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Brief Report

Glaucoma and frequent flying

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A 58-year-old male has advanced normal tension glaucoma. He has had bilateral cataract surgery and trabeculectomy. Despite good intraocular pressure (IOP) control at 10-12 mmHg bilaterally, visual field loss has progressed.

He travels frequently for work, weekly on domestic and monthly on international flights. To investigate whether decreased oxygen saturation could be a factor in his glaucoma progression, a Fingertip Pulse Oximeter was used to measure his oxygen saturation (SpO_2) during a flight and provide an indirect measurement of arterial oxygen saturations. At ground level (5 metres above sea level at Sydney Airport), SpO_2 was 96-99%, while during cruising altitude, SpO_2 varied from 93-95%. Occasionally, it fell below 93% when he was dozing.

The author (KO) evaluated the findings personally during an international 8-hour flight with a Fingertip Pulse Oximeter (MD300C2A, Medical Development International, Beijing, China). It was a Sydney-Singapore flight (Singapore Airlines Airbus A380) and according to the captain of the flight, cabin pressure was set to simulate atmospheric pressure at an altitude of 6850 ft (2088 m).

The author's SpO_2 was 96 to 99% at sea level, and ranged from 89 to 95% during flight, giving an oxygen desaturation of up to 7% during cruising altitude. Several other volunteers reported similar findings of SpO_2 above 95% at sea level and below 95% at cruising altitude. Humphreys[1] also found in their study of 84 passengers aged 1-78 years that mean SpO_2 at ground level was 97% and at cruising altitude 93%, with 54% of passengers having SpO_2 values of 94% or less at cruising altitude.

The author also measured IOP during flight with the iCare PRO tonometer (Icare Finland Oy, Vantaa, Finland). IOP was about 12 mmHg at sea level and 14-15 mmHg during cruising altitude.

IOP is the difference between the pressure in the eye and atmospheric pressure. This can be demonstrated when an eye drop bottle is opened at cruising altitude and the contents extrude out because the pressure in the container is higher than atmospheric pressure in the cabin. Similarly, IOP would be higher when

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atmospheric pressure is lower, and rapidly re-equilibrates due to the flow of aqueous and blood in and out of the eye. Facility of outflow would be a measure of this ability to re-equilibrate, and Foulsham and Tatham reported that filtration surgery may be protective against IOP fluctuations associated with ascent to high altitude.[2]

In the literature, some researchers have reported a decrease[3] and some have reported an increase[4] in IOP at high altitude. Some have attributed IOP rise to changes in central corneal thickness, but the latter may actually be a transient effect due to relative elevation of IOP when ambient pressure is reduced.

In summary, this case report has found that oxygen saturation can decrease by as much as 7% from baseline during cruising altitude, and IOP may rise 2-3 mmHg at cruising altitude. This would not be significant on short flights for a healthy person. However, in a patient with advanced glaucoma travelling on long haul flights, prolonged mild desaturation may contribute to optic nerve ischaemia and glaucoma progression. Hypoxia may be exacerbated if the subject has sleep apnoea and falls asleep during flight, or has a lung pathology such as emphysema that causes suboptimal gas exchange.

This anecdotal information would warrant a bigger study. It would also be useful to evaluate whether using an additional glaucoma eye drop, such as timolol, brimonidine (Alphagan), or brinzolamide (Azopt) can help. Acetazolamide (Diamox) has been used to help mountain sickness by lowering blood pH to encourage hyperventilation, which in turns helps improve oxygen saturation. If there is no allergy, perhaps taking half or a quarter tablet of acetazolamide 250 mg may lower IOP and also improve blood oxygenation.

References

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