

Comparing Retrobulbar and Topical Anaesthesia in Cataract Surgery by Phacoemulsification – How Can Patient Comfort During Surgery by Phacoemulsification Be Improved?

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Abstract

The first section of this article is a summary of the development of cataract surgery and the anaesthetic methods used in cataract surgery. When comparing the effectiveness of retrobulbar anaesthesia (RBA) and topical anaesthesia (TA), we found that more patients in the TA group indicated pain during the procedure ($p < 0.001$). After analysing pre-operative data, we could predict which patients would report intraoperative pain with 93% certainty. The type of anaesthesia and the skills of the surgeon are robust factors, while higher levels of stress hormones before surgery are also significant, especially in younger patients. The possible origin of pain and the role of positive verbal communication around the procedure are discussed. In order to prevent unexpected surgical situations, it is better to offer patients the most appropriate method of anaesthesia rather than using a 'one size fits all' solution.

Keywords

Phacoemulsification, retrobulbar anaesthesia, topical anaesthesia, prediction of pain, positive suggestive verbal communication

Disclosure: The authors have no conflicts of interest to declare.

Received: 25 March 2009 **Accepted:** 14 April 2009 **DOI:** 10.17925/EOR.2009.03.01.42

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Topical anaesthesia (TA) for cataract surgery was first used by Koller around 1884. However, this method fell out of favour because general anaesthesia and, later, retrobulbar anaesthesia (RBA) could provide better conditions for surgery.¹ At this time cataract surgery was performed using an incision of 10mm or more. Accordingly, hypotony and akinaesia were necessary. Hypotony was achieved using oculopression; this could activate the oculo-cardiac system,² which could be blocked by retrobulbar injection of anaesthetics close to the ciliary ganglion.³

Due to technical developments, cataract surgery methods have changed since the 1970s. Operations by phacoemulsification can be performed through a clear corneal incision of 3.2mm or less. During the intervention, manipulations are performed in a closed system, and movement of the iris diaphragm caused by rapid hydrodynamic changes can be avoided. These surgical developments mean that TA is once again seen as an attractive option.⁴ TA involves anaesthetising the cornea and conjunctiva using surface anaesthetic drops. The manipulation inside the lens does not cause any pain as the lens does not contain any nerves. Under adequate surgical conditions, TA is theoretically sufficient to perform phacoemulsification. As a result, TA is now in widespread use all over the world.

However, despite the theoretically expected results, the literature shows that more patients indicate pain during surgery and report pain retrospectively after surgery when TA is used rather than retro-/peribulbar or sub-Tenon's anaesthesia.^{5,6} The combination of TA with intracameral lidocain can reduce the level of reported pain. However, this neither reduces the necessity for supplementary

anaesthesia nor improves the patient's overall satisfaction. So, based on the literature, the advantages of routinely used intracameral anaesthetics are not clear-cut.⁷

On the other hand, even if current best practice is used, the retro- and peribulbar techniques (using a sharp needle in the orbit) can cause serious and life-threatening complications⁸ in a limited number of cases (0.066%).⁹ Sub-Tenon's anaesthesia by cannula can counteract this complication, but it increases the risk of mild complications of anaesthesia.¹⁰ Moreover, these techniques can cause post-operative akinaesia,¹¹ which is undesirable in one-day surgery – an important consideration given the high (and increasing) proportion of procedures carried out in one-day surgery.

So, which anaesthetic method provides the best comfort for patients in the peri-operative period? From our published results, we compared the effectiveness for the patient of RBA and TA and tried to identify factors that increase the risk of patient discomfort or pain in the peri-operative period.¹² Our results confirmed the data from the literature: more patients in the TA group indicated pain during the procedure ($p < 0.001$). The difference between the two groups increased when the patients were later asked about the pain they had experienced during the anaesthetic procedure (including the injection in the case of RBA) and the operation itself ($p < 0.001$).¹³

A further point of interest is that with both methods of anaesthesia many more patients remembered pain at the later date than had actually indicated pain during the procedure; this result is in line with another study.¹⁴

When we excluded the data of patients who did not report any pain, significantly higher blood pressure and increased adrenalin levels were seen in the TA group. One possible explanation for this is patient fear that anaesthesia administered without a needle would be less effective. An alternative explanation is that patients did not indicate pain actually experienced during the procedure.

Analysing our pre-operative data using a logistic regression model, intraoperative pain could be predicted with 93% certainty. The type of anaesthesia and the skills of the surgeon are robust factors in predicting intraoperative pain, while higher levels of stress hormones (noradrenalin and cortisol) before surgery considered alongside patient age are also significant; the effect of hormones is seen to a greater extent in younger patients.

We measured the psychological state of the patients with State-Trait Anxiety Inventory (S-STAI) and face scale tests before the procedure, but did not find any correlation between these results and the level of pain (either indicated during the procedure or remembered afterwards).

In our follow-up study we tried to determine the cause of pain when using TA for cataract surgery.¹⁵ To standardise the environment, the surgeon and staff were the same for all patients, and we selected only patients with normal anterior chamber depth, excluding patients with hard cataracts. Out of 69 patients, seven indicated pain during disinfection or during the insertion of the eyelid speculum. One possible cause could be that the anaesthetic drop did not have a sufficient effect in the upper fornix. Another six patients indicated pain during phacoemulsification. The cause of the pain could be the fluctuation of the depth of the anterior chamber and the manipulation of the wound, but the surgeon did not report such factors.

An additional surface anaesthetic drop eliminated the pain in a few seconds, although the patient's pain was relieved in far less time than would have been required for the drop to penetrate the anterior chamber. One possible explanation for this is that the cause of pain originated from the surface of the eye because the anaesthetic effect of the eyedrop had finished; however, the presence of pain did not correlate with the length of the operation. An alternative explanation is that the origin of the pain had stopped independently of the administration of the eyedrop; however, this seems unlikely as the surgeon performed the same phaco manipulation continuously. A third possibility is that when the patients indicated pain they were told that they would receive one more anaesthetic drop, and this message alone had a psychological therapeutic effect.

Discussion

The Origin of Pain

In order to choose the best anaesthetic method for cataract surgery, we first have to know the cause of the pain or discomfort, which means analysing the steps of the operation.

Anaesthetic Method

All needle anaesthesia causes pain, but despite this some patients prefer this method of administration.¹³ Perhaps based on their own experience or misinformation from other patients or doctors, they are concerned about anaesthesia administered without

needles. The incision of conjunctiva for the insertion of blunt cannulae for sub-Tenon's anaesthesia may be painless after surface anaesthesia.

Disinfection

Normal practice is to use betadine drops, but these have a strong stinging effect; however, the correct use of surface anaesthetics could prevent this. This is important because if patients have a bad experience at the beginning of the operation, they will be aware of it during the whole procedure and their stress levels will be elevated.

Insertion of Eyelid Speculum

Even if the speculum is chosen correctly, if the patient cannot co-operate there may be pain or discomfort during the insertion. Verbal communication is important to ensure the patient's co-operation. Only the infiltration anaesthesia developed by Van Lin can block this type of pain, but the infiltration of anaesthetics also causes pain.

Microscope Light

This does not really cause pain, but can be a source of discomfort. Verbal communication with the patient can reduce or eliminate this effect. Discomfort can be further reduced by increasing the intensity of the light gradually. RBA can also reduce this type of discomfort.¹⁶

Corneal Incision

If RBA is used, the peripheral conjunctival sensor nerves are not blocked; therefore, RBA has to be combined with surface anaesthesia. Theoretically, the corneal or limbal incision never causes pain after adequate TA. Despite this, in limited cases in our experience and in reports from the literature^{14,17} some patients indicate pain at this stage of the operation. One possible reason for this is the specific innervation of the limbus.

Phacoemulsification

One possible source of pain is movement of the iris-lens diaphragm. This should not happen if the operation is carried out correctly. However, some patients indicate pain at the start of phacoemulsification.¹⁵ The pain can be eliminated through a combination of an additional surface anaesthetic drop and verbal reassurance, while continuing with the emulsification procedure. It is our assumption that real pain is not the only factor behind this discomfort; the unfamiliar noise of phaco and water flow is also a contributing factor.

Insertion of the Artificial Lens

In some cases, patients can experience discomfort when the tunnel is stretched during insertion of the artificial lens, despite adequate surface anaesthesia. This has been explained above.

The Patient's Psychological State Around the Procedure

Illness, pain and emotionally demanding situations (e.g. an injury or being frightened) are associated with certain conditions of the psyche in which suggestions have strong effects on people. Therefore, our team included a psychologist whose working hypothesis was that if patients are psychologically well prepared before the operation and this is followed by positive verbal suggestions during the procedure, their pain relief requirement will be reduced and their condition will improve faster.

The psychologist observed that during the procedure the psychological state of the patients became almost hypnotic as a result of the surgical drapes (which blocked environmental stimuli), the light from the microscope and the monotonous sounds of the instruments. This is confirmed by data in the literature on operations performed without anaesthesia.¹⁸ The psychologist used specific verbal suggestion techniques with the more susceptible patients; this worked well in terms of reducing their fear and improving patient satisfaction. She has since developed a protocol for giving positive verbal suggestions that is easy for doctors and staff to learn.¹⁹

Who Is More Susceptible to Pain and Discomfort?

Patients can be divided into two groups:

- those who do not want to know a lot about the procedure and are content to leave everything to the doctor's ability; and
- those who want to know everything about the procedure – they tend to have read a lot on the Internet or in medical books, they worry more and need comprehensive information before, during and after the procedure.

Based on the literature and our studies, younger people are more likely to fall into the latter group.²⁰

Our efforts to find psychological tests that would predict the suitability of patients for TA were not successful. In clinical practice we estimated this from pre-operative discussion and from co-operation with patients during ophthalmic examination and the biometry of the artificial lens. If patients did not co-operate well (e.g. by blinking or moving their eyes) and were more worried about the procedure, we tried to solve the problem with verbal communication. If this was ineffective, we advised specific psychological preparation. We tried to avoid using intravenous sedation and opioids, despite reports that these can reduce pain during the procedure, because of the related side effects (nausea and vomiting).²¹ The other possibility is RBA, but this can reduce patient fear only in specific cases. If patients refused this, we offered general anaesthesia.

Despite careful pre-operative selection and use of a positive verbal communication suggestion, in some cases it was difficult for the

surgeon and the anaesthesiologist to maintain the patient in an adequate surgical state right through to the end of the procedure.

Conclusion

To summarise data from the literature and our experience, today RBA has a reduced role in cataract surgery by phacoemulsification. RBA is still appropriate if the surgeon is less experienced or if akinaesia is necessary. RBA should also be considered if the patient insists on anaesthesia by needle, although other possibilities to relieve their anxiety include more specific verbal communication with the help of a psychologist or general anaesthesia.

It is questionable whether TA can prevent all autonomous and somatic reflexes in the eye during the procedure. We found that in cases where the patient experienced no pain, the objective measured parameters changed significantly in TA compared with RBA.

Finally, we would like to draw attention to the roles of pre-operative psychological selection, positive suggestive verbal communication around the surgery and patient motivation. In order to prevent unexpected surgical situations, it is better to offer patients the most appropriate method of anaesthesia rather than using a 'one size fits all' solution. ■



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