Letter to Editor

Ocular Venous Air Embolism during Vitrectomy for Stage 5 Retinopathy of Prematurity

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Dear Editor,

Ocular venous air embolism (OVAE) is a potentially fatal complication which has been rarely reported during vitrectomy.[1] We herein report a case of OVAE developing during surgery for stage 5 retinopathy of prematurity (ROP) and explain the possible hypothesis for the same. Consent for publication was taken from parents and Institutional Ethics Committee of our institute approved the report.

Report of a case

A 1-year-old child with stage 5 ROP was posted for lensectomy and vitrectomy under general anesthesia. The child had been fasting for 10 hours. He was intubated and maintained on oxygen, nitrous oxide (N2O), and sevoflurane. Vitrectomy infusion was secured at the infero-temporal limbus (Figure 1A).

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Two 27-gauge scleral ports were made through the iris root, 0.5mm behind the limbus with a valved trocar canula system. The scleral ports were directed into the crystalline lens and there was resistance felt while making the ports. This was followed by standard steps of lensectomy and bimanual dissection of retro-lental fibrovascular tissue. A fluid-air exchange (FAX) was done at 30mmHg to keep the raw dissected edges apart and tamponade the scleral ports. Scleral ports were removed sequentially.

No leakage of air was detected, and the ports were left sutureless. At this point, end-tidal carbon dioxide (ETCO2) dropped from 35mmHg to 16mmHg within one minute. It was accompanied by a fall in oxygen saturation from 100% at 0.4FiO2 to 68%. Heart rate of over 200 beats-per-minute and non-specific ST and T changes were noted. There was a fall in blood pressure to 69/36mmHg. Intravenous infusion line was checked for any disconnection or air entrapment. The anesthetist communicated a strong suspicion of OVAE to the surgeon. Air infusion was discontinued. Nitrous oxide was stopped, and 100% oxygen was administered. Intravenous fluid bolus was

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given at 10mL/kg and patient was placed in head down, right up position. Oxygen saturation improved to 100%, $ETCO_2$ gradually normalized, and blood pressure also recovered. No murmur could be appreciated on chest auscultation. Anesthesia reversal was uneventful. The child was monitored overnight and discharged the next day. He had a favorable anatomical outcome 3-weeks following the surgery (Figure 1B).

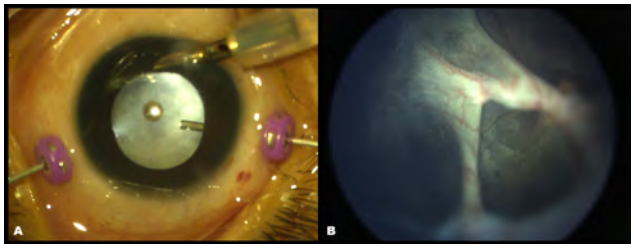

Figure 1. Intra-operative and post-operative clinical images (A) Intra-operative surgeons view of the right eye demonstrating the placement of infusion at the limbus and the active vitrectomy ports through the iris root. (B) Post-operative RetCam image showing reattachment of the retina.

Discussion

We report the first case of OVAE during surgery for stage 5 ROP. A precipitous decrease in $ETCO_2$ followed by cardio-vascular collapse are the hallmarks of OVAE.[1] The air entry into the venous system in the previously reported cases of OVAE has been hypothesised by inadvertent supra-choroidal displacement of infusion canula during FAX or directly through choroidal wounds secondary to trauma or tumour resection.[2] The unique anatomy of a stage 5 ROP eye could have contributed to the pathogenesis of OVAE in our case. The anterior vector forces have the potential to cause a ciliary body (CB) detachment in stage 5 ROP (Figure 2A).[3]

Insertion of instruments through this area can cause as well as accentuate such a detachment.[4] During FAX, the eye is insufflated with pressurised air from the vitrectomy system (Figure 2B).

During scleral port removal, this air can get sucked into the supra-choroidal space through the CB detachment (Figure 2C). Continuous pressurised flow of air through this conduit can cause rupture of vortex veins and OVAE as hypothesized before.[1,2] The prolonged fasting and use of N_2O for anaesthesia could have accentuated the effects of OVAE.[5,6]

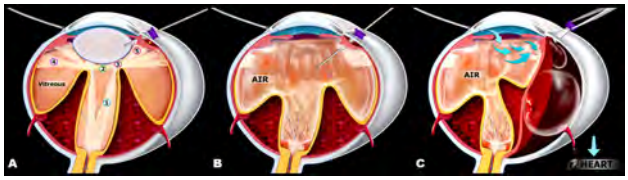

Figure 2. Illustration demonstrating possible hypothesis of ocular venous air embolism (OVAE) in stage 5 retinopathy of prematurity (ROP) (A) Vector forces in stage 5 ROP, 1. Ridge to disc 2. Ridge to ridge 3. Ridge to lens 4. Ridge to periphery 5. Ridge to ciliary body. The last two can induce a ciliary body detachment (yellow star) (B) Active air insufflation into the vitreous cavity at end of surgery. (C) Pathway of air from the vitreous cavity into the suprachoroidal space via the detached ciliary body, leading to rupture of vortex vein ampulla and OVAE.

This case highlights the possibility of OVAE in cases of stage 5 ROP with significant anterior traction. An alternate surgical technique for stage 5 ROP ensuring stable anterior chamber during surgery has been described by Chandra P et al using hybrid clear corneal entry with 23 G incisions for 25 G instruments.[7] This hybrid limbal based lensectomy and vitrectomy with sutureless closure for stage 5 ROP provides safe surgical entry and exit.

Other precautions that should be undertaken to avoid the potentially fatal complication of OVAE include adoption of a total limbal approach, documentation of CB anatomy by preoperative ultrasound bio microscopy, avoiding FAX, using viscoelastic to prevent retinal adhesions and suturing the scleral ports. If fluid air exchange is being used, nitrous oxide should be switched off before starting it.

OVAE is a rare but fatal complication. Awareness among ophthalmologists and anaesthesiologists is must and vigilant monitoring is required to prevent fatal outcomes.

Conflict of interest

None of the authors report any conflict of interest.

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