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Optic neuropathy after repair of rhegmatogenous retinal detachment

Jonathan I. Huz¹ · Tian Xia¹ · Larry Frohman¹ · Roger E. Turbin¹ · Neelakshi Bhagat¹

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The current report describes the intraoperative clinical setting and peri-operative variables of four patients who developed optic neuropathy after pars plana vitrectomy (PPV) for repair of primary rhegmatogenous retinal detachment (RRD). Baseline history, examination, and intraoperative parameters are displayed in Table 1. All patients underwent RRD repair under general anesthesia. Retrobulbar anesthesia was given through peri-bulbar approach using a blunt cannula at the beginning/end of the surgery.

Mean duration of surgery was 98.5 min (range 62–135 min). Oxygen saturation was 100% in all cases. No prior history of

glaucoma or optic nerve disorder was elicited in any subject. Three eyes had silicone oil tamponade and one had C3F8. Figure 1 shows intraoperative OPP during the course of surgery. Of note, subject 2 experienced large MAP fluctuations resulting in low OPP (<30 mmHg for 10-min and overall <35 mmHg for 30 min). Subject 3 also had low OPP (30 mmHg for at least 10 min). Maximum post-operative IOP noted in follow-up visits, before the diagnosis of optic neuropathy was made, ranged from 15 to 26 mmHg. Optic nerve pallor was first noted at an average of 49 days (range 6–74 days) after RRD repair surgery. No eyes had segmental or

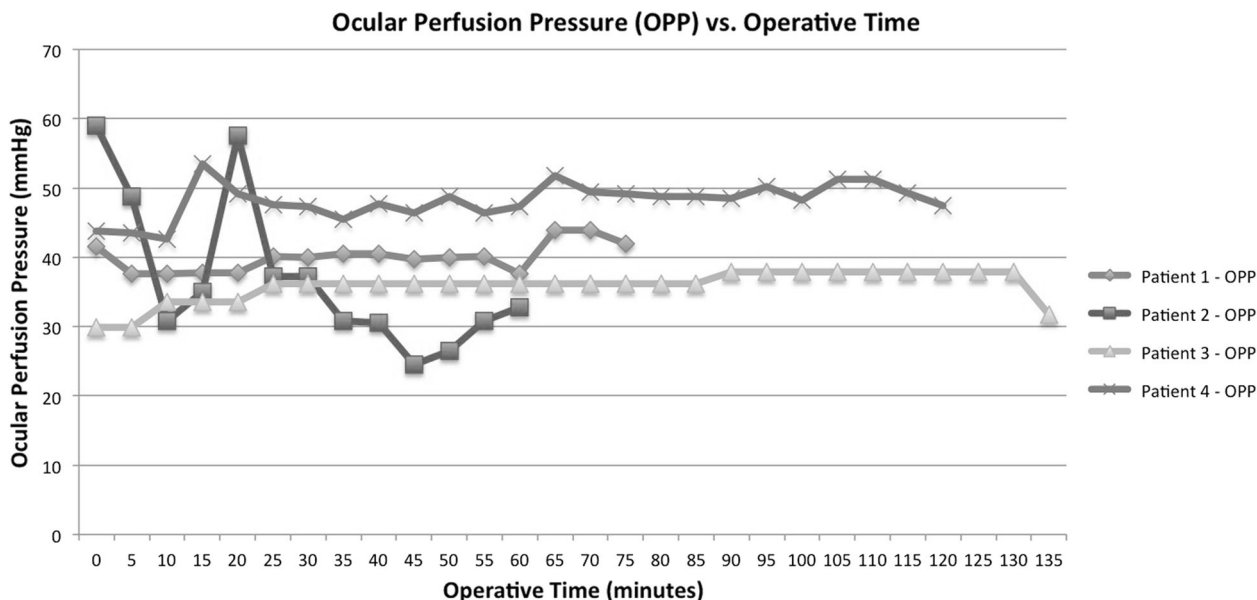


Fig. 1 Ocular perfusion pressure vs. operative time

✉ Neelakshi Bhagat
 bhagatne@njms.rutgers.edu

¹ Institute of Ophthalmology and Visual Science, Rutgers-New Jersey Medical School, Newark, New Jersey, USA

diffuse optic nerve edema, hyperemia or blurring of the disc margins on any post-operative visit. Extensive prothrombotic evaluation revealed a Factor V Leiden mutation, elevated sedimentation rate, and elevated anti-cardiolipin antibodies in subject 1, hyperlipidemia in subject 2, and hyperlipidemia and a slightly elevated C4 in subject 4.

Table 1 Baseline and presenting patient characteristics

Age (years)	Laterality/gender	Gender	Preop VA	Final VA	Preop IOP (mmHg)	Prothrombotic disorder	Presence of PVD	Macula sparing	Range of OPP ^a (mmHg)	Range of MAP ^a (mmHg)
Patient 1 27	OS	F	20/200	NLP	X	Protein C deficiency, factor V leiden, presence of anti-cardiolipin antibodies	No	No	38–51	82–98
Patient 2 54	OS	M	20/40 + 2	20/400	20	Sildenafil use, hyperlipidemia	Yes	Yes	26–73	70–122
Patient 3 26	OS	F	20/25	20/100	10	None	No	Yes	30–44	73–89
Patient 4 20	OS	F	20/20	20/400	17	Hyperlipidemia; mild elevation of C4.	No	Yes	37–51	82–98

IOP intraocular pressure, OPP ocular perfusion pressure, MAP mean arterial pressure, VA visual acuity

^a Calculation of intraoperative supine OPP was performed as described by Liu et al., using MAP values calculated as $MAP = 2/3 \times \text{diastolic blood pressure} + 1/3 \text{ systolic blood pressure}$. The calculation for OPP was $OPP = 11.5/130 \times MAP - IOP$ [3]. Reduced OPP was defined as an $OPP < 30 \text{ mmHg}$ [4]

Peri-operative hypo-perfusion of optic nerve is a well-documented phenomenon that can result in optic neuropathy [1]. Changes in mean blood pressure may have a greater effect on OPP and optic nerve head blood flow than fluctuations in IOP [1]. The optic nerve head can autoregulate its perfusion with fluctuation in blood pressure. Experiments with animal models have described that younger monkeys lose ability to autoregulate optic nerve perfusion once OPP falls below 30 mmHg [1]; no comparable human studies have been performed but similar mechanisms may occur in young adults. In this study, large MAP fluctuations and reduced OPPs (< 30 mmHg) were seen in subjects 2 and 3. Factor V Leiden mutation with elevated anti-cardiolipin antibodies in subject 1 and use of sildenafil [2] in subject 2 (detailed timeline of its use in relation to surgical repair could not be elicited) may have contributed in optic nerve perfusion. In the current study, the average age of patients was 32 years and the duration of operation ranged from 62 to 135 min. Young patients do not have as robust compensatory response to reduced perfusion pressure as older individuals [1]. The longer duration of surgery with relatively prolonged reduced ocular perfusion could have contributed to the development of ischemic optic neuropathy.

Inadvertent optic nerve touch during air-fluid exchange can also cause optic nerve injury, however, there was no record of peripapillary hemorrhage or edema or sectoral pallor of the optic nerve in these eyes. This report highlights the need to be aware of possible effects of low OPP and large MAP variations in young individuals in intraocular procedures.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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