Narrative Review

Anaesthesia for Open Globe Injury: Revisited

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Abstract

This review explores the management of anaesthesia for open globe injuries (OGI),emphasizing the critical considerations in minimizing intraocular pressure (IOP) to prevent further ocular damage. OGI, commonly caused by blunt or penetrating trauma, necessitates urgent intervention to mitigate vision loss and intraocular infections. The epidemiology highlights demographic trends and injury mechanisms prevalent in different populations, underscoring the need for tailored anaesthetic strategies. Diagnostic modalities like ultrasonography and computed tomography aid in assessing injury severity and guiding surgical timing. Effective management requires maintaining stable conditions for surgery, providing adequate anaesthesia /analgesia, and keeping IOP in check. Controversies surrounding succinylcholine use in unfasted patients are discussed, maintaining optimal intubating conditions while minimizing IOP elevation. The choice between local and general anaesthesia hinges on injury complexity and patient factors, with specific attention to mitigating IOP fluctuations. RA is viable for certain injuries, but GA remains essential in many cases. Proper preoperative, intraoperative, and postoperative care is crucial for optimal patient outcomes.

Keywords

open globe injury, anaesthesia management, intraocular pressure, diagnostic modalities, succinylcholine controversy.

Introduction

An open globe injury (OGI) refers to a traumatic ocular incident characterized by a breach in the structural integrity of the eye's outer layers, typically involving the cornea and sclera. These injuries can arise from various mechanisms such as globe rupture, laceration, perforation, or penetration, and are deemed urgent in the field of ophthalmology due to their potential

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to cause vision impairment and intraocular infections. The majority of OGI are attributed to blunt trauma, which can result in a sudden increase in intraocular pressure (IOP), leading to rupture at the eye's weakest point. In eyes without prior surgical interventions, ruptures commonly occur posterior to the extraocular muscles where the sclera is thinnest. However, in cases with previous intraocular surgeries, ruptures may manifest at the prior incision site. Additionally, blunt trauma can cause globe rupture at the limbus. Notably, extremely high pressures exceeding 7000 mm Hg may be necessary to rupture the globe.[1,2]

Epidemiology of OGI

In a large study from north India done over 4 years, it was found that out of 402 patients who suffered OGI, 72.9% were male and 27.1% were female, ranged from 2 to 70 years old, most vulnerable age group was 6–15 years (24.38%), followed by 16–25 years (23.88%). Most patients came from rural backgrounds (61.94%), and the extent of ocular trauma was 3.93% (95% CI: 3.23–4.63).The most common eye injuries were nonoccupational (82.3%), with sports-related incidents (23.9%) and road traffic accidents (23.6%) being the primary causes. Assault accounted for 17.2% of injuries, and domestic accidents made up 15.2% . Mechanical injuries comprised 89.3% of all cases, with wooden objects being the most frequent source (24.9%), followed by metallic objects (20.9%), stones (16.7%), balls (6.0%), and glass (3.7%). The majority of traumatic agents were solid (82.1%), with blunt and sharp objects causing 56% and 17% of cases, respectively.

About 7% of victims were drowsy during the trauma, and 98.4% were not using any protective devices at the time of injury. Among the 10.7% with nonmechanical injuries, thermal burns, cracker injuries, and alkali burns were present in 25.58%, 39.53%, and 18.6% of participants, respectively.[3–8]

Clinical history

The clinical history of patients presenting with globe rupture should focus on identifying the aetiology of the ocular or periocular trauma. Symptoms may include abrupt eye pain and visual impairment following a potential penetrating injury. Common causes of penetrating globe ruptures include glass or metal fragments, shotgun or BB pellets, and wood shavings from wood grinding. In children, sharp objects like scissors are frequent culprits, often encountered at home. Conversely, adults may experience OGI in workplace accidents, assaults, or motor vehicle collisions. Elderly individuals are particularly susceptible to injuries from ground-level falls. In some instances, OGI may result from explosive materials, gunshot wounds, sporting accidents, stab wounds, or blast injuries. Understanding the underlying causes is vital for both prevention and effective management strategies.[3–8]

Objectives of management

The objectives of anaesthesia for OGI are centred around ensuring adequate analgesia, maintaining optimal operating parameters, and preventing rises in IOP to minimize the risk of ocular content expulsion. The physical examination of patients with potential globe rupture necessitates a detailed ophthalmologic assessment.

Key aspects include evaluating the patient's baseline visual acuity, conducting a slit-lamp examination to assess the anterior segment of the globe and anterior chamber, and inspecting the conjunctiva for defects, foreign bodies, or lacerations. Special attention should be given to the equatorial sclera immediately posterior to the insertion of the rectus muscles, as this region is a common site for globe rupture due to its thin scleral composition. Additionally, pupil examination for reactivity and shape irregularities is crucial. It's important to note that during the evaluation, no pressure should be applied to the globe, which excludes tonometry and eversion of the lids from the initial assessment. Attention to the airway is very essential to assess the potential for a difficult airway.[9–11] The objectives of management are summarized in Table 1.

Table 1: Initial assessment and evaluation of ocular trauma

Systemic triaging	Teamwork (neurosurgeons, trauma specialists, ICU Physicians) intervention decisions. mechanism of trauma, associated injuries to cervical spine, maxillofacial structures and intracranial trauma
Ocular triaging	This includes the determination of the sequence of interventions as well as the nature and timing of the intervention
Incident	Date, Time, Place, Witness, Mechanism, Velocity of impact. Immediate visual symptoms. associated head injury, other injuries, last oral intake; quick review of other systems
Symptoms	Decreased visual acuity (sudden/ gradual), floaters, flashes, field defects, diplopia, pain
Ophthalmic H/O	Previous ocular disease or surgery
Medical H/O	Any systemic diseases, Tetanus Status, sickle cell anemia
Personal H/O	Family support, Alcohol/Drug abuse
Drug & Allergy H/O	Medications for systemic illness; allergy to any drugs. On any Anti coagulants

Anxiolysis during eye examination

Anxiolysis, if desired, can be achieved using benzodiazepines such as intravenous (IV) midazolam (1 - 2 mg) as it does not alter IOP significantly. However, caution is advised when administering midazolam to older adults, with consideration for dose titration in 0.5 mg increments. An alternative premedication option is dexmedetomidine IV (0.2 to 0.8 mcg/kg) administered over 10 minutes, although this may induce hypotension and bradycardia and should be used cautiously or at lower doses in patients with hypovolemia, cardiovascular disease, or advanced age. Continuous monitoring of vital signs is essential during anaesthesia administration, as entrapment of an intraocular muscle can lead to life-threatening bradycardia, especially in paediatric patients.[12]

Other diagnostic modalities

Diagnostic modalities play a critical role in evaluating open globe injuries. Plain X-ray, including AP and lateral views, are essential for assessing intraocular and extraocular injuries as well as fractures, and may also aid in detecting foreign bodies. Ultrasonography using B-scan is valuable for visualizing intraocular and intra-orbital damage, particularly when ocular media clarity is compromised. B-scan ultrasound can detect vitreous haemorrhage, retinal detachment, intraocular foreign bodies, extraocular muscle damage, and scleral rupture, providing valuable insights into the extent of ocular trauma. However, its use should be approached with caution if a ruptured globe is suspected, and it is typically deferred if a ruptured globe is confirmed. CT scans, especially with 1.5 to 2 mm axial and coronal cuts, are superior to ultrasound in locating foreign bodies and assessing damaged eye structures without direct eye contact, making them a non-invasive and valuable tool in diagnosing ocular injuries. MRI may be beneficial for patients with non-magnetic foreign bodies, although caution is advised in cases of suspected ruptured globe, particularly with potential metallic foreign bodies. Additionally, MRI may be suitable for pregnant patients or those with specific types of implantable metallic hardware.[2,5,7]

Importance of ocular trauma score

The Ocular Trauma Score (OTS) incorporates functional and anatomical characteristics to assess the severity and prognostication of open globe injuries. Functional characteristics include initial visual acuity (VA), with lower VA indicating poorer outcomes (e.g., counting fingers, hand motion, light perception). Anatomical characteristics such as rupture, endophthalmitis, perforating injury, retinal detachment, and afferent pupillary defect are considered negative prognostic indicators, raising suspicion for optic nerve damage or avulsion. Higher OTS values generally suggest a better prognosis. For patients, higher scores can enhance quality of life, alleviate anxiety, and inform economic decisions. For ophthalmologists, OTS scores assist in providing counselling, triaging patients, managing cases, and conducting research, see figure 1.[5,8,13]

Computational method for deriving the OTS score

Initial visual factor	Raw points	
A. Initial raw score (based on initial visual acuity)	NPL =	60
	PL or HM =	70
	1/200 to 19/200 =	80
	20/200 to 20/50 =	90
	≥ 20/40 =	100
B. Globe rupture		−23
C. Endophthalmitis		−17
D. Perforating injury		−14
E. Retinal detachment		−11
F. Relative afferent pupillary defect (RAPD)		−10
Raw score sum = sum of raw points		

Figure 1 Ocular trauma score in open globe injury

Intraocular pressure

IOP dynamics in OGI may exhibit increases, decreases, or remain within normal ranges following injury. Elevated IOP may result from leakage of lens protein or intraocular foreign bodies, often associated with inflammation. Presence of blood in the anterior chamber (hyphema) can decrease outflow through the trabecular meshwork, contributing to increased IOP. Occult bleeding within the orbit (orbital compartment syndrome)

can manifest as tight eyelids, difficulty in lid opening, proptosis, periorbital oedema, and a relative afferent pupillary defect, indicating a true ocular emergency that requires immediate attention.[14–15]

Surgical timing of repair

The timing of surgical repair is a critical consideration in open globe injuries, especially concerning anaesthesia administration. Penetrating injuries pose a heightened risk of infection, including endophthalmitis, necessitating swift intervention. Moreover, OGI carry the potential for vitreous loss and retinal detachment. However, not all cases of OGI require immediate surgical intervention. Some ophthalmic surgeons may opt to delay surgery until the patient has undergone adequate fasting before anaesthesia. This decision is often influenced by the extent of eye damage, where surgical intervention may not significantly enhance vision. In such instances, patients are admitted for bed rest, and their injured eye is shielded until they are deemed ready for primary wound closure. For cases where the eye remains substantially intact, and there is a promising visual prognosis, a more urgent surgical approach is warranted. The urgency of intervention hinges on various factors such as the size of the laceration, contamination of the wound, and the risk of infection. Typically, a fasting period of six hours is recommended for uncomplicated patients undergoing surgery.[16–17]

Nil per oral status

There is a growing trend to allow patients to consume clear fluids (e.g., water, non-fizzy fruit drinks) up to two to four hours before surgery.

It's crucial to consider the timing between the last meal and the injury, as trauma occurring shortly after a large meal can lead to a full stomach even after the standard six-hour fast. Additionally, alcohol consumption can delay gastric emptying, impacting the fasting period.

Pre anaesthetic evaluation

A comprehensive pre-anaesthetic assessment should be conducted, with careful attention to the patient's history of prior anaesthesia, especially focusing on any instances of difficult airway management or a history of nausea and vomiting. Information regarding the timing of the last oral intake of fluids and solids is crucial for determining the fasting period. Additionally, understanding the mechanism of trauma and the possibility of associated injuries to the cervical spine, maxillofacial structures, and intracranial trauma is vital for formulating an appropriate anaesthesia plan. The ophthalmological examination findings, particularly regarding the size of the defect and any associated ocular conditions, should also be considered in the anaesthesia management plan. Pre-operative assessments should include measures to avoid maneuvers that increase IOP, such as tonometry or ocular ultrasound. Stressors should be minimized in awake patients to prevent an increase in IOP. Tetanus vaccination should be considered for tetanus-prone wounds like open globe injuries. Although no specific prophylactic antibiotic regimen exists, topical antibiotics before surgery can theoretically reduce endophthalmitis risk. Sedatives or opioids may be used cautiously if an eye examination requires sedation.[18]

Anaesthesia management

In considering anaesthesia for open globe injuries, several critical factors come into play. Balancing the urgency of saving vision with the need to address other life-threatening injuries and the risk of pulmonary aspirations is crucial. Surgeons typically make decisions regarding treatment timing, especially in emergency situations like chemical burns, retinal artery obstruction, or traumatic injuries. Non-traumatic injuries, such as infections, complications from prior surgeries, and spontaneous retinal detachment, also require careful consideration. The choice of anaesthesia technique depends on various factors like patient condition, injury type, available facilities, and surgeon preferences. In emergencies with smaller open globe injuries topical anesthesia, sub-tenon blocks, or carefully administered peribulbar or retrobulbar blocks can be used.[19–22]

Indications for General anaesthesia (GA) in eye trauma

While LA is common for elective procedures, GA is often preferred in emergencies. Intravenous medications like lignocaine can help reduce IOP during induction, and rapid sequence induction techniques are used to minimize aspiration risk.[20–22]

GA is indicated in the following scenarios of eye trauma:

1. Corneal laceration with uveal prolapse or significant scleral extension
2. Late presentation (greater than 2 hours)
3. Contaminated wound
4. Significant corneal edema
5. Extensive corneal rupture with auto-expulsion of intraocular contents and collapsed globe
6. Patient with vision in only one eye
7. Severe pain or discomfort that cannot be managed with local anaesthesia or sedation.
8. Uncooperative patient, such as young children or those with cognitive impairments, where cooperation is essential for the procedure.
9. Complex or prolonged surgical procedures that require complete immobilization and a controlled environment.
10. Patient anxiety or psychological distress that makes local anaesthesia insufficient.
11. Hemodynamic instability or other medical conditions that require close monitoring and control, achievable more reliably under general anaesthesia.

Controversy of succinylcholine

The use of succinylcholine in unfasted patients has been a topic of significant controversy due to its effect on IOP. It is known to cause an increase in IOP by 8-10 mmHg, which typically returns to baseline within 7-10 minutes. This increase was initially attributed to the contraction of extraocular muscles leading to globe compression. However, this theory was disproven by Kelly et al. in 1993.[23] The rise in IOP is now understood to be due to reduced aqueous humor outflow, increased choroidal blood volume, and elevated central venous pressure. Consequently, most eye surgeons prefer to avoid succinylcholine.

The extent of the IOP increase also depends on the concurrent use of other drugs and the physiological response to laryngoscopy and intubation. Ensuring adequate fasting can help avoid the need for succinylcholine in the majority of urgent cases. This aligns with best practices for managing patients with open eye injuries, where minimizing IOP is crucial to prevent further ocular damage. Given anaesthesiologist expertise and ongoing concerns about optimal intubating conditions in scenarios involving a full stomach and open eye injuries, alternative agents like rocuronium, which provide rapid onset and excellent intubating conditions, might be preferable.[23–25]

Algorithm for the use of succinylcholine in setting of traumatic OGI

Succinylcholine usage in unfasted patients is controversial due to its impact on IOP. Here's a structured approach to its use, particularly in patients with open eye injuries:

Initial Assessment:

1. Is airway and mask ventilation believed to be easy?

Yes: Use non-depolarizing muscle relaxants and gentle mask ventilation.

No: Proceed to the next question.

2. Is eye or vision salvageable?

Yes or Uncertain: Discuss with the surgeon about the risk of vitreous extrusion and make an informed decision.

No: Use of succinylcholine is advocated.

Rapid sequence induction

In situations where surgery is deemed necessary for a patient with a full stomach, a rapid sequence induction technique should be employed during anaesthesia administration. This technique aims to mitigate the risk of aspiration while minimizing the potential for ocular damage. High-dose antiemetics, such as ondansetron (0.15 mg/kg, up to 12 mg), are often administered to prevent intraocular expulsion due to vomiting. Sedatives, such as IV lorazepam (0.05 mg/kg, up to 2 mg), and opioid pain medications, such as IV morphine (0.1 mg/kg, up to 10 mg), may be used to achieve adequate analgesia and sedation during the procedure.[9] To reduce the chance of aspiration, induction is done with the patient's head up, and preoxygenation with 100% oxygen is performed to improve the oxygen reserve. To reduce IOP, administer 1-1.5 mg/kg of lignocaine intravenously. RSIs are preferred in unfasted patients to avoid aspiration.

The most commonly used neuromuscular blocking agent is succinylcholine, which has a quick start, a short half-life, and good intubating conditions. When succinylcholine is given in conjunction with a sufficient dosage of an anaesthetic induction agent, there is a slight increase in IOP, but no documented cases of ocular contents being extruded have been reported.[4] Higher dosages of non-depolarizing neuromuscular blocking agents, such as rocuronium (1.2 mg/kg), combined with an induction agent, may be an option for patients who are not fasting. Fentanyl (1.5-2 mcg/kg) combined with propofol (2 mg/kg) is an alternate induction method that works well without the use of neuromuscular blocking drugs and creates excellent intubating circumstances.[1]

After intubation a deep plane of anaesthesia is maintained to prevent movement and coughing. To sustain general anaesthesia, hypnotics (like propofol), opioids (like fentanyl), and inhaled anaesthetics (like sevoflurane) all lower IOP when used with a neuromuscular blocking agent. Inhaled anesthetics (e.g., sevoflurane), hypnotics (e.g., propofol), opioids (e.g., fentanyl) all lower IOP and are combined with a neuromuscular blocking agent for the maintenance of general anesthesia. Volatile inhalational agents can be used for maintenance of anaesthesia as they decrease IOP by decreasing the production and increasing the outflow of aqueous humour. Desflurane causes airway irritation and coughing which in turn can lead to increase in IOP, thus it is not preferred in OGI cases. Total Intravenous Anaesthesia using propofol is ideal in cases having increased risk of post operative nausea and vomiting.[1]

A higher dosage of a nondepolarizing neuromuscular blocking agent, such as 1.2 mg/kg of rocuronium, can be employed in conjunction with an anaesthetic induction agent to swiftly achieve intubating conditions without elevating IOP. In the event of an unforeseen difficult airway, sugammadex can be administered to promptly reverse the effects of rocuronium. Alternatively, an induction technique without the use of neuromuscular blocking agents involves utilizing remifentanil at a dosage of 3-5 mcg/kg alongside propofol at 2-2.5 mg/kg, which yields excellent intubating conditions within 1-2.5 minutes. Ephedrine may be necessary to prevent profound bradycardia and hypotension.

Factors affecting IOP

The major factors that can lead to increase in IOP are uncontrolled hypertension, hypoventilation and hypoxia, external pressure from face masks or orbital tumours, positioning during surgery (supine or Trendelenburg) Table 2.[3] Most significant increase in IOP is seen during laryngoscopy. Intubation must be done very carefully and gently to minimize increase in IOP via laryngoscopy response. Repeated attempts of laryngoscopy should be thus avoided. Peribulbar blocks can cause greatest increase (increase in volume) but IOP returns to baseline within 5 minutes after an initial increase. Premedication can be done to prevent such IOP responses. IV dexmedetomidine 0.2-0.8 mcg/kg administered over 10 minutes helps to prevent significant increase in IOP during laryngoscopy. 1-2 mg IV midazolam can be helpful in relieving preoperative anxiety.[1]

Use of Supraglottic Airway (SGA) Device in OGI

In managing airways during open globe injuries, SGA play a crucial role. They provide effective ventilation and can serve as a definitive airway option when there's no risk of aspiration or difficulty in airway management. Even in cases of difficult airways, they can function as rescue devices. For consideration of IOP, particularly relevant in open eye injuries, second-generation supraglottic devices are preferred.[10]

Table 2: Factors affecting intra ocular pressure (IOP)

Factors ↑ IOP	Factors ↓ IOP
Hypoventilation, hypoxia, venous obstruction & hypertension can marginally ↑	Most drugs either have minimal effect or↓, with a few exceptions.
External pressure from face masks, fingers, orbital tumors, contraction of the extraocular muscles, or retrobulbar hemorrhage	Majority of sedatives and induction agents ↓ in a dose-related manner.
Positioning such as supine, and Trendelenburg positions	Opioids small ↓.
Most significant ↑ occurs at laryngoscopy & emergence	Dexmedetomidine ↓ IOP, attenuates sympathetic stimulation
↑ is even greater with repeated laryngoscopy	Hypotension, hyperventilation, and hypothermia
Coughing, straining, and vomiting	↓ arterial and venous pressure, hypocarbia
Video Laryngoscopy causes a smaller ↑ Insertion of LMA results in little or no ↑ .	Acetazolamide (↓aqueous humor) mannitol (↓ vitreous volume).
Peri-bulbar blocks cause greatest ↑ (higher volume). Use of ocular blocks initially ↑ by 5 to 10 mmHg, but returns to baseline within 5 minutes	
↑IOP can cause retinal ischemia, corneal opacification, choroidal & intraocular bleeding. Conversely, large ↓ in IOP ↑ risk of Retinal Detachment, vitreous hemorrhage, and corneal edema	

Oculo-cardiac reflex

Oculo-cardiac reflex also known as oculovagal reflex or Aschner phenomenon must be monitored in open globe injuries surgeries especially in neonates and paediatric patients where it is more sensitive. It is a phenomenon that involves a decrease in heart rate (bradycardia) triggered by manipulation of eyeball and pressure on the eye. It also has reported association with reduced arterial pressure, arrythmias, and rarely asystole or even cardiac arrest. It is mostly seen in strabismus surgery but may be activated by facial trauma, regional anaesthesia nerve blocks and during mechanical stimulation. Inadequate anaesthesia or sedation can make patients more susceptible to the reflex. It is necessary to take preventative steps like using topical anaesthetics, keeping a deep plane of anaesthesia, and gently manipulating the eyes. Release of pressure should be done if the oculocardiac reflex manifests during the procedure. Glycopyrrolate or atropine via intravenous route can be used to counteract the vagal response and raise heart rate. Deepening the plane of anaesthesia is necessary, and the ciliary ganglion can be blocked by retrobulbar or retrograde block, which blunts the afferent limb of the reflex arc.

Extubation

Extubation is another very critical phase in patient with OGI. Increased caution must be taken during awakening time and measures should be taken to prevent coughing, retching and vomiting as these may increase the IOP. In patients having surgery with general anaesthesia, it is a good idea to ask the surgeon to perform a local anaesthetic block before waking up the patient. If stronger analgesia is required this is best given as small intravenous doses of morphine or pethidine. Nausea and vomiting after emergency eye anaesthesia can be a major problem in some patients. Prophylactic antiemetics can be used such as ondansetron 4mg and dexamethasone 4mg. prior to extubation, IV lignocaine can be used to minimize these adverse outcomes and decrease coughing. An Infusion of remifentanil >0.1mcg/kg/min can be used with extubation to avoid sudden arousal of patient from anaesthesia.[20] "Deep extubation" i.e., endotracheal tube removed while patient is still under GA but maintaining spontaneous breathing is preferred in cases of OGI.[20]

Emergence of Regional Anaesthesia as an alternative

In the past, there was a tendency to avoid procedures that carried the risk of extruding ocular contents. However, the outdated belief that regional anaesthesia (RA) is contraindicated for OGI has been disproven.[26–28] In patient with compromised cardiopulmonary functions and potentially difficult airway where vision salvage is unlikely, RA can be considered as an alternative to GA.

Historically it has been avoided due to potential risk of extrusion of ocular contents. There was also the additional concern of altered eye anatomy and tissue distortion from trauma, bleeding, and oedema, making blocks more technically difficult. However, OGI can be repaired under a block and monitored anaesthesia care (MAC) depending upon the severity of the injury (zone 1 and zone 2), areas in the globe <= 5mm posterior to limbus. It is more likely to succeed in anterior and small wounds.[26] It is important to keep the IOP under control during the block and the surgery. It is important that all information regarding what is to be done should be conveyed to the patient so that they can be mentally prepared and it also helps in relieving anxiety to an extent. For less serious wounds, topical anaesthesia combined with sedation may be utilised. Sedation should be used cautiously. Oversedation can easily turn a cooperative patient into a difficult to manage patient due to airway problems and patient confusion. Sedation should not be used as an alternative to a general anaesthetic in a patient with a full stomach. In the event that a patient feels pain while undergoing a local anaesthetic procedure, analgesia rather than sedation should be administered. If more local anaesthetic is needed, the surgeon can augment the block with it or give modest intravenous analgesic doses.5 A comfortable operating table, someone to hold the patient's hand the entire time, and a thorough explanation of the process to the patient before operation begin are all important. It also helps to let patients empty their bladders before surgery.

Advantages of Regional anaesthesia in eye trauma

1. Avoidance of "Open Globe/Full Stomach" Scenario: RA mitigates the risk associated with GA in patients with open globe injuries and a full stomach, reducing the likelihood of increased IOP and aspiration.
2. Avoidance of Potential Airway Issues: By eliminating the need for intubation and airway manipulation, RA reduces the risk of complications in patients with difficult airways or respiratory issues.
3. Suitability for Medically Unfit Patients: RA is a safer option for patients who may not tolerate GA due to underlying medical conditions, minimizing systemic risks and complications.
4. Practicality When No 24-Hour Onsite Anaesthetic Service is Available: Regional techniques can be managed by available staff and are less dependent on continuous anaesthetic monitoring, making them feasible in settings with limited anaesthetic services.
5. Good Postoperative analgesia: RA provides effective and prolonged pain relief postoperatively, improving patient comfort and potentially reducing the need for systemic analgesics.
6. Reduced Incidence of Postoperative Nausea and Vomiting (PONV): Patients are less likely to experience PONV with RA compared to GA, enhancing recovery and patient satisfaction.
7. Less Risk of Eye Rubbing/Squeezing During Recovery: RA reduces the likelihood of patients inadvertently rubbing or squeezing their eyes during recovery, which can be detrimental in the context of eye trauma.
8. Patient Preference: Some patients may prefer RA over GA due to personal comfort, past experiences, or informed decisions.
9. Surgical Considerations: Certain eye surgeries may be better facilitated by RA, providing a stable operative field with less intraoperative movement.
10. Reduced Cardiovascular and Respiratory Depression: RA poses less risk of cardiovascular and respiratory depression compared to GA, which is particularly beneficial for patients with compromised cardiovascular or respiratory systems.
11. Rapid Recovery and Shorter Hospital Stay: Patients often recover more quickly from RA, leading to shorter hospital stays and faster return to daily activities.
12. Avoidance of GA in the Elderly: Elderly patients often have a higher risk of complications from GA. RA is safer and associated with fewer postoperative cognitive dysfunctions.
13. Lower Risk of Deep Vein Thrombosis (DVT): RA is associated with a lower risk of DVT compared to GA, beneficial for patients at risk of thromboembolic events.

14. Avoidance of Mechanical Ventilation: For patients with conditions that make mechanical ventilation risky or undesirable, RA avoids the need for intubation and ventilatory support.
15. Stable Hemodynamic Profile: RA generally maintains a more stable hemodynamic profile, reducing the risk of significant blood pressure fluctuations during surgery.
16. Reduced Need for Postoperative Opioids: Effective RA can reduce or eliminate the need for postoperative opioids, decreasing the risk of opioid-related side effects and complications.

The evolving role of RA in OGI has been extensively studied, with several notable findings.[26–30] A study compared combined O'Brien's block (facial nerve block), topical ropivacaine, and intracameral lignocaine versus peribulbar block in traumatic corneal rupture cases. The results showed that the combined technique was as efficacious as peribulbar block in providing adequate LA and reducing the incidence of vitreous prolapse.[26]

Another study retrospectively analyzed 507 eyes with open globe injuries treated with either RA-MAC or GA at a tertiary referral center. It found that primary closure under RA-MAC was performed in 91% of cases, leading to comparable visual acuity improvement compared to GA. Additionally, RA-MAC cases had less severe injuries, shorter operative times, and were less likely to require hospital admission.[28]

Another published study also highlighted the increasing Utilization of RA-MAC: The study noted a significant increase in the use of RA-MAC for open globe injuries over time, from 64% in 1995-1999 to 91% in the recent study period (2015-2020). This trend highlights the growing acceptance and effectiveness of RA techniques in this context.[29,30]

Practical approach to a patient with OGI

A practical approach to emergency eye anaesthesia would be to do a brief assessment of the indication of the emergency and to assess if the surgery can be deferred till normal fasting ours are achieved, figure 2.

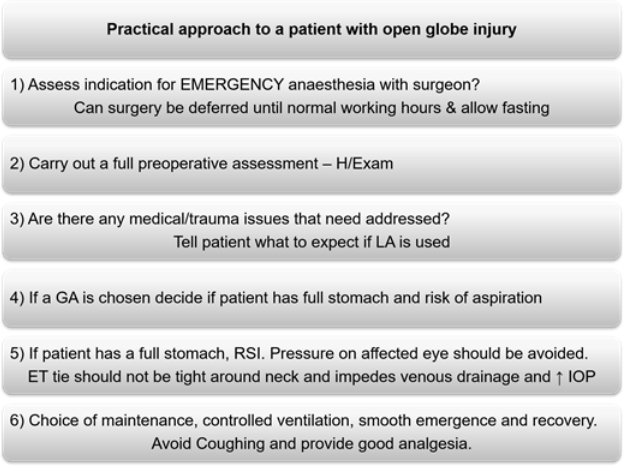

Figure 2 Practical approach to a patient with open globe injury

A full preoperative assessment should be done and patient must be provided with a full explanation of the need of the procedure to be done and various techniques of anaesthesia available and benefits and risks of all. Patient must be aware of what to expect if local anaesthesia is chosen. If GA is chosen and patient doesn't have adequate fasting then rapid sequence induction should be preferred, preoxygenation with 100% oxygen should be done and induction must be done with iv induction drugs such as propofol,

etomidate or thiopentone and short acting muscle relaxants such as succinylcholine is preferred. Pressure on the affected eye must be avoided and maneuver that might increase IOP should be very carefully dealt with. A slight head up tilt might reduce intra ocular pressure. Maintenance of anaesthesia depends on local availability with either intravenous pr inhalational agents. At the end of the procedure patient should be extubated on their side and once airway protective reflex have returned. Severe coughing and straining needs to be avoided as this increase the IOP and the risk of haemorrhage. Post operative care is also of utmost importance and measure must be taken to provide good analgesia and prevent coughing straining or any kind of nausea and vomiting.

Summary

OGI is a very important cause of unilateral blindness worldwide and it is considered as an emergency procedure. Visual outcomes generally depend on the severity of the injury. Thorough preoperative assessment and knowledge about the effects of various anaesthetic drugs and anaesthesia techniques on IOP is very important. The primary goals have always been to maintain a stable globe for surgery, providing a deep plane of anaesthesia, adequate analgesia and keep the IOP in check. Care must also be taken to prevent any post adverse effects that can potentially increase IOP and cause harm to the patient. Effective management includes providing analgesia, antibiotics, and eye protection to limit IOP, reduce the risk of infection, and prevent further injury. RA is a reasonable alternative for injuries in zones 1, 2, and minor anterior injuries, although GA still holds its special importance in certain cases.

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Conflicts of interest

There are no conflicts of interest.

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