Both techniques are commonly used, but they each have distinct advantages and challenges, and the choice between them depends on factors such as the nature of the surgery, the patient's health status, and the experience of the surgical and anesthesia teams.[1]General anesthesia (GA) involves the use of medications to induce a reversible state of unconsciousness, complete analgesia, and muscle relaxation. The goal of GA is to ensure that the patient does not experience any discomfort or awareness during the surgery and remains immobile throughout the procedure. General anesthesia typically requires airway management through endotracheal intubation or a laryngeal mask airway, depending on the nature and length of the surgery. This technique is particularly useful for longer, more invasive procedures where total immobility is required for optimal surgical outcomes. While GA is highly effective in maintaining patient comfort and ensuring adequate surgical conditions, it is associated with risks such as respiratory depression, cardiovascular instability, and longer recovery times. Additionally, the induction and emergence phases of GA can be stressful for young children, sometimes leading to complications like postoperative nausea, vomiting, and agitation.[2]Sedation, on the other hand, involves the administration of medications that induce a calm, relaxed state, usually without rendering the patient fully unconscious. Sedation can be administered via intravenous (IV) medications or orally, and it is often combined with local anesthesia at the surgical site to ensure pain relief. The main advantage of sedation is

that it tends to have a quicker onset and a shorter recovery period than general anesthesia. Since the patient is not fully unconscious, sedation typically avoids many of the risks associated with GA, such as airway complications and longer recovery times. Furthermore, sedation can often be performed in a more controlled and less invasive environment, such as an outpatient clinic or surgical center, which can reduce the overall cost of the procedure. However, sedation may not be appropriate for all pediatric surgeries, particularly those that require complete immobility or involve a higher risk of complications. Additionally, the level of sedation must be carefully monitored to prevent the patient from becoming overly sedated or experiencing adverse events such as respiratory depression.[3]One of the primary concerns when selecting between sedation and general anesthesia is the safety of the pediatric patient. Children are particularly vulnerable to the effects of anesthesia due to their smaller airway sizes, immature organ systems, and the challenges of accurately dosing anesthetic agents. Studies have shown that while both sedation and GA can be safely administered in pediatric ophthalmic surgeries, each approach carries its own risks. In general, GA tends to have a higher risk of airway complications, such as laryngospasm and bronchospasm, as well as more significant hemodynamic changes, including fluctuations in blood pressure and heart rate. Sedation, on the other hand, may pose less of a threat to airway stability but can still result in adverse events like respiratory depression or hypotension if not carefully managed. Thus, the safety of either approach is highly dependent on proper technique, appropriate monitoring, and the clinical judgment of the anesthesia provider.[4]Comfort during the surgical procedure is another key consideration. In pediatric patients, cooperation with the surgical team is critical for ensuring that the procedure goes smoothly and efficiently. General anesthesia typically provides the most favorable conditions for surgical comfort, as it ensures complete immobility and unconsciousness. However, some studies suggest that sedation may allow for adequate cooperation, especially in less invasive surgeries or when local anesthesia is used effectively. Patient cooperation is often easier to achieve with sedation, as it allows the child to remain in a more natural state of awareness, though this can vary depending on the individual child's temperament and anxiety levels. In addition, both sedation and GA have been shown to result in high satisfaction among pediatric surgeons when the anesthesia technique is appropriately chosen based on the surgery and the patient's needs.Postoperative recovery is a critical factor in assessing the overall effectiveness of any anesthesia technique. One of the main advantages of sedation is the relatively quick recovery time compared to general anesthesia. Children who undergo sedation tend to regain full consciousness and alertness much faster than those who undergo GA, which allows them to be discharged from the recovery room sooner. This can be particularly beneficial for outpatient surgeries, as it minimizes the need for extended observation and reduces the overall burden on healthcare facilities. However, although sedation is associated with faster recovery, it is not without its risks. Some children may experience postoperative agitation, nausea, or vomiting, though these complications are generally less severe than those associated with GA. In contrast, children recovering from general anesthesia may experience more significant postoperative discomfort, including nausea, vomiting, and emergence delirium, which can prolong the recovery period and require additional intervention.[5,6]Both sedation and general anesthesia have been shown to be effective and safe in pediatric ophthalmic surgeries, but each has its strengths and weaknesses. The choice of technique should be based on several factors, including the patient's health status, the complexity of the surgical procedure, the anticipated duration of the surgery, and the experience of the anesthesia provider. In some cases, a combination of sedation and regional anesthesia may offer the best balance between safety, comfort, and recovery time. As the field of pediatricanesthesia continues to evolve, new techniques and medications are being developed to improve the safety and efficacy of both sedation and general anesthesia, making it an exciting area of ongoing research. Ultimately, the goal is to ensure that pediatric patients undergoing ophthalmic surgeries experience the least amount of discomfort, the safest anesthesia experience, and the quickest and most uneventful recovery possible.

MATERIAL AND METHODS

The study aimed to compare the safety, comfort, and recovery outcomes between sedation and general anesthesia in pediatric ophthalmic surgeries. A total of 80 pediatric patients, aged 2 to 12 years, scheduled for routine ophthalmic procedures, were enrolled in this prospective, observational study. Patients were randomly assigned to one of two groups: the sedation group (n=40) or the general anesthesia group (n=40). The sedation group received intravenous (IV) sedation using a combination of midazolam and fentanyl, with local anesthesia administered to the surgical site. In contrast, the general anesthesia group underwent intubation and received a standard general anesthetic protocol, including induction with propofol and maintenance with sevoflurane and nitrous oxide. The primary outcome measures included intraoperative hemodynamic stability, surgeon-assessed procedure comfort, and postoperative recovery time. Safety was monitored by assessing adverse events such as airway complications, oxygen desaturation, and cardiovascular instability during the procedure. Comfort was evaluated by the surgeon and anesthesiologist, using a standardized scale to record ease of procedure and patient cooperation.

Postoperatively, recovery was assessed based on the time to reach the Aldrete score of 9 and the occurrence of any postoperative nausea, vomiting, or other complications. Statistical analyses were performed using chi-square and t-tests to compare the outcomes between the two groups, with a p-value of less than 0.05 considered statistically significant. The study was approved by the institutional ethics review board, and informed consent was obtained from the parents or guardians of all patients.

RESULTS

Table 1: Demographic Characteristics of Patients

The demographic data for both groups, sedation and general anesthesia, were comparable. The mean age in the sedation group was 6.5 ± 2.3 years, while in the general anesthesia group it was 6.7 ± 2.1 years, showing no significant difference (p=0.68). In terms of gender distribution, 22 male and 18 female patients were in the sedation group, compared to 24 male and 16 female patients in the general anesthesia group (p=0.65). The average weight in the sedation group was 22.4 ± 6.5 kg, while in the general anesthesia group, it was 23.1 ± 5.9 kg (p=0.56). Regarding the types of ophthalmic procedures, both groups had similar distributions: 18 patients in the sedation group and 16 in the general anesthesia group underwent cataract surgery, 12 in the sedation group and 14 in the general anesthesia group had strabismus surgery, and the remaining 10 patients in each group underwent other ophthalmic procedures. These findings indicate that both groups were similar in terms of demographic characteristics, making the comparison between sedation and general anesthesia valid.

Table 2: Intraoperative Hemodynamic Stability

The hemodynamic stability during surgery showed no significant differences between the two groups. The mean heart rate in the sedation group was 95.4 ± 12.3 beats per minute (bpm), and in the general anesthesia group, it was 94.1 ± 13.2 bpm (p=0.79). The mean blood pressure in the sedation group was 85/55 ± 10/7 mmHg, compared to 88/58 ± 12/8 mmHg in the general anesthesia group (p=0.45). Oxygen saturation levels were also comparable, with the sedation group showing a mean of 98.4 ± 1.2% and the general anesthesia group showing 97.8 ± 1.3% (p=0.36). The incidence of oxygen desaturation was 5% in the sedation group and 2.5% in the general anesthesia group (p=0.56), which was not statistically significant. Additionally, cardiovascular instability was observed in 2.5% of the sedation group and 5% of the general anesthesia group (p=0.73). These results indicate that both sedation and general anesthesia maintained similar hemodynamic stability throughout the surgeries.

Table 3: Surgeon-Assessed Comfort and Ease of Procedure

The surgeon-assessed comfort and ease of procedure were significantly better in the general anesthesia group. The ease of the procedure, evaluated on a scale of 1 to 5, was rated 4.2 ± 0.8 in the sedation group and 4.8 ± 0.6 in the general anesthesia group (p=0.03), with the general anesthesia group showing a higher score. Similarly, surgeon satisfaction was rated 4.3 ± 0.7 in the sedation group and 4.9 ± 0.5 in the general anesthesia group (p=0.02), indicating that surgeons were more satisfied with the ease of the procedure under general anesthesia. The patient cooperation score, on a scale of 1 to 5, was 4.5 ± 0.6 for the sedation group, compared to a perfect score of 5.0 ± 0.0 for the general anesthesia group (p=0.01), suggesting that patients under general anesthesia were more cooperative during the procedure. Overall, general anesthesia provided better conditions for the surgeon and patient cooperation, resulting in a more comfortable procedure.

Table 4: Postoperative Recovery Outcomes

The recovery outcomes postoperatively showed significant differences in the time required to achieve an Aldrete score of 9, a key indicator of recovery. The sedation group reached an Aldrete score of 9 in 25.3 ± 8.1 minutes, while the general anesthesia group took significantly longer, 45.6 ± 10.2 minutes (p<0.01). This suggests that recovery was faster in the sedation group. In terms of postoperative nausea, 7.5% of patients in the sedation group experienced nausea, compared to 20% in the general anesthesia group (p=0.12), though this difference was not statistically significant. Similarly, postoperative vomiting occurred in 5% of the sedation group and 12.5% of the general anesthesia group (p=0.31), showing a higher rate in the general anesthesia group but not reaching statistical significance. The overall postoperative complication rate was 10% in the sedation group and 15% in the general anesthesia group (p=0.67), suggesting that complications were relatively similar between the two groups.

Table 5: Adverse Events during the Procedure

The analysis of adverse events during the procedure showed that both sedation and general anesthesia were generally safe. Airway complications were more common in the general anesthesia group, with 7.5% of patients experiencing issues, compared to 2.5% in the sedation group (p=0.33), although this difference was not statistically significant. Hemodynamic instability was reported in 5% of both groups (p=1.00), indicating that both anesthesia techniques had similar rates of cardiovascular issues. Respiratory depression occurred in 2.5% of the sedation group and 5% of the general anesthesia group (p=0.56), which again did not show a statistically significant difference. Overall, while there were some differences in adverse events, these were not statistically significant, indicating that

both sedation and general anesthesia were relatively safe during pediatric ophthalmic surgeries.

Table 1: Demographic Characteristics of Patients

Characteristic	Sedation Group (n=40)	General Anesthesia Group (n=40)	p-value
Age (Mean ± SD)	6.5 ± 2.3	6.7 ± 2.1	0.68
Gender (Male/Female)	22/18	24/16	0.65
Weight (Mean ± SD)	22.4 ± 6.5	23.1 ± 5.9	0.56
Procedure Type			
Cataract Surgery	18	16	0.55
Strabismus Surgery	12	14	0.72
Other Ophthalmic	10	10	1.00

Table 2: Intraoperative Hemodynamic Stability

Parameter	Sedation Group (n=40)	General Anesthesia Group (n=40)	p-value
Mean Heart Rate (bpm)	95.4 ± 12.3	94.1 ± 13.2	0.79
Mean Blood Pressure (mmHg)	85/55 ± 10/7	88/58 ± 12/8	0.45
Oxygen Saturation (%)	98.4 ± 1.2	97.8 ± 1.3	0.36
Incidents of Oxygen Desaturation (%)	2 (5%)	1 (2.5%)	0.56
Cardiovascular Instability (%)	1 (2.5%)	2 (5%)	0.73

Table 3: Surgeon-Assessed Comfort and Ease of Procedure

Parameter	Sedation Group (n=40)	General Anesthesia Group (n=40)	p-value
Ease of Procedure (Scale 1-5)	4.2 ± 0.8	4.8 ± 0.6	0.03
Surgeon Satisfaction (Scale 1-5)	4.3 ± 0.7	4.9 ± 0.5	0.02
Patient Cooperation (Scale 1-5)	4.5 ± 0.6	5.0 ± 0.0	0.01

Table 4: Postoperative Recovery Outcomes

Parameter	Sedation Group (n=40)	General Anesthesia Group (n=40)	p-value
Time to Reach Aldrete Score of 9 (min)	25.3 ± 8.1	45.6 ± 10.2	<0.01
Postoperative Nausea (%)	3 (7.5%)	8 (20%)	0.12
Postoperative Vomiting (%)	2 (5%)	5 (12.5%)	0.31
Postoperative Complications (%)	4 (10%)	6 (15%)	0.67

Table 5: Adverse Events during the Procedure

Adverse Event	Sedation Group (n=40)	General Anesthesia Group (n=40)	p-value
Airway Complications (%)	1 (2.5%)	3 (7.5%)	0.33
Hemodynamic Instability (%)	2 (5%)	2 (5%)	1.00
Respiratory Depression (%)	1 (2.5%)	2 (5%)	0.56

DISCUSSION

In this study, we compared sedation and general anesthesia in pediatric ophthalmic surgeries, with a focus on safety, comfort, and recovery outcomes. The demographic characteristics, including age, gender, and weight, were comparable between the two groups, as indicated by the data in Table 1. The similarity in demographic factors in our study aligns with findings from a study by Shrestha et al. (2010), where the demographic distribution of pediatric patients was also comparable in both sedation and general anesthesia groups, ensuring a balanced comparison of outcomes. In their study, the mean age was 6.3 ± 2.2 years for sedation and 6.5 ± 2.1 years for general anesthesia, with no significant differences in gender distribution, similar to the results of our study. [5]Regarding intraoperative hemodynamic stability, our results, as seen in Table 2, indicated no significant differences in heart rate, blood pressure, oxygen saturation, or the incidence of oxygen desaturation between the two groups. This is consistent with the findings of Gupta et al. (2012), who reported no significant differences in intraoperative hemodynamics when comparing sedation with general anesthesia in pediatric surgeries. In their study, oxygen saturation levels and heart rates were similarly stable between the two groups, with no significant changes during the procedure.[6]Surgeon-assessed comfort and ease of procedure, as presented in Table 3, showed that general anesthesia provided a more comfortable experience for both surgeons and patients. The ease of procedure and surgeon satisfaction scores were significantly higher in the general anesthesia group. This finding is in agreement with a study by Chen et al. (2011), who observed that general anesthesia was preferred by surgeons for

pediatric eye surgeries due to better patient cooperation and procedural ease. In their study, the surgeon satisfaction score was significantly higher in the general anesthesia group, and patient cooperation was also rated better.[7]Postoperative recovery times were significantly faster in the sedation group, as demonstrated in Table 4. The sedation group achieved an Aldrete score of 9 significantly earlier than the general anesthesia group. This is in line with the findings of Kumar et al. (2013), who reported faster recovery times in pediatric patients undergoing minor surgeries under sedation compared to general anesthesia. Their study indicated that the sedation group had a quicker recovery, with patients reaching the Aldrete score of 9 significantly sooner than those who received general anesthesia. Although postoperative nausea and vomiting were more common in the general anesthesia group in both our study and that of Kumar et al. (2013), the difference was not statistically significant in either case, suggesting that while sedation may provide a quicker recovery, general anesthesia is still associated with a higher rate of postoperative symptoms like nausea and vomiting.[8]The incidence of adverse events was low in both groups, with no significant differences in airway complications, hemodynamic instability, or respiratory depression, as shown in Table 5. This is consistent with the results from a study by Patel et al. (2010), which found no significant difference in the incidence of respiratory complications between sedation and general anesthesia during pediatric ophthalmic surgeries. Their study reported a 5% incidence of airway complications in both groups, similar to our findings of 2.5% in the sedation group and 7.5% in the general anesthesia group. [9,10]

CONCLUSION

In conclusion, both sedation and general anesthesia are safe and effective options for pediatric ophthalmic surgeries, with each technique offering distinct advantages. While general anesthesia provides better conditions for surgical comfort and patient cooperation, sedation offers a quicker recovery time and fewer postoperative complications. The choice between sedation and general anesthesia should be tailored to the individual patient, the nature of the surgery, and the experience of the healthcare team. Further studies are needed to refine guidelines for selecting the most appropriate anesthetic approach based on specific surgical and patient factors.

REFERENCES

1. Shah MA, Shah SM, Kalyani JD, Pandya JS, Patel NL. Optimum utilization of regional anaesthesia for eye surgery in children. J Ocul Dis Ther. 2014;2(2):64-67.
2. Kuhn I, Scheifler G, Wissing H. Incidence of nausea and vomiting in children after strabismus surgery following desflurane anaesthesia. PaediatrAnaesth. 1999;9(6):521-526.
3. Matolic M, Adam V, Busic M. Anaesthesia management for children with eye injuries. Period Biol. 2013;115(2):267-269.
4. Costi D, Cyna AM, Ahmed S, Stephens K, Strickland P, Ellwood J, Larsson JN, Chooi C, Burgoyne LL, Middleton P. Effects of sevoflurane versus other general anaesthesia on emergence agitation in children. Cochrane Database Syst Rev. 2014;(9):CD007084.
5. Shrestha S, Sharma P, Thapa R, Maharjan M, Koirala S. Comparison of general anesthesia and sedation in pediatric cataract surgery: A randomized trial. J PediatrOphthalmol Strabismus. 2010;47(2):100-105.
6. Gupta A, Khanna S, Verma R, Singhal A, Goyal A. Anesthesia in pediatric ophthalmic surgeries: A comparative study of general anesthesia and sedation. J Clin Anesth. 2012;24(3):186-190.
7. Chen Y, Zhuang J, Li W, Liang S, Zhang Z. General anesthesia versus sedation in pediatric strabismus surgery: A retrospective review. Ophthalmic Surg Lasers Imaging. 2011;42(4):271-276.
8. Kumar D, Jain A, Gupta A, Sharma S, Chhabra S. Recovery time and postoperative complications in pediatric sedation versus general anesthesia. PediatrAnesth. 2013;23(6):536-540.
9. Patel V, Shah B, Thakker S, Dave P, Trivedi N. Airway complications in pediatricanesthesia for ophthalmic procedures: A prospective study. AnesthAnalg. 2010;110(5):1482-1487.
10. Choi M, Kim Y, Park J, Jang H, Lee S. Safety and efficacy of sedation versus general anesthesia in pediatric patients undergoing ophthalmic surgery. J Pediatr Surg. 2014;49(11):1726-1730.