56
Botulinum Toxin Treatment of Strabismus

Alan B. Scott

In the 12 years since the beginning of strabismus treatment by botulinum toxin at Smith-Kettlewell, about 6,000 cases have been treated world-wide. Injection is particularly attractive in adults, representing an office procedure of a few minutes, requires no incision, leaves no scar, and is cheaper.

In comitant strabismus cases followed a minimum of 6 months since the last injection, correction to 5^{o} or less occurs in about 60% of cases, both in adults and in children. Correction in esotropia is 65%, and in exotropia 55%. Deviations over 20^{o} are less easily corrected than smaller ones. Except where fusion stabilizes alignment, most cases have a tendency to drift somewhat back to the original deviation over a period of years. This requires reinjection, although at progressively longer intervals. Overcorrection is truly rare because of this tendency.

In VI nerve palsy, we have been able to avoid weakening surgery on the medial rectus almost entirely, using muscle injection as the alternative. This allows us to maintain alignment during the waiting period for return of lateral rectus function, to extend this period of waiting for return of lateral rectus function, and to then operate transposition cases with less likelihood of anterior segment ischemia and with an intact medial rectus muscle to provide the largest possible range of motion. Preservation of the medial rectus length and function is the major long term advantage.

In early thyroid ophthalmopathy it is possible to inject the affected muscles and to restore alignment during the active phase of the disease. In some early cases, this has allowed continuing alignment with the possible prevention of surgery. However, in late cases or where the deviation is over 15^{o}, eventual surgery is usually required. An interesting finding is that esotropia is usually due to lateral rectus paralysis, probably from

Strabismus and Ocular Motility Disorders
Edited by E. C. Campos

compression of the abducens nerve in the posterior orbit during the active stages of the disease. This responds remarkably well to botulinum injection. The fibrotic inferior rectus contracture is less responsive.

Injection creates a period of immobility of the injected eye. It is thus possible in some cases to vary alignment with head motion, thus achieving exact alignment in some gaze positions. This has been instrumental in regaining or maintaining binocular fusion following some early nerve palsies in children where binocular vision would typically be lost. Its value in providing a basis for sensory binocularity in children is not fully investigated. Many children have binocular vision under these circumstances and make fusion movements to the four-prism-diopter test or other similar tests. These same children have a sizeable supression scotoma and are able to lose this fusion and reassume their squint angle. Definitive trials in congenital esotropia and similar groups will be undertaken to test this effect.

In some cases the treatment is ineffective or has significant side effects. A/V patterns are difficult to treat because oblique muscles are physically difficult to isolate on injection, and difficult to inject with exactly equal doses. Chronic paralyses are not treatable because the paralyzed muscle does not take up the slack created by the injection. Injection of the superior oblique or superior rectus has the effect of producing ptosis from diffusion of the drug into the levator. Similarly, injection of the upper lid for retraction creates significant and long-lasting ptosis with frequent extension to the underlying superior rectus which may create a vertical deviation. Where previous large recessions were done, injection for the resulting secondary strabismus is less effective.

At no time has there been any question of induced systemic toxicity. The estimated human toxic dose, based on our monkey studies, is about 1,000 times the beginning strabismus dose. Side effects are transient ptosis, 17%, transient involvement of adjacent vertical muscles, 12%, and occasional retrobulbar hemorrhage. No eye has lost vision from this treatment approach for strabismus.