## **Research Article**



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# Effectiveness of single injection sub-Tenon's block for Pars Plana Vitrectomy and associated procedures

Chandra Mohan Kumar<sup>1\*</sup>, Edwin Seet<sup>1</sup>, Joselo Macachor<sup>2</sup>, Bakthavatsalu Maheshwar<sup>3</sup>, Audris Chia<sup>4</sup>

<sup>1</sup>Senior Consultant in Anaesthesia, Khoo Teck Puat Hospital, Singapore

<sup>2</sup>Clinical Associate in Anaesthesia, Khoo Teck Puat Hospital, Singapore

<sup>3</sup>Senior Staff Physician, Department of Ophthalmology, Khoo Teck Puat Hospital, Singapore

<sup>4</sup>Research Nurse, Department of Anaesthesia, Khoo Teck Puat Hospital, Singapore

#### Abstract

Background and objective: To determine the efficacy of a single injection sub-Tenon's block for Pars Plana Vitrectomy (PPV).

Patients and methods: Anaesthetic records and operative databases of patients undergoing PPV and associated procedures who received single injection inferotemporal sub-Tenon's block with 6mls of 2% lignocaine and 10IU/ml hyaluronidase were identified. Onset of surgical anaesthesia, surgery duration, intraoperative discomfort, time and number of supplementary injections, sedation administered and any complications were extracted

**Results:** Sixty-four records were identified. All patients were ready for surgery within 8 minutes. The time of block to start of surgery was 17 (±6) minutes. Mean duration of surgery was 88 (±30) minutes, 72% of patients did not require supplementary injection, 69% did not require sedation and no patient required conversion to general anaesthesia.

Conclusion: Single injection inferonasal sub-Tenon's block is effective in 2/3rd of patient undergoing PPV without requiring supplementary injection.

#### Introduction

Currently there are no specific guidelines concerning the safest and most efficacious mode of anaesthesia for patients undergoing Pars Plana Vitrectomy (PPV) and associated surgery. However, there is a recent Cochrane review comparing general versus regional anaesthesia [1]. Host of factors influence the specifics of PPV surgery resulting in varying preferences of anaesthesia and surgery. The choice of anaesthesia may be dictated by factors such as surgeon's preference, patient's age and preference as well as complexity of surgery, anticipated difficulty and duration of surgery [2-3]. Surgeon's preferences may be influenced by personal experience, availability of anaesthesia provider, influence of mentors, advances in technology, disease understanding, prevailing preferences of close colleagues, differential reimbursement incentives, instrument costs, personal attitude toward trying new approaches and bias [4].

Pars Plana Vitrectomy (PPV) and associated procedures (cataract surgery, scleral buckling etc.) have traditionally been performed under general anaesthesia which is more common in Europe than in the USA [4]. Patients requiring general anaesthesia tend to be younger; they are more likely to feel discomfort during regional anaesthesia and complete akinesia may not be achieved. Regional anaesthesia has increased in popularity in recent years [5-7]. Regional anaesthesia technique includes needle-based (retrobulbar and peribulbar) and cannula-based sub-Tenon's blocks. The use of topical anaesthesia (TA) in PPV surgery has been described [8] but shown to provide sufficient analgesia only in selected patients. Both retrobulbar and peribulbar blocks are used [9,10] however, they are associated with the inherent increased risk of brainstem anaesthesia, retrobulbar haemorrhage and globe perforation - especially in long eyes and thinner sclera which may the case in patients undergoing PPV surgery [11]. Although needle-based blocks may provide anaesthesia duration ranging from 45-90 minutes but they are considered unsuitable for subsequent supplementary injection due to changes in the shape of the globe which is altered intra-operatively following instrumentation.

Sub-Tenon's block requires incising the conjunctiva to gain access to the sub-Tenon's space and has been shown to be safer and effective block for vitreoretinal surgery [10,12-14]. This block has the advantages of avoiding serious albeit rare but well-known complications of the needle-based blocks [15]. The duration of anesthesia can be extended by simply injecting additional local anaesthetic agent through the initial dissection midway through the procedure on the operating table by the operating surgeon under sterile conditions [1]. Anaesthesia, akinesia and duration of sub-Tenon's block may be affected by several factors including the size of globe, orbital cavity, anaesthetic agent, volume, adjuvant and intraocular pressure lowering device [16,17]. There are wide variations in the volume of local anaesthetic agent used which ranges from 4 -10 mls [13,18]. Both single or multiple sub-Tenon's injection techniques are in use [19] but we routinely use a single injection sub-Tenon's block for PPV and associated procedures. This

*Correspondence to:* Chandra M Kumar, Senior Consultant in Anaesthesia, Khoo Teck Puat Hospital, Yishun Central 90, Singapore 7688828, Tel: +6566022317; Fax: +65660237648; E-mail: Chandra.kumar2406@gmail.com

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prompted us to conduct a retrospective case record review to assess the utility and suitability of this technique as a primary method of anaesthesia for PPV and associated procedures. We collected data on onset of anaesthesia, duration of anaesthesia, supplementary injection requirement, sedation requirement, complications arising from block and surgeon's acceptability.

#### Patients and methods

Approval from Institutional Review Board (NHG/2015/00762) was obtained for a retrospective review of anaesthetic charts and operative databases of a cohort of consecutive patients undergoing PPV and associated procedures performed by a single surgeon from the year 2014 to 2015 in the Day Surgery Operating Theatre.

The sub-Tenon's block is routinely performed on the operating table irrespective of complexity of PPV procedures after attaching monitors (ECG, pulse oximetry and non-invasive blood pressure). Surface anaesthesia of conjunctiva and cornea is achieved by topical drops of tetracaine 1% followed a few drops of antiseptic solution 5% aqueous iodine for 3 minutes. Non-toothed Moorfields forceps is used to grip the conjunctiva and Tenon's capsule followed by a small incision with Westcott scissors to expose the white sclera in the inferonasal quadrant. Injection is performed using a blunt 19G, 25.4 mm long curved metal sub-Tenon's cannula with 6 mls of 2% lignocaine and 10 IU/ml hyaluronidase. Honan balloon (intraocular pressure lowering device) is applied for 5 minutes after the injection. The onset of block (anaesthesia) is routinely assessed by observing the movements of the globe every 3 minutes in each direction of gaze (no movement, a flicker of movement, partial movement or full movement) after the removal of Honan's balloon. If muscle movements less than a flicker in all 4 gazes, anaesthesia is considered suitable for the surgery to start. If the muscle movements are more than a flicker after 11 minutes of initial injection, sub-Tenon's block is re-enforced with injection of 3 ml of 2% lidocaine through the initial inferonasal dissection area. Supplementary oxygen is administered to all patients. Intraoperative supplementary injection (top-up) with 3 ml of 2% lidocaine is administered by the operating surgeon when discomfort or pain is reported by the patient.

We collected patients' demography, onset of anaesthesia, start of surgery, duration of surgery, intraoperative supplementary injection/s, sedation and surgeon's acceptability of technique. Primary outcomes of this study to check if anaesthesia by single injection was of sufficient for the surgical procedure, need for supplementary injections as well as sedation. Data was entered in a Microsoft Excel spread sheet (Microsoft, Redmond, WA, US) and exported to the IBM SPSS Statistics program version 21.0 (IBM, Armonk, NY, USA). For each binary outcome, we used two sample t-test to compare the difference in continuous variables between the two groups of patients, and chi-square or Fisher's exact test if appropriate to test the association between categorical variables and the outcome. A p value of less than 0.05 was considered statistically significant.

#### Results

Records of 64 patients consisting of 27 females and 37 males were available for analysis. Their mean age was 58 (SD ±11) years old, mean height of 162 (SD ±9) cm, mean weight of 69.9 (SD ±13.1) kg, and mean body mass index of 26.9 (SD ±5.9) kgm<sup>-1</sup>. Five patients belonged to American Society of Anesthesiologist (ASA) physical status I, 31 patients ASA II and 28 patients ASA III. All patients achieved complete akinesia before the start of surgery. Twenty-eight percent of patients (18 out of the 64) required intraoperative supplementary injections and 31% (20 out of the 64) required sedation. The overall mean block to start of surgery time was 17 min and the mean time from sub-Tenon's block to supplementary injection was 63 min. There was no conversion to general anaesthesia.

Summary statistics comparing the group without supplementary injection versus the group with supplementary injection is shown in Table 1. Supplementary injections were more commonly employed in patients who required intraoperative gas  $(C_3F_8)$  by the operating surgeon (p values < 0.001). Surgery time was longer in the group with supplementary injections (96 min versus 85 min) but this was not statistically significant. Use of sedation was no different in patients with or without supplementary injection.

Analysis of the subgroup of patients that received supplementary injections with or without sedation is shown below (Table 2). Longer surgery times was seen in the group that received both supplementary injection and sedation compared to those without sedation (119 min versus 84 min, p value = 0.009).

#### Discussion

This retrospective study shows that a single inferonasal sub-Tenon's injection with 6 mls of 2% lidocaine and 10 IU/ml hyaluronidase provided sufficient duration of anaesthesia in 72% without requiring a supplementary injection in patients undergoing PPV and associated surgical procedures. Intraoperative supplementary injection was required in 28% of patients administered by the operating surgeon without any problem. The use of both supplementary injections and sedation were associated with longer duration of surgery. In addition, none of the cases required conversion to general anaesthesia. The surgeon was satisfied with the quality of anaesthesia and no complication related to sub-Tenon's block occurred.

Quality of anaesthesia, akinesia and duration of sub-Tenon's block may be affected by the size of globe, size of orbital cavity, local anaesthetic agent, volume, adjuvant administration and the use of intraocular pressure lowering device after the block [16,17]. Sub-Tenon's block is known to be effective but frequent intraoperative supplementary injections are required. In a study by Kwok and colleagues [20], 77% patients required 1 or 2 supplementary injection when 4 mls of 50:50 mixture of lidocaine 1% and bupivacaine 0.5% containing a total of 1200 IU of hyaluronidase was administered through single inferonasal

Table 1. Summary statistics	for supplementary injection	versus no supplementary injection
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	All (n = 64)	Supplementary Injection (n = 18)	No Supplementary Injection (n=46)	p value	
Age	58 (±11)	57 (±11)	59 (±12)	0.730	
Gender (Male:Female)		11:7	25:21	0.678	
BMI (kgm <sup>-2</sup> )	26.9 (±5.9)	27.3 (±6.7)	26.7 (±5.7)	0.749	
ASA Score					
I	5 (7.9%)	1 (5.6%)	4 (8.9%)	0.912	
П	30 (47.6%)	8 (44.4%)	23 (50%)		
Ш	28 (44.4%)	9 (50%)	19 (41.3%)		
Average surgery duration (min)	88.3 (±30.4)	95.6 (±28.9)	85.3(±30.8)	0.231	
Block to surgery start time (min)	16.8 (±5.6)	17.2(±4.3)	16.6(±6.0)	0.729	
Gas C <sub>3</sub> F <sub>8</sub> use	12 (19%)	12 (66.7%)	0 (0%)	<0.001	
Sedation use	20 (31.7%)	6 (33.3%)	14 (31.1%)	0.864	

	All (18)	Supplementary injection & sedation (n=6)	Supplementary injection without sedation (n=12)	p value		
Age	57 (±11)	55 (±11)	59 (±12)	0.392		
Gender (Male:Female)	11:7	2:4	9:3	0.141		
BMI (kgm <sup>-2</sup> )	27.3 (±6.7)	27.7 (±8.6)	27.0 (±5.9)	0.855		
ASA Score						
I	1 (5.6%)	1 (16.7%)	0 (0%)	0.294		
П	9 (50.0%)	2 (33.3%)	7 (58.3%)			
ш	8 (44.4%)	3 (50%)	5 (41.7%)			
Block to surgery start time (min)	17.2 (±4.3)	17.5 (±6.1)	17.0 (±3.4)	0.825		
Average surgery duration (min)	95.6 (±28.9)	119.2 (±26.2)	83.8 (±22.9)	0.009		

Table 2. Subgroup of patients who received supplementary injections (n=18).

sub-Tenon's injection. In another study, the number of supplementary injection was reduced to 37% when the volume of local anaesthetics agent was increased to 5 mls containing 50:50 mixture of lidocaine 4% and bupivacaine 0.75% with hyaluronidase [18]. Gil et al [19] recently used 10 mls of local anaesthetic agent (50:50 mixture of 2% lidocaine and 0.5% bupivacaine with 150 IU hyaluronidase) with two separate injections (5 mls inferonasal and 5 mls inferotemporal) in order to reduce the number of intraoperative supplementary injection. The authors managed to reduce the supplementary injection to zero. However, there are inherent increased risk of morbidities related to higher volume of local anaesthetic agent and multiple injections such as changes in shape and gaze of the globe, myotoxicity, proptosed orbit, conjunctival scarring and increased intraocular pressure.<sup>11</sup> Rise in intraocular pressure can occur in patients with smaller orbital volume and tighter orbital septum - this commonly seen amongst the Asian population [21].

Our study has a few strengths and limitations. A standardized sub-Tenon's block was used in all cases thus the influence of variation of anaesthesia technique was mitigated. The volume of local anaesthetic agent was 6 mls in all cases, irrespective of the complexity of the surgical procedures. A single surgeon operated on all patients undergoing PPV and associated procedures thus reducing the bias and confounding effects of multiple surgeons and procedures. We routinely keep the use of sedation to a minimum and only administered in selected patients with severe anxiety or raised intraoperative blood pressure because sedation is known to influence the need for supplementary injection. This is a retrospective cohort study and not without limitations. The sample size was limited and we would have liked to include more surgeons. The observations from this study are limited to Asian patients. A large sample size, prospective, randomized, double blinded controlled trial comparing variations of volume and sub-Tenon's injections (single vs multiple) would be a more robust methodology, but may not be ethically and logistically feasible. Sub-Tenon's block is associated with minor and clinically insignificant but frequent complications such as chemosis and conjunctival haemorrhage [15]. Presence of swelling and haemorrhage of conjunctiva may deter some surgeons from advocating this method of anaesthesia. Akinesia scores and surgeon's satisfaction scores were not recorded in the anaesthetic chart. We accept the feedback of the operating surgeons on the quality of anaesthesia and this is supported by continued use of the sub-Tenon's block for PPV surgery.

In conclusion, retrospective and non-comparative analysis of anaesthetic records and operative databases suggests that a single injection inferonasal sub-Tenon's block with 6 mls of 2% lidocaine and 10 IU/ml of hyaluronidase aided with Honan's balloon provides anaesthesia and akinesia for sufficient duration in 2/3<sup>rd</sup> of patients undergoing PPV surgery.

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