Egress of large quantities of heavy liquids from exposed choroid: a route for possible tumor dissemination via vortex veins in endoresection of choroidal melanoma

A. M. Jousseaume · D. Wong

Received: 21 September 2014 / Revised: 16 December 2014 / Accepted: 17 December 2014 / Published online: 10 January 2015
© Springer-Verlag Berlin Heidelberg 2015

The question of whether or not it is safe to perform resection of choroidal melanoma is controversial. The immanent risk is the spread of living tumor cells during surgery.

Thus, many centers use, e.g., proton beam irradiation prior to surgery. Briefly, after proton beam irradiation, a vitrectomy is performed; posterior vitreous detachment is induced, and any exudative detachment is stabilised with PFD. Thereafter, the tumour is approached transretinally. Using a vitreous cutter, the melanoma is excised down to bare sclera. After complete haemostasis, the margin of the excision bed is secured with laser retinopexy. Subsequently, PFD is directly exchanged for 5,000 mPas silicone oil.

We report here on the rapid intraoperative egress of heavy water (perfluorodecalin, PFD) during endoresection of large choroidal melanoma. PFD is frequently used as an intraoperative tool in complicated vitreoretinal surgery, and its application during endoresection of large choroidal melanoma is well described [1, 2]. In a 62-year-old patient, a temporal choroidal melanoma was treated. The tumour had a diameter of 16.5 mm at the base, and its posterior edge was abutting the macula. The tumour was excised under elevated IOP (up to 100 mmHg with subsequent stepwise lowering of the infusion pressure to 5–10 mmHg gradually over a period of 1.5 h). Haemostasis was achieved. It was noted that the excised edges

of the tumour bed were elevated, but well stabilised by PFD. Then, suddenly, it was noted that the perfluorocarbon liquid started to drain away. Despite refilling several times, PFD seemed to disappear (up to 80 ml were used). Eventually, when infusion pressure was reduced, the egress of the heavy liquid ceased. No choroidal haemorrhage was seen during (or after) surgery. At the end of surgery, PFD was successfully exchanged for silicone oil. No reduction of silicone oil filling was noted during the follow-up period. Post-operatively, the elevated edges of the choroid at the excision site diminished. There was no other serious adverse event noted.

A second patient operated in Hong Kong underwent a similar surgery with the tumor overlaying the vortex veins. When the perfluorocarbon drained away, the surgeon decided to perform a fluid-air exchange. The anaesthetist then noticed a drop in blood pressure as reported previously by Rice et al. [3]. A heart murmur typical of air embolism was heard. The anaesthetist normally worked with neurosurgeons, and thus had a high index of suspicion, asked if we were using an air infusion in the eye. At that time, the air was being exchanged for silicone oil. The blood pressure quickly recovered and the rest of the surgery and recovery were uneventful.

We suspect that in the first case, PFD, and in the second case, PFD and air egressed out of the eye through the sclera via the cut ends of the vortex veins as a result of the raised intraocular pressure (IOP). Normally when the IOP is high, all veins including the vortex veins are compressed. However, if the choroid was excised down to bare sclera, then the portion of the vortex vein remaining would be that within the sclera. The vortex vein might be kept patent by the structural integrity of the surrounding sclera. Both PFD and air could, therefore, escape. They were forced out by the high IOP.

PFD is probably well tolerated in the systemic circulation. In the past, perfluorocarbon liquids were used clinically as

A. M. Jousseaume (✉)
Department of Ophthalmology, Charité University Medicine Berlin,
Klinikum Steglitz (CBF), Hindenburgdamm 30, 12200 Berlin,
Germany
e-mail: jousseaume@googlemail.com

D. Wong
Department of Ophthalmology, University of Hong Kong, Pokfulam,
Hong Kong

blood substitutes, anti-shock, and anti-ischaemic agents [4, 5]. Air embolism during vitrectomy was shown to be experimentally possible when air was deliberately infused into the suprachoroidal space of cadaver eyes [6]. Yet rapid egress of perfluorocarbon liquid or air embolism from the eye has never been reported during endoresection of choroidal melanoma to date. One reason might be that PFD or air (with high interfacial tension) would not normally gain access to the suprachoroidal space even when the edges of the tumour bed were elevated. We think egress of these fluids is only likely to occur when the IOP is elevated and the vortex veins are cut back to the sclera.

We believe the implications of these two cases are important. On one hand, the awareness of the potentially fatal complication of an air embolism is important. On a pragmatic level, once egression of PFD is observed, air infusion should be avoided. Instead, silicone oil could be used. The high viscosity meant that it is less likely to get out of the eye. Of even greater importance is the realisation that if PFD or air could exit out the eye, then one presumes that tumour cells in the intraocular fluids could also be driven out by raised IOP. We feel, therefore, that endoresection of choroidal melanoma, though elegant and effective, would have a small, but real risk

of inducing systemic dissemination. As such, this operation should only be carried out as adjunctive treatment after proton beam therapy or brachyradiotherapy. Doubtless, the controversy of this type of surgery is likely to continue.

References

1. Konstantinidis L, Groenewald C, Coupland SE, Damato B (2014) Long-term outcome of primary endoresection of choroidal melanoma. *Br J Ophthalmol* 98:82–85
2. Bechrakis NE, Foerster MH (2006) Neoadjuvant proton beam radiotherapy combined with subsequent endoresection of choroidal melanomas. *Int Ophthalmol Clin* 46:95–107
3. Rice JC, Liebenberg L, Scholtz RP, Torr G (2014) Fatal air embolism during endoresection of choroidal melanoma. *Retin Cases Brief Rep* 8: 127–129
4. Clark LC Jr, Becattini F, Kaplan S, Obrock V, Cohen D, Becker C (1975) Perfluorocarbons having a short dwell time in the liver. *Science* 181:680–682
5. Dixon DD, Holland DG (1975) Fluorocarbons: properties and syntheses. *Fed Proc* 34:1444–1448
6. Morris RE, Sapp MR, Oltmanns MH, Kuhn F (2014) Presumed air by vitrectomy embolisation (PAVE) a potentially fatal syndrome. *Br J Ophthalmol* 98:765–768