The use of botulinium toxin in strabology

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The author reports on the importance of botulinium toxin in strabology and specifically in early onset esotropia, that is strabismus established during the first 9 months of life with major spastic component. Injection before the age of 2 years considerably reduces the spastic factor, thereby making surgery either unnecessary or minimal. Injection is performed under general anaesthetic in infants. A few temporary side-effects do exist and parents must be warned of these. In addition to the reduction of the scale of surgery, this injection is also used to improve the treatment of motor amblyopia.

Toxin A is secreted by Clostridium botuli and acts by blockage of the pre-synaptic release of acetylcholine in the neuromuscular junction. In this way it achieves regressive therapeutic chemodenervation. Its effect is actually transitory with the regeneration of new neuromuscular plaques. Its efficiency increases over a period of around 8 days before gradually reducing over 2 to 4 months.

The toxin is efficient in weakening a hyperactive muscle, without side-effect; it is not efficient, however, on a fibrosed or retracted muscle. Because of this its usage is of particular interest in early onset esotropia.

Early onset strabismus is established during the course of the first 9 months of life and is permanent. Binocular vision is abnormal and will remain so. In such cases of strabismus there is an imbalance in the vergence tone which is often associated with an abnormality in the central nervous system or an antenatal antecedent, particularly in cases of early onset exotropia.

In these children fixation is in adduction combined most frequently with a wide angle deviation but sometimes with a microtropia, with motor abnormalities exaggerated by monocular fixation and calmed by binocular fixation. At maximum the eyes present a symmetrical cross eyed gaze (fig.1).

Fig. 1

Later, when the child learns to fix his gaze, a compensatory attitude of the head is observed, to the right the right eye is in adduction, to the left the left eye is in adduction.
In this type of strabismus the initial pathology is a permanent absence of fusion, but hope of binocular union does remain however in case of microtropia. Vertical factors come in addition to these horizontal factors (over action of the inferior obliques and dissociated vertical deviation) and manifest latent nystagmus, present in monocular occlusion and disappearing in binocular vision.

Treatment starts with assessment of the ametropia by cycloplegia resulting in the wearing of total optical correction using frames adapted to the child's morphology and involving preventive amblyopia treatment (alternating occlusion, alternating optical penalisation). Nevertheless, the use of the toxin can, by removing the large spastic component of these types of strabismus, reduce the angle to a minimum, which enables one to hope for motor fusion as quickly as possible.

It was in 1973 that Alan Scott performed the first injections for strabismus [1].

In 1976, the FDA gave its approval for its usage in strabismus at all ages and it was in 1989 that its importance in childhood strabismus was shown at the American Academy of Ophthalmology.

In 1990, 400 cases had already been published by Alan Scott [2] involving children aged between 2 months and 12 years; these were followed by numerous series by John Lee [3] and Rosario Gomez de Liano [4].

In France the Marketing Licence (Autorisation de Mise sur le Marché - AMM) in oculomotricity for Botox® (Allergan) was obtained for use in patients of 12 years and over.

Of the other toxins on the market, the toxin Dysport® is not available in strabology and the new toxin Xeomin® (Merz), the first neurotoxin without complexing protein, has not yet been granted authorisation for usage in strabismus.

**Equipment and methods**

A study of the use of botulinium toxin in 50 cases of early onset crossed esotropia was carried out between 2003 and 2009. Allergan's Botox® was used: Lyophilisate of 100 units per vial, diluted in 2 ml or 50 units per vial in 1 ml of saline solution, performing a strict subconjunctival intramuscular injection without electromyographic guide, under general anaesthetic in children. 0.1 ml was injected, i.e. 5UI in the two medial rectus muscles (fig.2).

![Fig. 2](image)

The average age at the time of the injection was 17 months, in this study 70% of the children were treated with botulinium toxin only and only 30% required additional surgery. The time lapse between injection and surgery was an average of 13 months.

**Results**

The expected transitory exodeviation of –10 dioptres was observed in 75% of cases, residual esodeviation of less than 12 dioptres in 5% of cases, less than 20 dioptres in 20% of cases and a post-injection transitory ptosis was observed in 60% of cases.

**Discussion**

The use of botulinium toxin is interesting in cases of crossed esotropia because it accelerates the re-education of motor amblyopia acting on a non-retracted muscle with greater cerebral plasticity. The
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The patient thus regains a fusion reflex and can reorganise his oculomotor balance.

The paralysis caused to the medial rectus muscles (which explains the secondary transitory exotropia) makes convergence impossible and, therefore, the accommodation, which is used to reduce the orders of hyperconvergence that can be observed in the spasms of a baby suffering from early onset esotropia.

Of course the use of botulinium toxin does not remove the need for medical treatment for strabismus (the wearing of total optical correction, prevention or treatment of amblyopia, alternating occlusion or alternating optical penalisation).

It is also interesting in acquired oculomotor paralysis of the abducens nerve (VI) in children where it contributes to combating amblyopia through neutralisation [5].

Local risks linked to the usage of botulinium toxin

Sub-conjunctival haemorrhage is possible, rare scleral perforations have been described. The most frequent complication is diffusion to the muscle alongside, notably the muscle lifting the upper eyelid (ptosis).

Adie syndrome has also been described [6].

Conclusion

The use of botulinium toxin in early onset esotropia is a simple, easily accessible treatment, it is not very aggressive and facilitates re—education of motor amblyopia, removing the spasm that is frequent in these cases of strabismus and avoiding the need for or, at worst, delaying and limiting surgical treatment.

This toxin is for use in children aged less than 2 years, acting on a nonretracted muscle with greater cerebral plasticity allowing for reorganisation of oculomotor balance. It is for deviation angles of less than 30 dioptres, in cases of larger angles additional surgery will be necessary [7].

References
