Surgical Management of Essential Infantile Esotropia

Nicole Mocnay, BOrth&OphthSc(Hons) [1]
Konstandina Koklanis, PhD [1,2]
Zoran Georgievski, BAppSc(Orth)Hons [1,3]

[1] Department of Clinical Vision Sciences, La Trobe University, Melbourne, Australia
[2] Department of Ophthalmology, Royal Children's Hospital, Melbourne, Australia
[3] Department & Clinical School of Orthoptics, Royal Victorian Eye & Ear Hospital, Melbourne, Australia

ABSTRACT

There is universal agreement that surgical intervention is necessary to treat infantile ET, however debate regarding the timing of surgery and the type of procedure necessary to produce the best postoperative outcome continues. This paper highlights the issues regarding the management of infantile esotropia and briefly reviews a cross section of the literature.

Keywords: infantile esotropia, surgery

INTRODUCTION

Infantile esotropia (ET), or essential infantile ET (and previously commonly referred to as congenital ET), is a large-angle deviation with an onset usually in the first 6 months of life. It is characterised by a stable deviation of at least 30 prism dioptres (pd). Infantile ET is the most common type of childhood strabismus, affecting 1 – 2% of the population[1]. The aims of treatment of infantile ET are to align the visual axis and optimise the potential for binocular vision. Successful treatment will result in a small-angle ET (less than 10pd), preferably with subnormal stereopsis and peripheral fusion. There is universal agreement that surgical intervention is necessary to treat infantile ET, however, there is controversy as to the type of surgical procedure and the optimal age at which to operate.

TYPE OF SURGERY

Surgery to correct infantile ET involves adjusting the horizontally acting extraocular muscles. Surgery can be unilateral, consisting of a medial rectus recession and lateral rectus resection; bilateral, consisting of a bilateral medial or 'bimedial' rectus recession; and can include a three muscle procedure, consisting of a bimedial rectus recession with a lateral rectus resection on one side. There has been strong debate as to whether unilateral recess-resect or bimedial recession surgery is most favourable. Further, there is also controversy as to whether three-muscle surgery is optimum for treating very large angles or whether larger or augmented bimedial rectus recessions suffice.

Correspondence: **Konstandina Koklanis**
Department of Clinical Vision Sciences, La Trobe University, VIC 3086, Australia
Email: k.koklanis@latrobe.edu.au

Bimedial Recession Vs Unilateral Recess-Resect

Arnoult, Yeshurun and Mazow[2], Miles and Burian[3], Bartley, Dyer, & Ilstrup[4] and Simonz, et al[5] have compared bimedial recession with unilateral recess-resect surgery and reported variable findings. Arnoult et al[2] found that the initial operations in both groups were equally effective in terms of ocular alignment. When reoperation was required, however, the recess-resect group had significantly better results. In this study the bimedial recession group had bilateral lateral rectus resection at reoperation and the recess-resect group a recess-resect procedure of the other eye.. The authors therefore concluded that the most effective surgical approach is a recess-resect procedure, followed by the same procedure on the fellow eye if required.

Bartley et al[4], on the other hand, reported that patients undergoing recess-resect surgery achieved not only better reoperation prospects, but also better results in terms of inital ocular alignment. Similarly, Miles and Burian[3] found that the recess-resect procedure gave better results after the initial operation. However, as compared to Arnoult, this study had a larger series of patients with a relatively shorter follow-up period. In addition, a preoperative difference in visual acuity between the two groups was present which may have affected the results; patients in the recess-resect group having poorer average visual acuity (amblyopia) in the deviating eye to begin with.

More recently, Simonz et al[5] conducted a multicentre randomised study that included 120 patients. Patients were randomly assigned to receive either bimedial recession or recess-resect surgery. This study failed to find a difference

between the results of patients who received unilateral or bilateral surgery three months postopertively. However, a smaller preoperative angle was correlated with less effect.

Three-muscle Surgery Vs Large Bimedial Rectus Recessions

Proponents of large bimedial rectus recessions (of greater than 6 millimetres) argue that this procedure is simpler and less traumatic than three-muscle surgery[6], whilst those against are concerned about producing adduction deficits and subsequently a consecutive exotropia[7]. Szmyd, Nelson, Calhoun and Spratt[8], however, reported that large bimedial recessions do not significantly alter adduction, and advocated this procedure on the basis that re-operation options were significantly improved when this was performed initailly. They reported a 91% success rate with 6mm and 7mm bimedial recession surgery in deviations of ≥50pd. However, alignment was only measured 6 weeks postoperatively, which is far too short a follow-up for any conclusive remarks.

In agreement are Vroman, Hutchinson, Saunders and Wilson[9], Damanakis et al[7] and Altintas, Yilmaz, & Duman[10]. Vroman et al[9] looked at the rate of reoperation in 56 patients with small versus large angles of deviation. The success rate for alignment in patients receiving bimedial recession did not appear to diminish when applied to deviations ≥50pd or greater compared with smaller deviations. The follow-up period was 2 years, though it is possible that with a longer term follow-up a greater number of patients may have developed consecutive exotropia due to underaction of the medial recti. The authors failed to assess adduction and could not comment on the effect of large recessions on the action of the medial recti.

Damanakis et al[7] investigated bimedial recessions of 8mm in patients with infantile ET and angles of 80–90pd. With a follow-up of at least 18 months, successful alignment to within 10pd was achieved in 75% of patients; the remaining 25% were under-corrected by 15-40pd. In addition, no postoperative limitation of adduction was observed. The authors concluded that 8mm bimedial recession surgery is an effective procedure for the correction of infantile ET of 80-90pd. On a similar note, Altintas et al[10] reported that augmented (greater than 6mm) bimedial recession for larger angles is an effective procedure and produces similar results to those achieved with a standard bimedial recession surgery for smaller deviations.

Some studies investigating the effectiveness of three-muscle surgery have also suggested that augmented recessions may be a preferred option to three muscle surgery. For instance, Minkoff and Donahue[6] reported that bimedial recessions combined with one lateral rectus resection resulted in a satisfactory horizontal alignment in only 30% of patients; 60% were over-corrected and 10% remained under-corrected. However, other studies have shown that three muscle surgery can be successful. Contrary to Minkoff and Donahue[6], Forrest, Finnigan, Finnigan, & Gole[11] found their success rate of three-muscle surgery to be 78%. Their results showed that 10% of patients had residual ET and 12% had consecutive exotropia. The authors concluded that operating in a graded fashion on both medial recti and one lateral rectus in children with very large angle infantile ET has a high success rate, even over longer follow-up.

SURGICAL TIMING

There has been much controversy as to the ideal age and timing for patients to undergo infantile ET surgery; though there is general consensus that it is more advantageous to perform early surgery before the age of 2 years[12]. Despite this, the question of "how early, is early enough?" remains and there are still some proponents of late surgery. Very early surgery refers to surgery performed between 3-6 months of age, early surgery describes surgery performed before 2 years, and late surgery refers to after 2 years. Early surgical alignment minimises the duration of misalignment, therefore possibly resulting in better stereopsis[13]. Von Noorden[14] argued that early surgery provides a better chance for functional improvement, is desirable for psychological reasons, and that secondary changes occur in the extraocular muscles, the conjunctiva, and Tenon's capsule – all of which make correction at a later age more difficult and less predictable. Proponents of late surgery argue that the correction of the angle of strabismus can be more precise after 2 years of age because it can be measured more accurately, and therefore result in fewer operations[16]. There is also a chance of spontaneous remission of the ET with age[17].

Simonsz, Kolling and Unnebrink[17] recently conducted a prospective, non-randomised, multicenter trial comparing early and late surgery. They used a large number of patients from 58 clinics across Europe, and employed a range of surgical procedures. They included children with angles between 10 and 60pd. Children in the early surgery group were operated on before the age of 2 years, while those in the late surgery group were operated on after the age of 2. Children operated on before 2 had significantly better gross stereopsis at age 6 years compared to children operated on after 2. Interestingly, there was no significant difference in the angle of strabismus between the two groups at the final examination; however, the number of surgeries was higher in the early surgery group. It was concluded that early surgery for infantile ET, before the age of 2, appears warranted.

Many other studies have also suggested that early surgery is beneficial. Trikalinos, Andreadis and Asproudis[18], for instance, found that more children will experience stereopsis by the age of 8 years if they are operated on very early (at 6 months of age) and early (at 2 years of age)

than late (at 4 years of age). In addition Zak and Morin[19] showed that fusion was most frequent in the children whose eyes were successfully aligned to within 10pd by 9 months of age and least frequent when it was achieved after 18 months. Inferior oblique over-action was also less frequent when the initial operation was performed before 1 year of age.

Others have also advocated that surgery prior to 6 months of age is optimal. A recent prospective study by Birch and Stager[20] compared surgery at 6 months to surgery between 7 and 12 months in a cohort of 397 infants diagnosed with infantile ET. Postoperative ocular alignment was similar in both groups, but more children in the early surgery group demonstrated peripheral fusion, central fusion and random dot stereopsis than in the later surgery group. It was concluded that early surgery was associated with a higher prevalence of fusion and stereopsis, without adverse motor outcomes. These results are further supported by Autrata, Hromadkova and Rehurek[15] who also found that surgical outcomes improved when surgery was performed by 6 months.

Contrary to these findings, Ing[21] found no significant difference between the patients that underwent surgical alignment before 6 months compared to those who underwent alignment at 6 months of age. Ing therefore suggested that it remains controversial to recommend surgery before 6 months of age. Similarly, in another study Ing and Okimo[13] found that, the proportion of patients with stereopsis was identical for patients aligned before 6 months of age and patients aligned between 7 and 12 months of age. However, patients aligned between 1 and 2 years of age demonstrated a lower percentage of stereopsis.

One of the issues when studying the timing of surgical intervention for infantile ET is that often the duration of the deviation is neglected and only the age at surgery is considered. It is probable that conflicting finding regarding timing may be influenced by the onset and duration of the strabismus. Birch, Fawcett and Stager[22] conducted a study focusing on the duration of misalignment prior to surgery rather than the patient age at surgery. The age of onset was calculated to the nearest month according to an average of the parents' and paediatrician reports and the age at initial visit, minus the average delay between referral and scheduling of an office visit. Significantly more patients achieved random dot stereopsis when the duration of misalignment was 3 months compared to 1 year. The results suggested that early surgical alignment is associated with better stereopsis in patients who were treated before 2 years of age, as early surgery may minimise the duration of misalignment, not because alignment is achieved during a critical period of visual development. On a similar note, when Ing[23] looked at the age at which initial adequate alignment was achieved rather than age at initial surgery, he found that patients who were adequately aligned by the age of 6 months did not statistically differ from those aligned by 1 year of age. However, significantly fewer patients aligned after 2 years of age demonstrated binocular vision.

CONCLUSION

There is a large body of literature on the treatment of infantile ET, this review only providing a snapshot; however, the majority of the literature consists of retrospective and cohort studies. Due to the lack of sufficient randomised controlled trials, it is difficult to resolve the controversies concerning the ideal surgery and timing of surgery. Some authors advocate unilateral recess-resect procedures, while others prefer the bimedial recession. In cases of very large deviations, high success rates have been reported with three-muscle surgery, as well as with augmented bimedial recessions. Prospective cohort studies have found that surgical alignment is associated with better stereopsis in patients who receive surgery within the first 2 years of life, and most authors agree that surgery should be performed before the age of 2 years. Some authors have gone further and recommend surgery as early as 6 months of age. Whilst numerous studies have addressed these various issues, many aspects remain controversial and will only be resolved with higher quality evidence.

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