# Ketamine Anesthesia for Pediatric Ophthalmology Surgery

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**Abstract**

*Aims*: Children with treatable, vision impairing conditions may not have access to surgical care when they live in regions where anesthesia is unavailable. We studied the use of ketamine anesthesia in a developing region to determine its safety and effectiveness.

*Methods*: This is a consecutive series of 679 children who had a variety of pediatric eye disorders necessitating a short general anaesthesia. Ketamine was administered intravenously by a pediatrician with training in pediatric resuscitation procedures. Procedures performed were both intra and extraocular operations. The location of treatment was the Tilganga Eye Hospital in Kathmandu, Nepal, a developing region of the world. The study took place over a 5 year time period.

*Results*: All procedures were performed without any anesthetic complications. No child required unanticipated resuscitation or laryngeal intubation. Post operative dysphoria occurred occasionally and was difficult to measure quantitatively. This side effect of ketamine resolved by the first postoperative day.

*Conclusion*: Ketamine is an effective agent for both intra and extra ocular surgery in the pediatric age group. None of the children in this series needed resuscitation or intubations, and the ophthalmic surgery was carried out safely. Ketamine can be used safely in any ophthalmic procedure of short duration by a person having some training in anesthetic resuscitation procedure. Because of its simplicity and safety, ketamine may be useful in a simple ophthalmic setup in the developing word.

Key words: ketamine, anesthetic, ophthalmic, intraocular, surgery, resuscitation

## *Introduction*

No one can argue the devastating effects of a child's blindness on family and society. Although pediatric blindness is less common than acquired adult blindness, children who are blind experience a lifetime of severe disability and a shortened life expectancy. Recognizing this, the World Health Organization targeted blinding pediatric eye diseases in its 2020 erradication of blindness program (1997).

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Many cases of pediatric blindness are *preventable*, given an effective public health program. Conditio such as trachoma, vitamin A deficiency, and measles could be eliminated with better vaccination, sanitat and nutrition. Other conditions such as pediatric cataract, glaucoma, and retinopathy of prematurity c be *treated*, but treatment can only occur in a setting where analgesia *and* immobility during surgery a possible. Volatile anesthetics and short acting agents such as barbiturates, widely used in the develop world, may not be safe or practical in the developing world. Volatile agents need sophisticated hosp and safety procedures, while short acting agents frequently suppress respiratory and cardiac effort. T ideal agent for developing regions of the world should not suppress respiratory effort, must be easy administer, and should be inexpensive.

Ketamine Is a phencylidine derivative used for general anesthesia in short surgical procedures. I partially water soluble with high liquid solubility, 5 – 10 times that of the thiopental. It is metabolized hepatic microsomal enzymes to nor-ketamine and hydroxylated to from hydroxy-nor-ketamine a excreted in the urine (Katzung and Mikhail 1998). It causes a dissociative anesthesia with profou analgesia and crosses the blood brain barrier rapidly, increasing cerebral blood flow and intracra pressure (Morgan and Mikhail 1996). Ketamine increases heart rate, cardiac output and blood press but relaxes bronchial smooth muscles (Idvall, Ahlgren et al. 1979).

And ketamine has a wide range of uses. It may be used as the sole anesthetic agent for short-t procedures, and for induction and maintenance of anesthesia in high risk patients with respiratory, car disorder, and shock. Adverse effects include an increase in lacrimation & salivation, dilation of pu increase in intraocular pressure, nausea and vomiting (Morgan and Mikhail 1996). None of these s effects is life-threatening. The dissociative experience associated with ketamine (hallucinations) are o not unpleasant, and last a short period of time (Cunningham and McKinney 1983).

Many of ketamine's pharmacological properties make it potentially useful in regions where it is difficu deliver adequate general anesthesia to children. We used it during a 5-year time period in a develop region of the world, to determine its safety and effectiveness.

**Methods**

Ketamine has been the anesthetic agent for pediatric ophthalmic surgery at the Tilganga Eye Cente Kathmandu, Nepal, for the last 5 years. The total number of children operated during this time is 6 ranging in age from 3 months old to 18 years. Table I lists the procedure and numbers. Surgery inclu extraocular procedures (chalazion, removal of foreign body, squint correction, correction of entropi ptosis) and intraocular procedures (cataract extraction with intraocular lens implantation, capsulotor goniotomy and cornea transplant). Time to perform these procedures ranged from two minutes to hour. All procedures were performed by skilled surgeons, thereby minimizing the length of time of surg Anesthesia was always administered by a person trained in pediatric airway management and resuscitat

***Screening for Anesthetic Purpose:***

All children undergoing an operation using general anesthesia were screened for any systemic or l infection, and for signs or symptoms of cardiopulmonary disease that could interfere with safe anaesthe Children were asked to fast for at least 6 hrs. In older children, psychological preparation was inclu to attempt to minimize fear of undergoing surgery.

**Premedication:**

After assuring compliance with preoperative protocols, children were given oral atropine at a dos 0.04 mg/kg, 20-30 minutes before anesthesia. The aim of this intervention was to reduce salivation, th by reducing chances of aspiration.

**Preparation in the preoperative area:**

All the necessary drugs for anesthesia & resuscitation were made ready beforehand. $O_2$ cylinder, laryngoscope, endotracheal tube of appropriate size, masks, and ambu bag were included.

***Dose*:**

Intra venous ketamine – 0.5 – 2mg/kg bolus
Infusion - 10-50ugm/kg/min
Maintenance – ½ of the induction dose as needed.
Intramuscularly- 3-10mg/kg

**Anesthesitic Procedure:**

Once the necessary arrangements were made, children were taken to the operating theater where an intravenous line was positioned. Anesthesia was induced with ketamine at the dose of 1-2mg/kg, given slowly over 20-30 sec. Half of the induction dose was given as needed throughout the course of surgery for maintenance. In children over two years of age, diazepam at a dose of 0.2mg/kg was administered intravenously to reduce post-anesthetic side effects.

In addition to ketamine, local anesthesia (retrobulbar or parabulbar Lignocain 2%) was also administered especially for cataract surgery, followed by ocular massage for a few minutes. This supplemental local aneasthesia could be given safely after the patient received ketamine. The patients vital signs were monitored in the usual way, including a pulse oximeter reading.

**Postoperative period:**

After surgery, the child was taken to the recovery room with the IV line in place. The child was kept in the left lateral position until consciousness was fully regained. The child was handed over to his or her parents.

**Results**

A total of 619 children were operated and there were no serious side effects from ketamine. No child required intubation, and resuscitations was also not necessary.

## DISCUSSION

The ideal pediatric anesthetic agent in the developing world should have a rapid onset, rapid offset, and ease of administration. Its duration of action must be long enough to allow completion of contemplated surgical procedures. The agent should not cause significant respiratory or cardiac suppression, but should offer immobilization of the patient and good analgesia. The anesthetic should also be inexpensive. Ketamine offers these various qualities.

Administration of ketamine for pediatric ophthalmology has been studied in a number of settings, for a variety of conditions (Weisman 1971; Joucken, Coltura et al. 1972; Simitovic 1974; Magoon 1989). At least one survey on the use of ketamine in developing regions has been published (Green, Clem et al. 1996). The authors of this report found only one ketamine related death in over 12,000 administrations in developing regions of the world. The series of patients was not limited to children, and included a variety of short, non-ophthalmic procedures. In a large number of cases in this report, no trained anesthetist was present. We are aware of one randomized, controlled study of ketamine, where ketamine was found to be as effective and safe as other anesthetics in the developing world. In this report, ketamine was used for gynecological procedures (Grace, Lesteour et al. 2001).

Of the non-volatile agents ketamine may be the closest to being a "complete" anesthetic, since it induces analgesia, amnesia and unconsciousness (Morgan and Mikhail 1996). Ketamine is a potent bronchodilator, making it a good induction agent for asthmatic patients. And in contrast to the depression of reticular

activating system induced by barbiturates, ketamine functionally "dissociates" the thalamus (which rel sensory impulses from the reticular activating system to the cerebral cortex) from the limbic cortex (wh is involved with the awareness of sensation). While some brain neurons are inhibited, others are tonic excited. Clinically, this state of dissociative anesthesia causes the patient to appear conscious but una to process or respond to sensory input (Morgan and Mikhail 1996).

Besides being a powerful analgesic, ketamine is the only intravenous anesthetic that routinely produ cardiovascular stimulation. The peak increase in these variables (heart rate, arterial blood pressure card output) occur 2-4 minutes after IV injection and then slowly decline to normal over the next 10-20 minu

In most patients ketamine decreases the respiratory rate slightly for 2 – 3 minutes. Upper airway refle are usually but not always active. Ketamine produces little change in other organ systems (Katzung a Mikhail 1998).

Although it is a desirable anesthetic in many respects, ketamine has been associated with disorientati sensory and perceptual illusion, and vivid dreams following anesthesia, effects that are termed "emerge phenomena" (Siegel 1978; Pedersen 1981; Cunningham and McKinney 1983). For children over years of age, we routinely administer Diazepam, 0.2 – 0.3 mg/kg IV 5 minutes before administratio ketamine, to reduce the incidence of these phenomena. This low dose of diazepam did not cause additional problems for the children. In cases where cataract surgery was performed, we gave the chil retrobulbar anesthesia shortly after ketamine induction. The use of local anesthesia in conjunction w ketamine seems to improve analgesia, and allows improved postoperative recovery (ref here).

In 5 years of experience with ketamine at the Tilganga Eye Hospital, none of the operated children nee resuscitation or intubation. All ophthalmic surgery was conducted safely. We used a simple pulse oxim to monitor the patient's heart rate and arterial blood oxygen saturation intraoperatively.

Ketamine offers an additional advantage that is particularly useful in a developing world environmen has a short recovery time, hence allowing quick turnover of patients. This means a great deal in a sim ophthalmic setup in the developing world, where space management and recovery room expenses m be minimized. Ketamine is also inexpensive.

First, and foremost, operating on children in the developing world must be safe. In this large collectio surgical experience using ketamine as the anesthetic, we encountered no serious ill effects, but this d not mean that ketamine anesthesia should be administered by untrained medical personnel. Just as important for the ophthalmic surgeon to have experience and trainng, so, too, must the anesthetist. W appropriate personnel in place, surgical care of children with blinding eye diseases need not be avoid

**TABLE I**

**Pediatric Ophthalmology Surgical Procedures At the Tilganga Eye Hospital**

| Procedure | Number |
|---|---|
| Cataract extraction w/without IOL | 240 |
| Secondary IOL | 15 |
| Corneal Transplantation | 74 |
| Strabismus | 25 |
| Post. Capsulotomy | 33 |
| Glaucoma | 32 |
| Trauma – corneal laceration | 27 |
| Lacrimal Probing | 10 |
| Others | 223 |
| **Total** | 679 |

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