Review Article

Peri-operative considerations for sedation-analgesia during cataract surgery: a narrative review

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Summary

Cataract surgery is usually of short duration and is associated with minimal pain when employing topical or regional anaesthesia. Patient education regarding the peri-operative process may help alleviate anxiety and avoid the need for sedation. However, sedation may be required, and we discuss the various options. Many consider that pre-operative fasting is necessary due to the risk of aspiration but fasting may not be required if minimal sedation is administered. If the use of sedatives, hypnotics or analgesics is required, then their associated adverse events should be considered.

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Introduction

Cataract surgery is one of the most common operations performed worldwide [1]. Modern techniques, such as phacoemulsification and small-incision extracapsular surgery, have resulted in a significant reduction in surgical duration as well as an increased turnover of patients in the operating room, leading to improved efficiency. Using topical or regional anaesthesia techniques, rather than general anaesthesia, should translate to an even more expeditious throughput of patients [2]. However, improved efficiency should not be at the expense of the individual patient's safety and comfort. For each patient, a cataract operation is a significant event, with a high likelihood of success, but with a small risk of devastating complications. The aim of this review was to determine the peri-operative considerations for sedation and/or analgesia, including the rationale and risks, in patients scheduled for cataract surgery under topical or regional anaesthesia.

Methods

We conducted a literature search of PubMed and Scopus in April 2019 to identify relevant articles. Key search terms were: 'cataract surgery', AND 'regional anaesthesia', 'local anaesthesia', 'topical anaesthesia', 'sedatives', 'hypnotics', 'sedation', 'adverse events' and 'complications'. No date limits were set. The abstracts of identified articles were assessed for relevance, together with screening of their references for further relevant publications.

A full-text assessment of 154 articles was undertaken, of which 74 were included in the final review. We identified significant heterogeneity with regard to sedation/analgesia techniques, drugs and doses used and modes of administration. Hence a narrative review, including critical clinical analysis of the published literature, was performed.

Selection of anaesthetic technique

The choice of anaesthesia technique is influenced by the preferences of patients, anaesthetists and surgeons, the complexity of the procedure, resources and the healthcare delivery system. There is no gold standard and management should be determined on an individual basis [2]. Whatever the choice, the goals are to be safe, painless, efficient and effective [3]. Several approaches are used for cataract surgery, including: topical anaesthesia (eye drops); intraconal (retrobulbar); extraconal (peribulbar); and blunt-cannula (sub-Tenon's) blocks [2].

Topical anaesthesia involves the application of local anaesthetic to the surface of the globe and is associated with minimal discomfort during administration and the least complications. However, it does not block sensation arising from intra-ocular structures in the anterior segment [4]. Thus, intra-operative manipulation of the iris or stretching of the ciliary muscles may cause discomfort. Additional anaesthetic instilled into the anterior chamber (intracameral anaesthesia, usually with preservative-free lidocaine) improves patient comfort [5].

Intraconal (retrobulbar) block involves injection of local anaesthetic further back in the orbit inside the muscle cone behind the globe. Extraconal (peribulbar) block involves injecting local anaesthetic in the orbit around the equator of the eye globe outside the muscle cone [6]. Sub-Tenon's injection involves placing local anaesthetic under the Tenon's capsule, usually with a blunt cannula [7]. There is debate as to which needle block technique is superior with respect to discomfort during administration of the block [8, 9], as well as the extent of analgesia during surgery [10]. The injection techniques provide effective analgesia and akinesia compared with topical techniques [8, 11], however injection techniques are more often associated with rare, serious complications [12–16].

Factors that increase the likelihood of intra-operative pain include: young age; surgery on the dominant eye; previous cataract surgery; myopia; difficult or prolonged surgery; sudden changes in intra-ocular pressure; and accidental stimulation of the iris with surgical instruments [17]. Patients are more likely to have pain during second eye surgery, which may be related to higher pre-operative anxiety [18, 19]. Other intra-operative factors that influence pain include: choroidal effusion; suprachoroidal haemorrhage; and aqueous misdirection syndrome [20–22]. Pain during surgery will generally affect patient satisfaction [23] but can usually be controlled with additional measures (e.g. local anaesthetic eye drops and/or intra-cameral injection, sedative/hypnotic/analgesic administration, explanation and reassurance).

Sedation and analgesia

Despite advances in surgical techniques and anaesthesia, a large proportion of patients scheduled for cataract surgery experience pre-operative anxiety [24–26]. Patients may worry about various aspects of the procedure [24], including the possibility of a poor outcome. Those who accept a local anaesthetic technique may worry about pain or discomfort during the procedure, or an inability to remain still. Unintentional patient movement induced by pain or anxiety will negatively influence surgical outcomes. Sedation/analgesia minimises patient anxiety and discomfort and should help patients remain immobile for the procedure, as well as improve patient satisfaction.

Use of sedation/analgesia appears to vary significantly between and within countries. Reasons for this include: cultural expectations; cost; tradition; institutional practice; and availability of personnel and facilities. In some parts of the world, sedation is routinely administered for cataract surgery [27], whereas other countries have very low rates of sedation, or none at all [28].

In the USA [authors' personal experience] and much of Canada [29], intravenous sedation appears to be routine for cataract surgery. In the USA, involvement of anaesthetists in cataract surgery varies from hospital to hospital [30]. Sedation/analgesia for cataract surgery under local or regional anaesthesia, 'monitored anaesthesia care' (MAC), is commonly provided using an anaesthesia care team model in which an anaesthetist supervises nurse anaesthetists or anaesthetic assistants. Although some have questioned the need for an anaesthetist or anaesthetic practitioner during cataract surgery performed under topical anaesthesia, others have reported that the presence of qualified anaesthesia providers is justified because they contribute to the overall quality of patient care [31]. Previous studies have reported a high level of patient satisfaction with anaesthesia care regardless of sedation or the local/regional anaesthetic technique [32].

In Canada, in addition to consultant anaesthetists, monitored anaesthesia care may be provided by anaesthesia nurses or anaesthesia-trained registered respiratory care practitioners [33, 34]. Of note, in such situations, a consultant anaesthetist is readily available. Importantly, studies reporting safety with non-anaesthesia practitioners either did not include sicker patients or involved consultant anaesthetists in this patient population. Overall, in North America, anaesthesia care during ophthalmic surgery is most likely utilised due to improved patient and surgeon satisfaction [23].

By contrast, the UK has no such tradition of using intravenous sedation: surveys [13, 14] have shown low intravenous sedation rates for cataract surgery. The most recent published data in 2016 showed 4.1% of patients received sedation, 3.4% general anaesthesia and 92.5% local anaesthesia without sedation [35]. To the authors' knowledge, no comparable data are available from other European countries. Why does the UK have such a low rate of sedation for cataract surgery? For many years, it has been standard practice for nurses to prepare patients for cataract surgery, performing pre-operative assessments and explaining the procedure [2]. Nurses are considered empathic and exert a positive influence to reduce patient anxiety and improve co-operation during cataract surgery [36]. Most patients in the UK seem happy with an explanation rather than sedation. Introducing the no-sedation approach in other countries also appears to be successful and popular with the majority of patients [28]. However, it seems that there will always be a proportion of patients who require sedation for cataract surgery.

The ideal sedative technique should reduce anxiety and the stress response, increase the patient's pain threshold, eliminate undesired and accidental movement and facilitate patient co-operation [37]. The sedation/analgesic technique should balance the goals of patient comfort and immobility, with safety. Given the potential concerns, it is necessary to avoid liberal and indiscriminate use of sedation and analgesia. The primary aim is to allay anxiety and control pain rather than impair consciousness. The sedative and analgesic medications should not interfere with the patient's ability to communicate and co-operate. Options for sedation/analgesia include pre-operative oral sedatives and intra-operative intravenous sedatives, hypnotics and/or analgesics. Each approach has its advantages and disadvantages. Local conditions and resources should determine which approach is used and individual patient preferences should play a significant role in the chosen strategy.

Pre-operative oral medication

Advantages of oral sedation and/or analgesia include ease of administration, high patient acceptance and low cost. Pre-procedure oral sedation is intended to induce a state where patients respond to verbal commands but airway reflexes and cardiorespiratory function are unaffected. However, cognitive function and physical co-ordination may be impaired. Untoward respiratory or cardiovascular responses may also occur in the case of polypharmacy. The oral route is limited by the delayed, and somewhat unpredictable, onset of clinical effects, as well as the lack of precise control over the level of sedation. Medications are increasingly prescribed that have sedative synergy and so a thorough assessment of all medications taken, and potential side-effects related to the sedation, is necessary.

Oral sedatives include: benzodiazepines (diazepam, lorazepam, midazolam); gabapentinoids (gabapentin, pregabalin); an α_2 adrenoreceptor agonist (clonidine); and melatonin. In a study comparing oral diazepam 2.5–5.0 mg given 30 min pre-operatively with intravenous midazolam 0.5–1.0 mg given immediately preceding cataract surgery performed under topical anaesthesia, fewer patients receiving oral diazepam showed undesired movement during surgery [37]. There were no differences in the number of patients showing poor co-operation or experiencing pain or anxiety [37]. Oral lorazepam has been successfully used to achieve anxiolysis in lieu of intravenous sedation in carefully selected patients undergoing cataract surgery under topical anaesthesia [38]. Oral clonidine, given 2 hours before cataract surgery, resulted in decreased subjective anxiety, reduced systemic blood pressure and intra-ocular pressure (mean (SD) 20 (0.5) to 13 (0.5) mmHg), compared with oral diazepam [39]. Oral non-opioid analgesics such as paracetamol and non-steroidal anti-inflammatory drugs or cyclooxygenase (COX)-2 specific inhibitors may provide additional analgesic benefits.

Intravenous sedation/analgesia

Drugs used for intravenous sedation/analgesia include: benzodiazepines; propofol; opioids; and α_2 adrenoreceptor agonists (dexmedetomidine and ketamine). Their recommended doses, as well as advantages and disadvantages, are shown in Table 1. An understanding of the pharmacological and physiological effects of these drugs is essential in order to achieve optimal surgical conditions and patient satisfaction, while preventing adverse events. Of note, there is an important synergistic interaction between sedative drugs and opioid analgesics with respect to respiratory and cardiovascular depression. There are several published articles detailing the pharmacological and physiological effects of individual drugs and only a brief description of some commonly used drugs relevant to cataract surgery is included here.

Intravenous midazolam is commonly used for anxiolysis and sedation, either alone or in combination with opioids. Concerns with benzodiazepines include the risk of paradoxical reactions (e.g. increased talking, emotional

Table 1 Commonly used intravenous agents for sedation/analgesia during ophthalmic surgery [30].

Drugs	Dose	Advantages	Disadvantages
Midazolam	Bolus dose of 0.01–0.1 mg.kg^{-1}	• Onset 2–5 min • Duration of action 30–60 min • Suitable for bolus administration • Amnesia • Antagonist	• Not analgesic • Respiratory depression and airway obstruction • Unpredictable in elderly and difficult to titrate • Paradoxical reactions can occur • Can cause prolonged sedation • Postoperative cognitive dysfunction
Propofol	Bolus dose of 0.25–0.5 mg.kg^{-1} i.v., followed by an infusion or 10–20 mg incremental boluses	• Rapid onset • Easy to titrate • Rapid recovery • Anti-emetic properties • Suitable for boluses, infusion, TCI, and patient controlled sedation	• Not analgesic • Pain on injection • Narrow therapeutic range • May be associated with hypotension, respiratory depression and airway obstruction • No antagonist
Fentanyl	Bolus dose of 0.25–0.5 µg.kg^{-1} Repeated every 5–10 min until an appropriate level of analgesia achieved	• Onset of action 3–5 min • Duration of action 30 min • Antagonist	• Miosis, respiratory depression, nausea, vomiting, pruritus • Context sensitive half time rises markedly with infusion > 1 hour • Not a sedative • Synergism with sedatives
Remifentanil	Administered as TCI or an infusion of up to 0.1 µg.kg^{-1}.min^{-2} May be administered as 10–20 µg bolus repeated every 5–10 minutes until an appropriate level of analgesia achieved	• Easy to titrate • Rapid time to peak effect • Rapid and organ independent offset • Ultra-short-acting opioid with a context-sensitive half-time 3–5 min • Antagonist	• Miosis, respiratory depression, nausea, vomiting and pruritus • Muscle rigidity • Not a sedative • Synergism with sedatives
Ketamine	Bolus of 0.25–1 mg.kg^{-1}	• Reduces propofol and opioid requirements • No effects on respiratory function • Haemodynamically stable	• Hypersalivation and laryngospasm • Skeletal muscle hypertonus, involuntary movements • Hallucinations and nightmares • Tachycardia, hypertension, • Emergence delirium • Nausea and vomiting • Increases intra-ocular pressure
Dexmedetomidine	Bolus dose of 0.5–1.0 µg.kg^{-1} given over 10 min Continuous infusion of 0.2–0.7 µg.kg^{-1}.h^{-2}	• Reduces propofol and opioid requirements • Hypnotic, analgesic and sympatholytic properties • Minimal effects on respiratory function • Patients remain rousable • Decreased muscle tone • Decreases intra-ocular pressure	• Upper airway obstruction can still occur • Reduced blood pressure and heart rate • Dry mouth • Recovery time can be prolonged and variable

TCI, target controlled infusion.

release, excitement and excessive movement) [40]. A large randomised, placebo-controlled trial in adults (n = 1062) < 70 y found that sedative premedication did not improve the self-reported patient experience the day after surgery and delayed cognitive recovery [41]. Also, midazolam, in a dose that produces sedation, is associated with an increased incidence of pharyngeal dysfunction and discoordinated breathing and swallowing, a combination that impairs airway protection and potentially increases the risk of pulmonary aspiration [42, 43]. Propofol is preferred for moderate-to-deep sedation because it is easy to titrate, allows a more rapid recovery of cognitive function and has anti-emetic properties [44]. It does, however, have a narrow therapeutic range which may result in deeper than expected sedation, and there is no antagonist. Propofol can be associated with hypotension, respiratory depression and airway obstruction and is not an analgesic, so must be combined with analgesics for painful procedures.

Opioids such as fentanyl and remifentanil have often been used as analgesic adjuncts or sole agents during the performance of eye blocks, as well as topical anaesthesia. These can be given as boluses, but serum concentrations are controlled more accurately with a target-controlled infusion [45] or patient-controlled sedation [46]. These have both been used during ophthalmic regional blocks. Remifentanil has been shown to have superior efficacy in reducing unwanted movements compared with propofol [47]. However, there is risk of miosis, respiratory depression, nausea, vomiting, pruritus and increased sensitivity in elderly patients, who themselves are more likely to require cataract surgery [48]. Fentanyl is the most commonly used opioid due to its ease of administration but time to peak effect is relatively slow.

Low dose ketamine (0.5–1.0 $mg.kg^{-1}$) can be used in combination with propofol as it reduces propofol requirements and has fewer adverse respiratory and haemodynamic effects. The analgesic effects of ketamine should improve the quality of procedural sedation; however, it causes salivation that might lead to laryngospasm. It can also produce skeletal muscle hypertonus and involuntary movements. Another major concern with ketamine (even in low doses) is the potential for hallucinations and nightmares [49].

Dexmedetomidine is a potent, highly selective α_2 adrenoreceptor agonist with hypnotic, analgesic and sympatholytic properties [50]. Respiration is minimally affected and patients remain rousable. However, a recent study suggests that sedative doses of dexmedetomidine can reduce the ventilatory response to hypoxia and hypercarbia to a similar extent as propofol, thus warranting caution [51]. Also, dexmedetomidine-induced sedation can cause upper airway obstruction and episodes of apnoea. It must be given as a slow loading dose to avoid hypertension and, subsequently, produces a modest reduction in blood pressure. Recovery time can be prolonged and variable.

Drugs commonly used for sedation/analgesia during the performance of an eye block include propofol, fentanyl and remifentanil. A single bolus dose of propofol (0.25–0.5 $mg.kg^{-1}$) administered 2–3 min before peribulbar block can effectively reduce recall of the block without major systemic side-effects or need for airway support [52]. Verbal response or grimacing during the block may correlate with, or predict, patient recall [53]. An intravenous bolus of fentanyl 25–50 μg provides analgesia with minimal sedation and has been used for patient-controlled analgesia during cataract surgery under topical anaesthesia [46]. Remifentanil is also effective as a sole agent during eye blocks. Remifentanil (0.5–1 $\mu g.kg^{-1}$) was found to be better than propofol with respect to limiting patient movement and did not cause clinically significant respiratory depression during 106 retro/peribulbar eye blocks [47]. Movement of the patients' hands, arms and head were significantly greater in the propofol group during all stages of the block but almost no movements were recorded in the remifentanil group. Nineteen patients in the propofol group sneezed during the medial peribulbar injection compared with none in the remifentanil group. Patient movement and sneezing are known to occur after propofol administration during peri-ocular injections for oculoplastic surgery [54, 55].

Determining the exact dose needed for a specific level of sedation is a unique challenge due to wide variability in patient response. Understanding the pharmacokinetics and synergistic effects of various agents, as well as incremental dosing, is critical. The decision to provide sedation/analgesia and the agents selected can vary, and is usually based on the needs of the patient or surgeon and the duration of the procedure.

Computer-assisted and patient-controlled modalities have increasingly been used during various surgical procedures (including eye surgery) [46, 56], with the intention of achieving better individualised titration. Patient controlled sedation may be useful for longer duration ophthalmic procedures but is not practical for short procedures such as cataract surgery. Newer physiological closed-loop controlled medical devices automatically adjust the delivered drug to the patient based on a measured physiological variable. These devices have been used to control fluid and drug delivery, mechanical ventilation, anaesthesia and sedation [57], but they have no current applicability in this setting [58].

Adverse effects of sedation and litigation

Procedural sedation can result in significant adverse effects, particularly in the elderly who may have comorbidities [59] and these are shown in Table 2. Marked individual variations in pharmacokinetics as well as pharmacodynamic sensitivity to sedatives and analgesics can make it difficult to provide the optimum degree of sedation. Therefore, patients may drift into unintended deeper levels of sedation. This can result in airway obstruction and respiratory depression, which may lead to life threatening

Table 2 Adverse events associated with sedation [37, 47, 63, 65].

Events	Implications
Airway obstruction	Hypoxaemia and hypercarbia
Respiratory depression	Hypoxaemia and hypercarbia
Cardiovascular depression	Hypotension and cardiac arrhythmia
Impaired protective reflexes	Aspiration
Reduced communication	Reduced compliance to surgeon's command during topical anaesthesia
Unwanted movements	Interruption of surgery and accidental damage to the patient by surgical instruments

hypoxaemia and hypercarbia. Cardiovascular depression causes hypotension and cardiac arrhythmias. Furthermore, impaired protective airway reflexes may increase the risk of aspiration of gastric contents. Excessive sedation can impair the patient's ability to communicate verbally, reduce compliance and increase patient movement. It has been reported that, although cataract surgery is a safe procedure with a low absolute risk for medical complications, intra-operative sedation is associated with an increase in adverse events [10]. The exact complication rate is unknown because published data are limited and lack quality, but it is generally perceived that, although mortality is low, morbidity can be significant [59].

Reports of litigation related to cataract surgery in the UK make little specific mention of sedation. An analysis of 96 negligence claims after UK cataract surgery (1990–1999) included four claims due to excessive pain (three intra-operatively and one postoperatively) [60]. Another similar UK series of 324 such claims (1995–2008) included five patients of inadequate anaesthesia, but sedation was not specifically mentioned [61]. The authors concluded that claims related to inadequate anaesthesia or anaesthetic-related complications are particularly hard to defend. The authors were also of the opinion that the law courts would be sympathetic to the psychological distress caused to a patient who suffered pain while being conscious during an operation and that this was of concern if topical anaesthesia was used. In contrast, needle ophthalmic blocks are associated with globe perforation and other rare but serious complications [12–15], resulting in well-known medico-legal concerns [62].

The American Society of Anesthesiologists (ASA) Closed Claims Project is a structured evaluation of adverse anaesthetic outcomes obtained from the closed claim files of US professional liability insurance companies [63]. The claims involving needle blocks (retrobulbar or peribulbar) were classified according to the nature of the anaesthesia provided. If a surgeon performed the eye block and the anaesthetist provided monitoring and sedation, the claim was classified as monitored anaesthesia care. If the anaesthetist performed the block, it was classified as regional anaesthesia. The ASA analysis of closed malpractice claims showed that 78% of closed claims related to GA, 6% to monitored anaesthesia care and 16% to regional anaesthesia. Inadequate oxygenation or ventilation was the most common specific respiratory event in monitored anaesthesia care claims and nearly half the injuries related to sedation were judged to be preventable by using additional, or improved, monitoring [63]. The 121 claims following monitored anaesthesia care included 25 patients of eye surgery (21% of all monitored anaesthesia care claims), 24 of which were cataract operations. Respiratory depression due to an absolute or relative overdose of sedative/hypnotic/opioid agents was responsible for 25 monitored anaesthesia care-related claims (21%). Inadequate anaesthesia and/or patient movement during surgery accounted for 13 (11%) monitored anaesthesia care claims, but only 3% of GA claims and 2% of regional anaesthesia claims. Eleven out of these 13 patients resulted in eye injury during a regional block or surgery [63]. Nearly 75% of the patients who experienced injury related to sedation received a combination of two or more drugs, a benzodiazepine and an opioid or propofol plus others. An earlier (1985–1990) ASA closed claims report of eye injuries associated with anaesthesia found 21 claims involving patient movement during eye surgery, all of which caused blindness. Of these, 16 patients had GA and five had monitored anaesthesia care [64].

Safe practice

Several measures have been suggested to reduce the risk of adverse events during cataract surgery. Pre-operative patient information and education regarding anaesthesia and surgery [2] are considered useful. A low ambient noise level, reduced lighting in the procedure room, maintaining a comfortable temperature for the patient and appropriate selection of anaesthesia or sedation/analgesia technique, are all important. The patient's vital signs should be monitored as appropriate, training/equipment/facilities should be of a good standard, and there should be adequate support in the event of a medical emergency [63].

As a part of shared decision-making, patients need to be informed and educated regarding the risks and benefits of sedation, as well as alternatives and be given realistic expectations [2]. It is important that the patient is not expecting total amnesia, unconsciousness or complete absence of pain. For uncomplicated cataract surgery under topical anaesthesia, where the duration of the procedure is short, patient comfort can be assured by non-pharmacological means such as appropriate pre-procedural counselling and intra-operative hand-holding. Thus, patient expectations are managed without compromising patient safety or satisfaction. Although it could be argued that adverse events are minimised with adequate sedation, there is no credible evidence. Certain sedatives such as propofol might increase the likelihood of unwanted movements and/or reflex movement during local anaesthetic injection and this movement could result in needle injury to the globe or adjacent structures [37, 65]. Reflex sneezing and unwanted movement certainly appear to be more likely in patients who are sedated with propofol [47, 54, 55].

Fasting

Fasting for routine cataract surgery is debatable [66]. Strict adherence to pre-operative fasting is prevalent in many institutions around the world, although high level evidence does not support this practice [67]. Proponents cite the need for intravenous sedation as the main reason, with other justifications being to reduce the risk of pulmonary aspiration, particularly in the older population who may have several comorbidities (e.g. gastro-oesophageal reflux disease, hiatus hernia or diabetic autonomic neuropathy), possibility of conversion to general anaesthesia and airway manipulation during rare resuscitation attempts (e.g. anaphylaxis or complications following regional blocks) [66]. However, prolonged fasting may affect the patient's physical and psychological well-being and lead to dehydration, hypovolaemia, low blood glucose levels, irritability and other side-effects [68]. Anxiety may also be worsened by thirst and hunger, inducing unwanted stress [68,69]. Unintentional omission of the patient's usual medications (e.g. antihypertensive or diabetic medications) during fasting may result in hypertension or hyperglycaemia. Reports from the Emergency Medicine literature suggest that "*preprocedural fasting for any duration has not demonstrated a reduction in the risk of emesis or aspiration when administering procedural sedation and analgesia*" [70]. A group from Vancouver, Canada, detailed their experience of over 5000 cataract operations performed without fasting, with half receiving intravenous sedation. None of their patients suffered aspiration or pneumonia [71]. A systematic review that investigated the extent of pulmonary aspiration during procedural sedation concluded that, outside of gastrointestinal endoscopy, the incidence of aspiration is rare. Of note, none of the instances of aspiration involved cataract surgery [72]. In the unfortunate event of aspiration during sedation, mortality thankfully appears to be low [72]. Even in the context of general anaesthesia, the risk of aspiration is very low and in the range of approximately 1 in 10,000 adult surgical procedures [73]. Consensus is lacking regarding the need for fasting when sedation is given, and has led to the production of various guidelines and recommendations around the world [74]. It appears that the advantages of not fasting for routine cataract surgery under topical or regional anaesthesia outweigh the low risk of pulmonary aspiration, especially if intravenous sedation is omitted [66]. United Kingdom guidelines state that it is generally not necessary to fast patients before ophthalmic surgery under local anaesthesia without sedation. If additional sedation is to be administered, the patient may need to be fasted in accordance with local protocols [2]. A summary of advantages and disadvantages of fasting for cataract surgery is shown in Table 3.

Table 3 Advantages and disadvantages of fasting for cataract surgery performed under regional anaesthesia [66, 70–72].

Justification for fasting in cataract surgery	Disadvantages of fasting in cataract surgery
• Minimise aspiration risk when intravenous moderate or deep sedation occurs. • If there is the possibility of conversion to general anaesthesia. • Patients with cataracts tend to be older with comorbidities, placing them at risk of regurgitation and aspiration (e.g. reflux disease, diabetic autonomic neuropathy, hiatus hernia). • Optimising operational and logistical issues pertaining to Operating Suite efficiency. • Potential need for airway manipulation in a crisis (e.g. brainstem anaesthesia from ophthalmic needle block, anaphylaxis, cardiac arrest, etc.).	• Patients' physical and psychological well-being. • Dehydration, hypovolaemia, hypotension. • Stress response, catabolism and insulin resistance. • Hunger, thirst, anxiety, headache, irritability. • Unintentional omission of patients' usual medication (e.g. antihypertensives or diabetes medications), resulting in peri-operative hypertension or hyperglycaemia.

Other practice considerations

Patients should be positioned comfortably on the operating table. Minimal monitoring should include ECG, non-invasive blood pressure, pulse oximetry, respiratory rate and, if feasible, physical contact with the patient by handholding as the surgical drapes obscure the patient's face [2]. Significant respiratory and cardiovascular depression due to sedation is unlikely provided patient consciousness is maintained. Thus, safety depends on maintaining respiratory function, ensuring adequate oxygenation and preventing accumulation of carbon dioxide under the surgical drapes [2]. Patients should receive supplementary oxygen by a suitable and efficient system.

It is important to use appropriate drugs based on their pharmacological properties. For example, sedative drugs, if chosen, should be administered to provide anxiolysis and thus administered pre-operatively if given orally. When used during performance of regional blocks (typically given intravenously), these drugs should be administered before the noxious stimuli, rather than at the time of the stimulus, as they have slow blood-brain equilibrium times. Sedatives administered to provide pain relief at the time of the noxious stimuli may result in accidental over-dosing. Similarly, drug boluses should be adequately spaced, based upon the time to peak effect, in order to avoid over-dosing.

Following an ophthalmic regional block, patients generally remain conscious during the surgical procedure. Intra-operative pain arises when a complication occurs or with prolonged operation times when it becomes difficult for the patient to lie still. It is important to avoid using deeper levels of sedation to compensate for inadequate analgesia as sedative drugs do not generally possess analgesic effects and further dosing is likely to result in cognitive impairment, delirium and non-compliance. Inadequate analgesia (discomfort) should be treated with appropriate local/topical/regional anaesthesia or analgesics, rather than inappropriate sedation.

Conclusion

Modern techniques for cataract surgery involve a small incision during phacoemulsification and implantation of an intra-ocular lens, which is associated with minimal pain when topical local/topical anaesthesia is used. Patient information and education regarding the peri-operative process and setting realistic expectations is usually adequate in allaying anxiety in most instances, thus avoiding the need for pharmacological approaches. Many patients will need no sedation at all. Pre-operative fasting affects the patients' well-being and may not be required if only minimal sedation is administered.

In a sub-set of patients, sedatives and/or analgesics may be necessary, but these have medical and legal risks that need to be appreciated. There is an ongoing debate as to whether oral or intravenous sedation/analgesia is safer for facilitating cataract surgery under local/topical and regional anaesthesia. Sedation has the potential for sight-threatening complications mainly related to unwanted patient movement, either during performance of the ophthalmic block or during the surgery itself. The combination of sedatives and opioid analgesics significantly increases risk and should not be used to mitigate inadequate local/topical or regional anaesthesia. Future research is necessary to determine the comparative efficacy and safety of the various sedative and analgesic agents.

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