Original Article

# Caruncular Anaesthesia for Combined Cataract and Vitreoretinal Surgeries

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## Abstract

### Purpose

To describe the technique and outcomes of caruncular anaesthesia in patients undergoing combined cataract and vitreoretinal surgery.

### Methods

This prospective observational study included 60 patients with coexisting cataract and surgical retinal diseases who underwent phacoemulsification with intraocular lens implantation (IOL) and 23 G Micro-Incision Vitreous Surgery (MIVS) under caruncular anaesthesia from March 2015 to May 2024. Intra- and postoperative analgesia, akinesia, complications, and visual improvement were assessed.

### Results

Sixty patients were included. Mean surgery time was 65.4 minutes (SD = 24.9, Range: 30-125 minutes). Caruncular anaesthesia provided excellent akinesia and analgesia. Twelve patients reported mild pain during initial injection, while two required a supplemental injection during surgery. Postoperative inflammation was minimal, with 90% of eyes showing clear corneas and grade 1 or fewer anterior chamber cells on day one. Most patients (71%) experienced significant improvement in visual acuity, although outcomes were limited in eyes with advanced retinal pathology. No serious complications related to anaesthesia or combined surgery was observed.

### Conclusion

Caruncular anesthesia is a safe, effective, and reliable technique for combined cataract and vitreoretinal surgeries. It offers excellent akinesia and adequate anesthesia duration, making it a preferred technique for such complex surgeries. The outcomes of combined cataract and vitreoretinal surgeries under caruncular anesthesia were encouraging.

### Key Words

caruncular, anaesthesia, akinesia, cataract, retina surgery

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## Introduction

Microincision vitreous Surgery (MIVS) has revolutionized modern vitreoretinal surgery.[1] With MIVS, surgeries are faster, cleaner, and with minimal postoperative inflammation.[2] Though various ocular anaesthesia techniques have been employed for vitreoretinal surgery,[3] peribulbar anaesthesia is the preferred technique for most surgeons. [4]

In patients having coexisting cataract and surgical retinal diseases, combining phacoemulsification and MIVS will have significant advantages such as reducing the number of surgeries and cost along with faster rehabilitation and recovery for the patient.[5–9] However combined surgeries are longer and require prolonged anaesthesia and akinesia.

Recent reports have favoured transcaruncular and sub-Tenon's anaesthesia over peribulbar anaesthesia with an adequate duration of anaesthesia.[4] Though most publications have mentioned the technique as caruncular anaesthesia, the injection site is either medial to the caruncle or between the caruncle and plica semilunaris.[10,11] We describe an anaesthesia technique that we consider the "true" caruncular anaesthesia and share our experience with its application in patients undergoing combined cataract and vitreoretinal surgeries.

## Materials and Methods

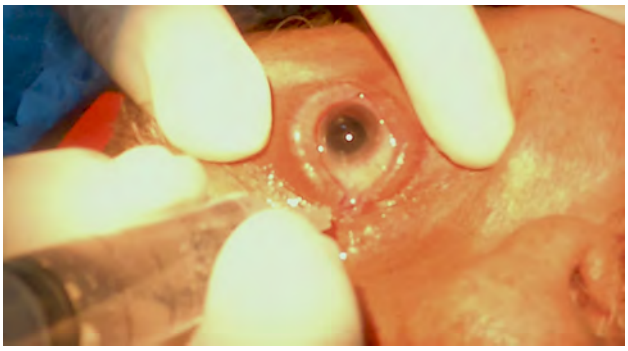
Patients with co-existing cataract and surgical retinal disease undergoing phacoemulsification with or without intraocular lens implantation (IOL) and pars plana vitrectomy (PPV) - 23 G Micro-Incision Vitreous Surgery (23 G MIVS) under Caruncular anaesthesia at our centre from March 2015 to May 2024 were included in this prospective observational clinical study. Patients with contraindications for regional anaesthesia, complicated cataracts such as brunescent nuclear cataract, subluxated cataract, cataract with pseudoexfoliation syndrome and extensive vitreoretinal pathology that require general anesthesia,were excluded from the study. All patients underwent Caruncular regional anaesthesia. All surgeries were performed by a single surgeon (BR).

The Surgeon (BR) administered the caruncular anaesthesia for all patients and assessed the extent of akinesia approximately 1 minute after the injection, before injection of Ropivocaine, at the end of phacoemulsification, and at the end of the surgery. Primary outcomes were intra and postoperative analgesia and akinesia as assessed by the surgeon (BR). Patients were asked about the pain and to describe the severity of the pain which was graded from "no pain, a little pain, a lot of pain, and too much pain" and converted to a scale of 0 to 3 for documentation, where grade 0 = no pain, grade 1 = a little pain, grade 2 = a lot of pain and grade 3 = too much pain. Pain assessment was done during caruncular anaesthesia, after creating the 23 G ports using the trocar-cannula system, at the end of the surgery, and during 1st postoperative visit. Postoperative functional and anatomical status and complications were the secondary outcomes assessed in this study.

Phacoemulsification was done through a superior clear corneal 2.8mm incision. All the patients underwent 23 G MIVS. The Trocar-cannula system (Mani Knives, Japan) was used to make the ports, and PPV was performed as per the standard procedure. In patients with traction retinal detachment, membrane removal was done with the 23 G cutter. After membrane removal, PFCL was used to reattach the retina, followed by Endo laser photocoagulation (Iridex GLX, USA). All surgeries were done with a combined anterior and posterior segment machine (Stellaris PC, Bausch and Lomb, USA).

## Caruncular Anaesthesia

After achieving pupillary dilatation with a combination of 0.5% Tropicamide and 5% phenylephrine every 15 minutes for 1 hour, 2 drops of proparacaine hydrochloride, 5 minutes apart, were instilled, The caruncular anaesthesia was administered by the operating surgeon (BR). A 27G needle (BD Microlance Needle 27G X 0.5; with an outer diameter of 0.4mm) was used. With the eye in the primary gaze, the needle was advanced through the middle of the caruncle, perpendicular to the sagittal plane for half the length of the needle, and then directed slightly medially to go the full length of the needle, approximately 13 mm. [Figure 1]



***The technique of "true' caruncular anaesthesia. The 30G needle is advanced into the peribulbar space right through the middle of the caruncle.***

The first injection was 5 ml of 2% lignocaine with 1:200 000 adrenaline[12] and 0.75% ropivacaine mixture. Hyaluronidase, 125 IU, was added to the lignocaine mixture to enhance the spread of the anaesthetic. After adequate ocular massage to achieve hypotony, a second injection of 2 ml 0.75% Ropivacaine alone was given. The second injection and supplemental injection, if needed, were given using the same technique. At the end of the procedure, all patients received 2 mL of 0.75% Ropivacaine injection for prolonged anaesthesia during the postoperative period.

## Results

Between March 2015 and May 2024, 60 patients underwent combined cataract and vitreoretinal surgery at our hospital. There were 38 (63%) males and 22 (37%) females. Thirty-two patients (53.3%) were diabetics, and the commonest retinal pathology in the series was proliferative diabetic retinopathy (PDR) and its sequelae, such as non-clearing vitreous haemorrhage (VH), traction retinal detachment (TRD), accounting for 41% of cases. In patients with vitreomacular interface disorders, 50% of patients had full-thickness macular holes. Of the 9 patients who underwent silicone oil removal along with cataract surgery, 7 had previous retinal surgery for diabetic TRD, and 3, for rhegmatogenous retinal detachment.

The average time for the combined surgeries was 67 minutes (Minimum - 30 minutes; Maximum - 160 minutes). None of the patients had any complications due to caruncular anaesthesia.

Except for a mild ooze at the injection site over the caruncle, none of the patients had subconjunctival haemorrhage or chemosis due to caruncular anaesthesia.

Twelve patients reported grade 1 pain at the time of the first injection of local anaesthetic. All patients tolerated the procedure well, with none reporting pain during the insertion of the trocar-cannula and the vitreoretinal surgical manoeuvres. All patients were comfortable at the end of the surgery and did not have any pain during the post-operative period. The level of akinesia was excellent in all patients throughout the procedure. Two patients complained of Grade 1 pain during Endo laser photocoagulation and were given a supplemental caruncular injection of 1 mL of Ropivacaine, which was adequate, and they remained pain-free throughout the rest of the procedure.

Over 90% of eyes had stable or improved vision after combined surgery with 71% of eyes with significant improvement in visual acuity. The status of the retinal disease limits the visual improvement in these eyes, and therefore, few eyes (18%) still had poor vision after combined surgery. [Figure 2]

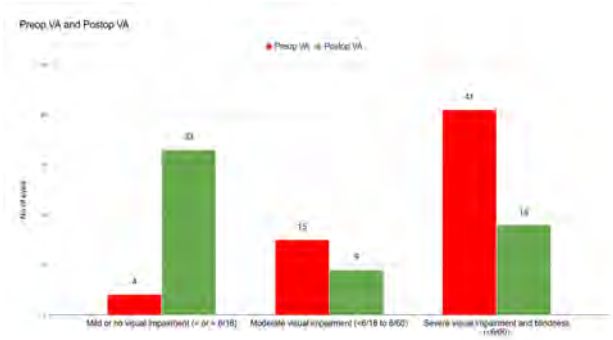
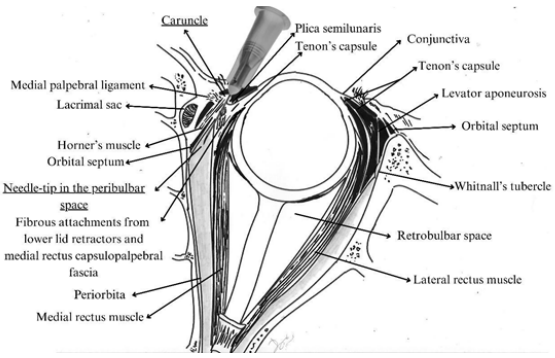



***Chart comparing the number of eyes vs degree of visual impairment pre-op and post-op showing that most eyes (90%) had stable or improved visual status after combined surgery.***

## Discussion

Cataract and coexisting retinal surgical diseases present a challenging clinical situation, at times demanding a combined surgical solution for both.[5,7–9] The choice of local anaesthesia in such surgeries depends on factors like patient and surgeon comfort, duration of action of the anaesthesia, the safety and ease of giving the local anaesthesia, and patient comfort during the postoperative period. Caruncular anaesthesia fulfils all the above criteria. Because caruncular anaesthesia is given through the caruncle with a very small gauge needle, it is relatively painless. Instilling a drop of topical anaesthetic like proparacaine before the injection makes caruncular anaesthesia painless and very comfortable for the patient. The injection is given into the peribulbar space in the medial orbit.[13] [Figure 3]




***Axial section showing the tip of the needle in the peribulbar space in caruncular anaesthesia. Note the fibrous attachments to the caruncule separating the space under it from the sub-Tenon's space. (Figure is not drawn to scale). Modified with permission from Shorr N. Transcaruncular approach to the medial orbit and orbital apex.[12]***

It is well known that the medial orbit is devoid of any major vessels and nerves and thus is one of the safest areas of the orbit to give local anaesthesia.[14] [Table 1]

***Table 1: Advantanges of caruncular anaesthesia.***

| | |
|---|---|
| 1. | Safe - no major neurovascular bundles in the medial orbit. Lesser risk because of the shorter needle |
| 2. | Less pain and discomfort - the caruncle can be anesthetized by topical anesthesia before injection of local anesthetic with a small gauge needle. |
| 3. | There is less chance of subconjunctival hemorrhage or chemosis - because the injection is through the caruncle into the peribulbar space and not through the subconjunctival or subtenon's space |
| 4. | Technically Easy - the caruncle being a visible landmark, it is easy to identify and give the injection |
| 5. | The easiest way to give supplemental anesthesia during the surgical procedure |
| 6. | The most minimally invasive technique for ocular anesthesia |

The technique of caruncular anaesthesia is relatively simple and gives adequate anaesthesia and akinesia. In this series, the akinesia and anaesthesia achieved by caruncular anaesthesia were adequate and both the patient as well as the surgeon were comfortable.

The caruncle (from Latin 'caro' = flesh) is an ovoid body, about 5 mm high and 3 mm broad, situated in the lacus lacrimalis and harbours skin elements, such as hair follicles, sebaceous glands, sweat glands, and accessory lacrimal tissue.[15,16] It is bound by the plica semilunaris temporally and by the medial canthal tendon nasally. The few fine hairs on the caruncle are believed to filter debris from the lacrimal fluid passing to the lacrimal canaliculi. The Caruncle has extensive attachment to the lower lid retractors, the medial rectus capsulopalpebral fascia, the medial check ligament, and Horner's muscle.[13,14,17] It is separated from the bulbar conjunctiva by the plica semilunaris. The connective tissue in the stroma of plica semilunaris is much denser than the surrounding bulbar conjunctiva and has tight collagenous fibres.[18] The presence of the fibromuscular attachments and fascial septa under the caruncle along with its separation from the conjunctiva by the plica semilunaris help prevent chemosis and subconjunctival haemorrhage in caruncular anaesthesia.

When compared to the traditional transcutaneous retrobulbar and peribulbar anaesthesia techniques, caruncular anaesthesia has excellent advantages. Caruncular anaesthesia is superior to sub-Tenon's anaesthesia, especially in combined cataract and vitreoretinal surgeries. Because sub-Tenon's anaesthesia involves a conjunctival incision to access the sub-Tenon's space and injecting the local anaesthetic via a blunt cannula into the sub-Tenon's space, most of these cases will have significant subconjunctival haemorrhage and chemosis (23 to 100%).[19] The presence of subconjunctival haemorrhage and chemosis can affect the placement of the corneal incision and the vitrectomy ports and can hinder both surgical procedures. A needle passing through the caruncle will enter the peribulbar space.

Some surgeons advocate a medial caruncular injection, where the needle passes at the lateral edge of the semilunar fold.[10,20] Injections through the semilunar fold or lateral to the fold may result in an inadvertent placement of the needle into the subconjunctival space or the sub-Tenon's space resulting in subconjunctival haemorrhage or chemosis. Because the caruncle is bound by fibrous tissue,[15] separating it from both the subconjunctival and sub-Tenon's space, there is less chance of chemosis or subconjunctival haemorrhage, and the site is farther away from the globe, there is a lesser risk of globe perforation.

We used Ropivacaine because, compared with Bupivacaine, Ropivacaine has a faster onset and longer duration of action with an intraocular pressure-lowering effect[21].

Combined cataract and vitreoretinal surgeries are of longer duration. As seen from this series and other recent studies, caruncular anaesthesia achieves excellent akinesia and analgesia for an adequate duration.[4,14] Caruncular anaesthesia has been proven to have a faster onset and longer duration than both peribulbar and subtenon's anaesthesia.[4] Another advantage of caruncular anaesthesia is its ease of supplementing the anaesthesia if required during surgery.[22] [Table 2]

***Table 2: Comparison of caruncular anaesthesia with retrobulbar, peribulbar, and sub-Tenon's anaesthesia.***

| **Parameter** | **Retrobulbar Anesthesia** | **Peribulbar Anesthesia** | **Sub-Tenon's Anesthesia** | **Caruncular Anesthesia** |
|---|---|---|---|---|
| Injection Site | Directly into the muscle cone behind the globe | Outside the muscle cone | Underneath Tenon's capsule | Through the caruncle into the peribulbar space |
| Needle Length | Long needle (25-27 gauge, ~38 mm) | Moderate needle (25-27 gauge, ~25-30 mm) | Blunt cannula (usually ~25 mm) | Short needle (30 gauge, ~12 mm) |
| Anesthesia Coverage | Deep anesthesia with complete akinesia | Similar to retrobulbar, with a slower onset | Good analgesia; akinesia may require additional intervention | Effective analgesia and akinesia |
| Risk of Complications | Higher: retrobulbar hemorrhage, optic nerve injury, globe perforation | The risk of retrobulbar hemorrhage is lower than Retrobulbar | Very low: minimal risk of hemorrhage or globe perforation | Minimal: avoids deep orbital structures |

| Parameter | Retrobulbar Anesthesia | Peribulbar Anesthesia | Sub-Tenon's Anesthesia | Caruncular Anesthesia |
|---|---|---|---|---|
| Ease of Administration | Requires high skill due to proximity to critical structures | Easier than retrobulbar, but still requires precise technique | Cumbersome; requires a conjunctival cut-down | Easiest and minimally invasive |
| Time to Onset | Rapid (within minutes) | Slightly slower than the retrobulbar | Slow onset (5-10 minutes) | Moderate onset (within 5 minutes) |
| Patient Comfort | May cause discomfort and pain due to larger needle, deeper injection and the transcutaneous route | Less discomfort than retrobulbar mostly requires 2 injections, transconjunctival route is less painful than transcutaneous | Comfortable, as no sharp needle is used | Comfortable, as the injection is given through the anesthetized caruncle after topical anesthesia |
| Duration of Action | Long-lasting (sufficient for most surgeries) | Long-lasting | Moderate; additional supplementation may be required | Long-lasting, enough for most procedures; |

While the duration of anaesthesia in this study was adequate, the surgeon must also be competent enough so that the surgery is not prolonged. In our experience, a combined machine with the capability of both anterior and posterior segment surgeries helps save valuable time during the switch over from cataract to vitreoretinal surgery.

## Conclusion

Caruncular anaesthesia is a safe and reliable option for local anaesthesia in combined cataract and vitreoretinal surgeries. The ease of administration as well as in supplementing anaesthesia during surgery, its safety, and duration of action make Caruncular anaesthesia the procedure of choice for local anaesthesia in combined cataract and vitreoretinal surgeries.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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