Botulinum Treatment of Strabismus Following Retinal Detachment Surgery

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• **Twenty patients with strabismus and diplopia following surgery for retinal detachment were treated by botulinum toxin injection of the eye muscles. Twelve patients had regained fusion with elimination of diplopia in the primary position at the time of examination, 5 to 96 months after treatment (mean, 24 months). Three patients had partial diplopia elimination, and five patients continued to have diplopia.**

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Postoperative strabismus with diplopia is a serious functional problem for patients undergoing successful retinal repair.[1,2] Strabismus surgery is not always technically easy or perfectly successful in this group.[3-5] Redetachment and opening of poorly healed scleral drainage sites with vitreous loss can occur with such strabismus surgery.[6] Combined horizontal and vertical deviations are common in this group, often requiring rectus muscle operations to be separated in time or requiring operation on the fellow eye. For all these reasons, injection with botulinum toxin is an attractive alternative.

PATIENTS AND METHODS

Twenty patients with postoperative diplopia underwent 28 retinal operations. Four of these patients had unsuccessful postretinal strabismus surgery (7 operations) to repair the deviation. Visual acuity in the eye operated on ranged from 20/25 to 20/400; for 16 patients it was in the range of 20/30 to 20/60. All patients were fully informed and consenting adults were aware of the experimental nature of botulinum injection treatment. The time from detachment repair to injection ranged from 4 months to 20 years. The mean preoperative deviation for distance was 21 prism diopters (PD) (we counted the larger deviation for those who had both horizontal and vertical deviations). We advised patients in whom deviations were over 35 PD, and in whom motility restrictions seemed due to scar tissue, to have surgical repair, and most of these cases were eliminated from this series.

One injection treatment was done in 17 cases, and two or more injections were done in 3 cases. Four patients received combined horizontal and vertical muscle injections; when done at the same time, this was considered one injection treatment. All injections were into muscles of the eye operated on. All individuals were injected in an office setting and received topical anesthesia. Dosages for individual muscles ranged from 1.5 U to 7.5 U, with 5 U the most frequent initial and subsequent injection dose. All patients whose diplopia was considered to have been eliminated were followed up a minimum of 5 months after the last injection (Table).

RESULTS

Twelve of the 20 patients had a reestablishment of fusion with elimination of diplopia in the primary position. Three patients (5, 7, and 19) had a partial elimination of diplopia. Patient 5 had recurrence of esotropia about 12 months after each injection due to underaction of each lateral rectus. Patient 7 had had strabismus for 20 years, and may have been intermittently suppressing the second image rather than fusing the residual 8 PD of exotropia and 6 PD of left hyperdeviation. Patient 17 was a 92-year-old man aligned by injection for distance, but whose low accommodation convergence ratio still gave intermittent diplopia with exotropia at near fixation.

Five additional patients continued to have diplopia, although their deviations have been reduced.

COMMENT

In 17 cases of strabismus after detachment repair followed up by Mets et al,[7] the deviation spontaneously reduced during the interval 3 to 6 months after surgery by 4 PD or less in 14 cases and by 5 PD, 6 PD, and 8 PD in 1 case each. Thus, it seems unlikely that the deviations in our patients who were followed up for 6 months or less following surgery would have spontaneously resolved (case 2, 6 months, 25 PD of exotropia; case 11, 4 months, 25 PD of esotropia, 6 PD of left hypertropia; and case 18, 5 months, 20 PD of esotropia, 10 PD of left hypertropia).

No overcorrections resulted in this series; might larger doses be advantageous? In four cases these doses induced a vertical deviation exceeding 2 PDs that persisted for more than 6 months, and in two of these cases the induced vertical was a problem as great as the initial deviation. Patient 4 required strabismus surgery for the residual vertical deviation. Patient 13 continued to have vertical diplopia for the 15-month follow-up period. Many of the muscles had been previously operated on and recessed, requiring injection in the posterior orbit, where overflow from large doses to the target muscle frequently created side effects involving other muscles. Therefore, it is probably wiser to stay with smaller doses and consider reinjection when needed. Notice that medial rectus injection induces hypertropia of the injected eye (cases 1, 4, and 12) and lateral rectus injection induces hypotropia (cases 3 and 17).

There were relatively few injections per patient. There was either fusion, stabilization, and success with alignment after the first injection or failure of fusion and alignment was readily apparent, and such patients were not reinjected. The visual acuity result, deviation size, and duration of time since the retinal operation were not predictive of success or failure. We were surprised that motility restriction to passive duction (traction test) was also not predictive of injection outcome. In lateral rectus palsy cases, restriction of the medial rectus due to internal muscular contracture, responsive to botulinum, could not be differentiated from external fibrotic scarring unresponsive to botulinum.[8] We suppose that some of the restrictions in these cases were due to such contracture. However, motility restriction due to muscle weakness was a barrier to permanent correction by injection (cases 5 and 8).

Injections seemed particularly useful in the following situations: In case 1, anterior segment ischemia after the

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Patient Data											
Patient No.	No. and Type of Operation	Time Since Last Operation, mo	Visual Acuity in Eye Operated on	Deviation Before Injection, PD*	No. of Injections	Dose, U	Muscle Injected†	Deviation at Last Examination, PD‡	Diplopia, Y, N, or Partial (P)	Time Since Last Injection, mo	Comments§
1	1 Retinal	24	20/200	20 ET 5 LHT	1	1.50	RMR	2 LH	N	96	MR injection reduced hypotropia
2	1 Retinal	6	20/40	25 XT	1	5.00	RLR	6 X	N	84	. . .
3	1 Retinal	16	20/60	30 XT 16 LHT	1	6.25	LLR	Orthophoria	N	10	LR injection induced hypotropia
4	1 Retinal	9	20/60	12 ET 6 LHT	1	2.50	LMR	2 ET 12 LHT	Y	6	MR injection induced hypertropia
5	2 Retinal (R + L)	36	20/30 20/30	40 ET	10	5.00 5.00	RMR LMR	20 E(T)	P	72	Impermanent effect due to weakness of the antagonist lateral recti
6	1 Retinal	7	20/40	18 XT	1	5.00	RLR	8 X(T)	N	24	. . .
7	2 Retinal 2 Strabismus	240	20/60	30 XT	5	10.00	LLR	8 XT 6 LHT	P	12	. . .
8	1 R Retinal 1 L Retinal 3 Strabismus	180	20/40	20 ET	1	6.25	LMR	15 ET	Y	4	Poor effect due to weakness of the antagonist lateral rectus
9	4 Retinal	18	20/25	25 RHT	1	5.00	LIR	4 X	N	24	. . .
10	3 Retinal 1 Strabismus	12	20/200	10 XT 10 LHT	1	5.00	LLR	10 XT	Y	18	. . .
11	1 Retinal	4	20/100	25 ET 5 LHT	3	5.00 5.00 2.50	RMR RMR RIO	12 E	N	8	. . .
12	1 Retinal	9	20/40	6 ET	1	2.50	LMR	8 LHT	Y	15	MR injection induced hypertropia
13	1 Retinal	10	20/200	20 RXT	1	3.75	RLR	Orthophoria	N	22	. . .
14	1 Retinal	8	20/400	18 LHT	1	5.00	RIR	Orthophoria	N	5	Redetached, requiring reoperation at 5 mo
15	1 Retinal	84	20/40	16 XT 3 LHT	1	3.75 1.25	RLR RIR	10 XT 2 LHT	Y	15	. . .
16	1 Retinal	84	20/40	5 RHT	1	3.75	LIR	2 LH	N	9	. . .
17	1 Retinal 1 Strabismus	72	20/50	20 XT 6 RHT	1	5.00	RLR	8 X(T)	P	9	LLR injection reduced hypertropia
18	1 Retinal	5	20/50	20 ET 10 LHT	1	3.75 3.75	RMR RIR	Orthophoria	N	10	. . .
19	1 Retinal	9	20/30	45 XT	1	5.00	RLR	30 X	N	10	. . .
20	1 Retinal	14	20/50	12 LHT 10 ET	1	2.50 2.50	RMR RIR	Orthophoria	N	26	. . .

*ET indicates esotropia; LHT indicates left hypertropia; XT, exotropia; and RHT, right hypertropia.

†RMR indicates right medial rectus; RLR, right lateral rectus; LLR, left lateral rectus; LMR, left medial rectus; LIR, left inferior rectus; RIO, right inferior oblique; and RIR, right inferior rectus.

‡LH indicates left hyperphoria; X, exophoria; E(T), intermittent ET; X(T), intermittent XT; and E, esophoria.

§MR indicates medial rectus; LR, lateral rectus.

retinal operation made strabismus surgery seem risky. In case 2, transsection of the medial rectus 20 mm from the limbus at the time of retinal surgery was not favorable for surgical exploration and repair. Patient 5 had had a cataract removed and had a secondary lens implant and a retinal buckle on each eye. The retinal surgeon believed the patient would be at high risk for redetachment if strabismus surgery were performed. Patient 17 was 92 years of age and avoiding surgery was attractive.

In three of four cases combined horizontal and vertical deviations were corrected by simultaneous multiple muscle injections.

While full correction of large deviations is difficult to achieve by botulinum injection, some patients refused to consider another operation. The reduction of deviation and restoration of binocularity in case 5 (40 PD) and case 19 (45 PD) show that even some large deviations are treatable by injection. No complications, such as redetachment, scleral perforation, or orbital hemorrhage, due to injection occurred in this series.

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