Myopia-related strabismus – heavy eye syndrome

Introduction

Myopia can be associated with any type of strabismus, but high myopia has increased frequency of esotropia and vertical heterotropia. The incidence and severity of the strabismus increases with the degree of myopia and age of the patient.

Classification

The esotropia associated with myopia could be associated with pulley displacement (strabismus fixus) or without pulley displacement.

Features of pulley displacement

1. Long axial length
2. Elderly patients
3. Marked limitation of abduction with esotropia marked as myopic strabismus fixus
4. Marked limitation of elevation with hypotropia marked as heavy eye syndrome
5. The angle of dislocation approaching 180 degrees.

The location of the rectus muscles pulley can be assessed on the CT or MRI orbital scans. Normally, the line connecting the centre of the globe to the superior rectus and lateral rectus muscles will create an angle around 100 degrees. This is the angle of dislocation of the globe and can increase to around 180 degrees in cases of pulley displacement. This usually happens due to stretching and splaying of the connective tissue band between the superior rectus and the lateral rectus muscles in high myopia patients where the posterior pole staphyloma bulges outside the muscle cone superior-temporally. This with time will lead to displacement of the superior rectus muscle nasally and the lateral rectus muscle inferiorly.

Myopic strabismus without pulley displacement

1. Moderate to high myopia with gradual onset esotropia
2. Usually young adults
3. Starts with distance esotropia and then later develops near esotropia
4. Might not be associated with diplopia if vision of the deviated eye is poor due to myopic macular degeneration
5. Ocular movements are usually full but can develop some restriction of abduction if myopia is high. This could be related to medial rectus muscle contracture
6. Minimal or absent vertical heterotropia with full elevation movement
7. Orbital scans will show normal position of the superior rectus and lateral rectus muscles.

Figure 1: Bilateral myopia associated esotropia (more obvious in the right eye) with limitation of elevation and abduction.

Management

Prisms can help if diplopia is a feature, but most patients wear contact lenses and aren't keen on using prisms. Botulinum toxin can be used as a short-term treatment option, but care should be taken while injecting as these patients have larger globes.

Surgical intervention with medial rectus recession and lateral rectus resection is usually necessary and successful in restoring ocular alignment, although calculations need to be adjusted and larger amount or surgery is needed in high myopia patients. Horizontal muscle transposition could be used as well while doing the recess / resect procedure to aid correction of the vertical deviation.

Myopic strabismus with pulley displacement (Figure 1):

Aetiology

There are several theories such as the increased weight of the globe, structural changes to the extraocular muscles or contact of the lateral rectus muscle with the orbital wall. However, recent studies suggest that there are changes in the path of the extraocular muscles through the orbit with nasal displacement of the vertical recti and downwards displacement of the horizontal recti with imaging evidence of downwards displacement of the lateral rectus muscle which could have changed its direction of pull and reduced its abduction effect. The posterior staphyloma dislocating outside the muscle cone can lead to displacement of the superior rectus nasally and the lateral rectus downwards and reducing elevation and abduction as well as mechanically restricting these ductions.

Features

1. Diplopia or concern regarding the position and the appearance of the eye
2. Large angle esotropia with limitation of abduction
3. Hypotropia with limitation of elevation
4. High myopia with long axial length
5. Secondary contracture of the medial rectus muscle
6. Evidence of muscles displacement on orbital scans.

Differential diagnosis

1. Thyroid eye disease
2. VI cranial nerve palsy
3. Congenital fibrosis of the extraocular muscles (CFEOM)
4. Orbital trauma and medial or floor fractures.

Management

Option 1: traditional surgery (recess medial rectus and resect lateral rectus): a tenotomy of the medial rectus muscle might be needed, combined with the lateral rectus resection and the use of temporary traction sutures (passed through the insertion of the superior and inferior rectus muscles) to anchor the globe in an abduction position. This option of surgical management will only work in the early stages of the condition prior to the development of significant pulley displacement. Once this displacement has developed and the lateral

rectus muscle has been displaced inferiorly, resecting that muscle will likely increase the preoperative hypotropia.

Option 2: transposition of medial rectus and lateral rectus muscles superiorly: the aim is to try and restore the natural path of the muscle. This can be achieved by superior transposition of the insertions of the lateral rectus and the medial rectus muscles. This could be combined with recession of the medical rectus and resection of the lateral rectus as well as an equatorial superior fixation of the belly of the lateral rectus muscle to try to change its pathway. This must be done with extreme care as these patients are very high myopes with very thin sclera posteriorly.

Option 3: muscle myopexy with MR recession later if needed: repositioning of the globe into the muscle cone could be achieved by closing the gap between the lateral rectus and the superior rectus muscles. This can be done by bringing these two muscle bellies closer together posteriorly doing a muscle belly myopexy using a non-absorbable suture without having to go through the sclera. This could be combined with a medial rectus recession if there is still a restricted abduction and a positive forced duction test on abduction.

Conclusion

High myopia can be associated with increased frequency of esotropia and vertical heterotropia. The incidence and severity of these imbalances increases with the degree of myopia and age of the patient and present a challenge for the managing clinician. It is important to recognise these complex cases though comprehensive clinical and orthoptic assessment, recognising their identifying clinical features and arranging suitable investigations such as neuroimaging when necessary. Surgical management is usually the way forward but can be complex and requires a high level of experience in strabismus surgery as outlined above.

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