The Role of Exercise in Glaucoma Management

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Introduction

Glaucoma is a disease of the optic nerve, with progressive and irreversible loss of optic nerve fibres. Risk factors for glaucoma include intraocular pressure (IOP), age, race, family history, refractive error and vascular factors. Exercise has both short- and long-term effects on IOP and vascular factors, such as ocular blood flow (OBF). Exercise may, therefore, influence the pathogenesis and/or progression of glaucoma.

Potentially Beneficial Effects of Exercise in Glaucoma Patients

Intraocular pressure-lowering effects

Isometric exercise is defined as work performed by a muscle with no change in the length of that muscle. In general, acute isometric exercise results in acute but transient IOP reduction, which correlates with hyperventilation and hypocapnia.7

Dynamic (isokinetic) exercise is defined as work performed by a muscle with changes in the length of that muscle. Walking and swimming are examples of dynamic exercises. Acute dynamic exercise results in acute but transient IOP lowering in the post-exercise period.3 The magnitude of IOP lowering can be up to 12.8 mmHg in glaucoma patients. IOP lowering induced by dynamic exercise appears to correlate with the intensity of the exertion.1,4 and is more pronounced in glaucoma patients than in the normal population.5 It has no significant correlation with blood pressure,6 heart rate7 or hypocapnia.8 The IOP-lowering effect appears to be additive to the effects of glaucoma drugs.9 There is no significant difference in IOP lowering between aerobic and anaerobic exercises.10 Dynamic exercise results in greater IOP reduction than isometric exercise, but of shorter duration.11

The mechanisms underlying exercise-induced IOP reduction are not well delineated. Three mechanisms have been proposed: osmotic dehydration of the globe, reduced aqueous production due to reduced ultrafiltration, and a hypothalamic reflex.12 The above exercise-induced IOP lowerings were all short-lived, and their relevance in the long-term management of chronic glaucoma is uncertain. Long-term regular exercise is associated with overall improvement in physical fitness. Physical fitness appears to be associated with lower baseline IOP,13 but diminished acute IOP-lowering response to exercise.4 On termination of the exercise regimen, values return to pre-training levels within 3 weeks.14 Such sustained reduction of IOP associated with regular exercise and improved physical fitness may be more relevant to the halting of glaucoma progression, but controlled studies are needed to confirm such potential therapeutic benefits.

Effects of Exercise on Ocular Blood Flow

Reduced ocular blood flow (OBF) is a potential risk factor for glaucoma.15 In healthy subjects, OBF is unchanged during exercise due to vascular autoregulation.16 This autoregulation fails at ocular perfusion pressures greater than 67% above baseline.16 The relevance of these findings to the pathogenesis and progression of glaucoma is uncertain. The effects of exercise on OBF in glaucoma patients have not been studied.

Potential Deleterious Effects of Exercise in Glaucoma Patients

Certain isometric exercises, such as weightlifting and exercise at maximal exertion, may paradoxically increase IOP.17,18 and the increase may be even more significant when the subjects are holding their breath.19 Raised intracranial pressure may contribute to the IOP increase.20 Exercise may also provoke increased IOP in patients with pigmentary glaucoma.21 In these patients, the potentially harmful effects of exercise on IOP should be carefully weighed against the beneficial effects of exercise on general health. Young adults with advanced glaucoma may sometimes experience a temporary loss of vision during vigorous exercise. This was attributed to a ‘vascular steal’ phenomenon.22 The relevance of this phenomenon to glaucoma progression is uncertain.

Conclusions

In general, acute exercise results in an acute but transient IOP reduction in the post-exercise period. Physical fitness secondary to a long-term regular exercise regimen is associated with lower long-term baseline IOP. Certain types of exercise, e.g. weight lifting, may increase IOP. Certain subtypes of glaucoma, e.g. pigmentary glaucoma, may have IOP increased after exercise. However, it remains uncertain whether such exercise-induced IOP changes correlate with glaucoma pathogenesis and/or progression. Taking also into consideration the beneficial effects of exercise on general health and well being, the author believes glaucoma patients should not be discouraged from regular and moderate exercises.
References
