ORIGINAL ARTICLE

Intraocular Pressure Variation Following Retrobulbar Anaesthesia Among the Different Sex, Age and Ethnic Groups in Malaysia

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Summary

A total of 114 patients (48 Chinese, 34 Malay and 32 Indian) undergoing extracapsular cataract extraction (ECCE) with intraocular lens implantation, were enrolled. All were given 3 ml of local anaesthetic (combination of equal amounts of lignocaine 2% and bupivacaine 0.5%) using retrobulbar technique. Intraocular pressure (IOP) was measured at different time intervals; before, immediately after and 5 minutes after injection with Honan balloon compression. Mean IOP increased by 5.0mmHg immediately after injection ($p<0.001$) and reduced to baseline level after 5 minutes of external compression. Although there were no statistical difference in terms of IOP variation between sex and age groups, Chinese patients demonstrated the highest IOP rise following retrobulbar anaesthesia. This is the first study to demonstrate the influence of race in the IOP response with Chinese subjects having the highest IOP rise.

Key Words: Retrobulbar, Anaesthesia, Intraocular pressure, Race, Sex, Age

Introduction

Local anaesthesia was first described by Herman Knapp in 1884 following the discovery of cocaine. It has now overtaken general anaesthesia as the anaesthetic of choice for cataract surgery[1,2]. Local anaesthesia provides a number of advantages over general anaesthesia; there is earlier patient mobilisation due to the reduction of systemic complications such as confusion, nausea and vomiting. Retrobulbar and peribulbar administration of anaesthetic agents have always been the method of choice[3] but subconjunctival[4], sub Tenon's[5] and topical anaesthesia[6] techniques have recently gain popularity.

In University Hospital Kuala Lumpur, the retrobulbar technique remains the common practice amongst ophthalmologists and resident trainees. Although significant complications associated with retrobulbar anaesthesia such as anaesthesia-induced ptosis[6], central retinal artery occlusion[7] or bleeding[8] have been reported, they are fortunately relatively rare. One such concern is raised intraocular pressure. Although this issue has been addressed before, our research objectives are different because we were interested in the effect of sex, age and ethnic groups on intraocular pressure following retrobulbar anaesthesia.

Materials and Methods

One hundred and fourteen consecutive patients scheduled for extracapsular cataract extraction (ECCE) under retrobulbar anaesthesia in the 6 month period between July and December 1997 were recruited prospectively to the study. They comprised 48 Chinese, 34 Malays and 32 Indians and all the patients were above 40 years of age (range from 43 to 87 years). All patients were counselled regarding the study and informed consents obtained. No sedation was given preoperatively. Patients with glaucoma, ocular hypertension or previously documented intraocular pressure (IOP) exceeding 21mmHg, were excluded as were anxious patients and patients with high myopia, orbital diseases or deformities.

The study protocol involved measuring a baseline intraocular pressure using a Perkin's hand-held tonometer. Following an injection of 3ml of local anaesthetics consisting equal volume of lignocaine 2% and bupivacaine 0.5% into the retrobulbar space, an immediate post-injection IOP was taken. The eye was then compressed with a Honan balloon set at 30mmHg for 5 minutes. On removal of the device, a final intraocular pressure was recorded.

The data for all 114 patients were analysed using paired *t* test and repeated measures of analysis to assess the influence of age, sex and ethnicity on IOP changes.

Results

Of the 114 patients (Table I), there were 47 were males and 67 females with a mean age was 66 years. There were no differences between the mean ages of the Chinese (67 years), Malay (64.6 years) and Indian (64.9 years) patients. The subjects were divided into 2 arbitrary age groups; (I) 65 years and below and (II) above 65 years to compare the 59 patients above and 55 patients below this age.

The IOP of all 114 subjects demonstrated a mean increase of 5mmHg following 3ml of retrobulbar injection which subsequently decreased to within 0.8mmHg of baseline level after 5 minutes of ocular compression (Table II). This rise in pressure was statistically significant compared to the preoperative level ($p<0.001$). Similar trends were noted when the IOP was analysed according to sex and age groups but no statistical significant differences were noted between the male and female patients or between patients under and over 65 years.

Although all 3 ethnic groups experience a similar trend of IOP increase following retrobulbar injection, the Chinese patients recorded the highest mean intraocular pressure rise compared to the Malays and Indians. This mean increase of 6.3mmHg was statistically significant compared to 4.4mmHg and 3.7mmHg in the Malay and Indian patients respectively using general linear model of repeated measure analysis (Table III). There were however no differences noted between the Malay and Indian patients.

All patients underwent uneventful surgery and the IOP variations did not influence their visual outcome.

Discussion

Previous studies have confirmed that retrobulbar and peribulbar injection of local anaesthetic will cause an elevation in intraocular pressure (Table IV). Our results

Table I
Demographic Characteristics of the Study Group

		Chinese n=48	Malay n=34	Indian n=32	Total n=114
Sex :	Male	21	14	12	47
	Female	27	20	20	67
Age (mean±sd) (in years)		67.0±8.6	64.6±9.0	64.9±7.6	66.0±8.5
Age Group :	65<	21	16	18	55
	>65	27	18	14	59

Table II
Mean IOP Change (mmHg) amongst All Subjects, Different Sex and Age Groups

		IOP^0	IOP^1	IOP^5
All Subjects (n=114)		12.5±2.3	17.5±3.7*	11.7±2.6
Sex:	Male	12.7±2.2	17.7±3.7*	11.9±2.5
	Female	12.4±2.3	17.4±3.7*	11.7±2.7
Age:	65<	12.6±2.1	17.2±3.4*	12.0±2.6
	>65	12.4±2.4	17.9±3.9*	11.5±2.6

Mean ± sd
**p<0.001 (paired t test)*

Table III
Mean IOP Change (mmHg) amongst the 3 Ethnic Groups

	IOP^0	IOP^1	IOP^5
Chinese	12.9±2.4	*19.2±4.1	12.4±2.9
Malay	12.3±2.1	16.7±3.0	11.5±2.3
Indian	12.3±.2	16.0±2.7	11.1±2.3

Mean ± sd
**p = 0.003*

Table IV
Review of Mean IOP Variation (mmHg) Following Regional Anaesthesia

	Postinjection IOP	Postcompression IOP
[7]Jay et al ('85)*	+4.4	-1.8
[8]Palay & Stulting ('90)*	+6.2	-5.7
[9]O' Donoghue et al ('94)*	+5.6	+1.4
Our Results ('98)*	+5.0	-0.7
[9]O' Donoghue et al ('94)◊	+6.2	-0.6
[10]Morgan et al ('94)◊	+14.7	+0.7
[11]Bowman et al ('96)◊	+11.4	-2.4

**Retrobulbar injection*
◊ Peribulbar injection

resembled those published reports on retrobulbar anaesthesia, with a relatively similar magnitude of IOP rise above (between 4.4 to 6.2mmHg) and fall below (1.8 to 5.7mmHg) baseline level following injection and compression respectively[7-9]. With the exception of 1 study, the peribulbar technique resulted in 2 to 3 fold increases in IOP rise, which would be even higher, if no compression was given[7,9-11]. It is therefore quite clear that this increase must be related to the larger volumes (between 8 to 10ml) administered with the peribulbar technique.

Amongst the 3 ethnic groups, we have found Chinese subjects to have the highest intraocular pressure rise given the same volume of anaesthetic. The reasons are not known. From our observations, Chinese generally exhibit a smaller palpebral fissure and the globe seemed more anteriorly placed within the orbit suggesting a smaller orbital volume. Although there are no data on orbital volumes amongst different racial groups in the current literature, variation in the orbital and/or ocular anatomy may account for the racial differences in IOP response following retrobulbar injection. Presumed factors in the Chinese population which may contribute to this different response include:

a) smaller orbital volumes
b) higher intraorbital fat volumes
c) stiffer orbital septum which prevent the natural forward displacement of the globe following retrobulbar injection

The bony orbit and orbital fat volume measures approximately $30cm^3$ and $14cm^3$ respectively[12]. It is also known that orbital volumes can vary up to 7% between

orbits in the same person and up to 22% between different individuals[13]. Assuming the volume of both the orbit and orbital fat volume are constant, quite clearly 8ml of peribulbar anaesthetic will exert more pressure compared to 3ml of retrobulbar anaesthesia due to the extra volume of anaesthesia injected. Conversely if the orbital volume were smaller in Chinese patients, a fixed volume of anaesthesia will exert more pressure compared to other races as there is less space for the anaesthetic to diffuse into. However this is only speculative and more studies are currently being performed using radiological imaging techniques at this establishment.

In summary, we have demonstrated that the IOP rise following retrobulbar anaesthesia in Chinese is significantly higher compared to the Malay or Indian patients. In situations such as advanced glaucoma where an IOP spike can result in further optic nerve head damage, retrobulbar or peribulbar anaesthesia should be avoided. An alternative form of anaesthesia such as general anaesthesia or topical anaesthesia where there is no associated IOP rise, should be used instead.

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