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Botulinum Treatment of Childhood Strabismus

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INTRODUCTION

The surgical treatment of childhood strabismus has evolved over the twentieth century to its present state of refinement. In contrast, the use of Botulinum Toxin for strabismus has been limited to about one decade and also limited by US FDA restraints. The primary purpose of the initial phase of the investigation was to determine the safety and side effects of this treatment, as well as its effectiveness in a wide variety of strabismus problems. Although this was not designed to be a well controlled, definitive study comparing this treatment to surgical treatment, a great deal of very useful information has been obtained that would be of interest to strabismologists and perhaps serve as a springboard for more definitive prospective studies. The four authors have pooled their data for Botulinum Treatment of childhood strabismus where a minimum of six months follow up was available.

METHODS

A total of 413 children were treated with a follow up of six months or more in 362 (88%) of the cases. Various strabismus types were included; selection of patients was determined primarily by physician preference and parent consent rather than other pre-selection criteria. Injections were performed either using topical anesthesia, IV Ketamine or insufflation nitrous oxide. The dosage of toxin for individual muscles was 1 to 12.5 units based on the degree of deviation, body weight and the results from prior injection on that patient. Alignment data were

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

obtained with patient wearing full refractive correction when appropriate and by using prism and cover tests with distant fixation when possible. In some infants where this was impossible, measurements were determined by Krimsky or Hirschberg with near fixation.

RESULTS

The results are summarized in Tables 1, 2, and 3. More complete data will be published later this year. Of 362 patients receiving an initial injection, 35% achieved alignment within 10 prism diopters. Of the 151 patients who had multiple injections (2.6 injections), 62% were corrected to 10 prism diopters or less. Seventy-eight patients had surgery subsequent to Botulinum Toxin injections, and 83% of those had a deviation of 10 prism diopters or less at the last exam. This leads to the conclusion that injections did not impair the outcome of subsequent surgery. Transient ptosis occurred in 31% and transient vertical deviation in 16% of the patients. No globe perforations, amblyopia or visual loss produced by the injection procedure or by the drug effects in this series.

DISCUSSION

The essential statistic of these results is that 61% of the 362 children treated with an average of 1.7 botulinum injections maintained an alignment correction within 10 prism of ortho position after an average of twenty-six months of follow up with a minimum of six months follow up. Better results are obtained when treating esotropia (66%) than exotropia (45%). The difference in outcome between previously operated and not-operated cases was not great. With further refinement, i.e., bilateral injection, enhanced localization techniques, dose adjustments and treatment of younger children, it is possible that injection results may be further improved for infantile esotropia as well as other horizontal strabismus problems. Its proper place in our treatment armamentarium will gradually be established in the years ahead.

TABLE 1: RESULTS OF BOTULINUM TOXIN INJECTIONS BY CONDITION

	N	AGE (MONTHS)		PRIOR SURGERY		DEVIATION INITIAL	DEVIATION FINAL	% CHANGE	FINAL WITHIN 10 OF ORTHO		NO. INJS.
		Avg.	Range	N	%				N	%	
TOTAL	362	58	2-144	128	35	30	11	64	219	61	1.7
TOTAL ESO											
no prior op	185	47	3-141	0	0	34	10	70	121	65	1.8
prior op	80	65	6-144	80	100	25	10	62	54	68	1.6
INFANTILE ESO											
no prior op	61	25	4-96	0	0	43	10	76	40	66	2.2
prior op	46	51	6-114	46	100	28	11	61	30	65	1.6
SENSORY ESO	14	58	13-123	3	21	34	19	43	4	29	1.7
RESIDUAL ACCOM ESO	90	67	8-141	8	9	27	8	71	64	71	1.5
OTHER ESO											
no prior op	31	43	3-113	0	0	36	13	64	18	58	1.4
prior op	20	80	11-144	23	100	20	7	65	19	83	1.7
TOTAL EXO											
no prior op	49	73	2-140	0	0	32	15	51	19	39	1.3
prior op	48	72	12-144	48	100	20	11	45	25	52	1.6
INTERMITTENT EXO	21	72	16-134	3	14	28	15	47	6	29	1.3
SENSORY EXO	3	118	111-126	1	33	25	5	81	3	100	1.3
OTHER EXO											
no prior op	29	74	2-140	0	0	33	17	49	11	38	1.4
prior op	44	68	12-144	44	100	20	11	47	24	55	1.6
PARALYTIC	21	47	2-113	2	10	40	16	59	12	57	1.3
NEUROLOGICAL	9	50	21-96	4	44	22	7	68	6	67	1.8

TABLE 2: RESULTS OF BOTULINUM TOXIN INJECTION BY LENGTH OF FOLLOW UP AND NUMBER OF INJECTIONS

	N	AGE (MONTHS) Avg.	Range	PRIOR SURGERY N	%	DEVIATION INITIAL	FINAL	% CHANGE	FINAL WITHIN 10 OF ORTHO N	%	NO. INJS.
TOTAL											
1 inj.	211	62	2-144	83	39	28	11	61	125	59	1.0
2+ injs.	151	51	3-144	45	30	34	11	67	94	62	2.6
Follow up											
6-12 mo.	77	61	6-135	31	40	30	10	66	45	58	1.7
13-24 mo.	109	58	6-144	40	37	30	11	63	65	60	1.6
25+ mo.	154	58	4-144	50	33	30	8	72	109	71	1.7
ESOTROPIA											
1 inj.	144	59	5-144	50	35	28	10	65	94	65	1.0
2+ injs.	121	44	3-135	30	25	36	10	71	81	67	2.6
Follow up											
6-12 mo.	50	55	6-132	15	30	32	9	72	35	70	1.8
13-24 mo.	84	56	6-144	30	36	30	10	66	54	64	1.7
25+ mo.	115	49	4-135	32	28	32	7	77	86	75	1.7
Prior overcorrections of XT	14	87	36-144	14	100	21	4	79	13	93	1.6
Prior undercorrections of ET	44	51	6-114	44	100	28	11	63	29	66	1.7
EXOTROPIA											
1 inj	67	69	2-140	33	49	26	13	50	31	46	1.0
2+ injs.	30	79	12-144	15	50	26	14	46	13	43	2.5
Follow up											
6-12 mo.	27	73	16-135	16	59	26	13	50	10	37	1.6
13-24 mo.	25	65	17-134	10	40	28	12	56	11	44	1.2
25+ mo.	39	83	10-144	18	46	25	12	52	23	59	1.5
Prior overcorrection of ET	35	70	12-144	35	100	20	11	48	20	57	1.6
Prior undercorrections of XT	1	73		1	100	18	12	33	0	0	3.0

TABLE 3: SUMMARY OF RESULTS -- STRABISMIC CHILDREN

AGE	N	% WITHIN 10 PD OF ORTHO
2-12 mo.	41	56
13-24 mo.	49	69
25-144 mo.	272	60

INITIAL DEVIATION	N	% WITHIN 10 PD OF ORTHO
10-20	123	73
21-30	102	52
31-50	112	55
51-110	25	60

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