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THREE CASES OF SPASTIC HEMIPLEGIA TREATED
BY OPEN TENOTOMY OR MYOTOMY IN
THE FOREARM AND HAND.

By AUGUSTUS THORNDIKE, M.D.,

BOSTON.

ALTHOUGH neurologists have not as yet expressed their approbation of tenotomies for the amelioration of the gait in cerebral spastic paraplegia of children (Little's disease), yet the published experience of many, like Rupprecht¹ in Germany, Adams² in England, Bradford³ and Bullard, Scudder,⁴ Willard⁵ and others in this country, has led orthopedists to regard spastic paralysis of the lower limb as a condition usually remediable under surgical treatment with or without the use of apparatus. The present attitude of many nervous specialists is shown by the following quotation from Gowers's *Diseases of the Nervous System*, vol. i. p. 453, edition of 1892: "The tendo Achillis is sometimes divided for contracture of the calf-muscles, but the operation is useless and ought never to be performed." Nevertheless, I venture to say that there are few orthopedic surgeons in this country who have not seen good, nay, even brilliant, results from this very operation.

In the upper extremity, however, the task of restoring the impaired function presents difficulties which do not occur in the leg and foot; instead of merely improving locomotion, the operation aims to restore the power of grasping and lifting with the hand, and to obtain, if possible, precise and delicate motions with the fingers, and comparatively few have attempted it. It follows as a matter of course that very few such operations have been published,

¹ Volkmann's klin. Vorträge, p. 172.

² Adams: Lancet, September 27, 1891.

³ TRANS. AMERICAN ORTHOPEDIC ASSOCIATION, vol. iii. p. 7.

⁴ Ibid., vol. iv. p. 366.

⁵ Ibid., p. 391.



and I shall therefore confine myself to a report of three cases—one of Dr. Bradford's, one of Dr. Burrell's, and one of my own—all hitherto unpublished, and in all of them the condition of the hand is known more than one year after operation.

No claim is made to a permanent and absolute cure; for although many of the results obtained in the foot have been brilliantly successful, it does not seem possible that dividing with the knife the bellies or tendons of the affected muscles can cure the central nervous lesion on which the condition depends. All that is claimed here is that in these few cases of tenotomy or myotomy in the forearm and hand—cases where the operator felt that he was invading the dangerous ground of experimental surgery and was taking great risks in a locality where septic infection would be disastrous in the extreme—in all three of these cases there has been some improvement of function.

It was not my intention to refer to trephining and the older operation of nerve-stretching for the relief of spastic hemiplegia; but I believe that the results here reported show greater improvement in the utility of the hand than any recorded cases where the lesion has been localized and attacked at its focal centre.

CASE I.—Miss X. was a private patient of Dr. Bradford's, who has kindly given me the following notes: At eighteen months she presented herself with spastic hemiplegia of the right hand and foot. The foot was in a position of moderate equinus; the knee was not affected; the adductors and other thigh muscles not involved; ankle clonus was present. The arm hung with the elbow semiflexed, the hand in extreme pronation, the wrist slightly flexed, the fingers and thumb not bent, but the thumb carried in on to the palm of hand. After the tenotomy of the tendo Achillis the child soon learned to walk, and the arm was at first treated by massage only. This was five years ago. No apparatus was used after removing the plaster bandage on the foot. As the child grew older she learned to use her hand a little, but the mother insisted on having the same operation performed on the hand as on the foot, and two years after the tenotomy of the tendo Achillis, Dr. Bradford divided all the flexor group of muscles in the forearm by an oblique incision starting two fingers' breadth below the bend of the elbow

at the inner border of the supinator longus muscle, and extending obliquely inward and downward to the inner surface of the forearm, taking care in deepening the incision to avoid the median nerve and ulnar artery, which were found and isolated by the anatomical rules usually employed. The operation was done under ether, and was rendered bloodless by the Esmarch method. After all the muscles of the forearm arising from the internal condyle of the humerus had been divided, the resulting dead space was left to heal by blood-clot; the skin was sutured over it, baked dressings applied, and a plaster bandage held the wrist and elbow straight with the hand in extreme supination. Several weeks later the plaster was removed, the wound was all healed, and massage was employed as before. It is now three years since the operation, and the patient still comes in occasionally for observation. She can do many things with her hand and fingers, but as the biceps was not divided there still remains a little flexion at the elbow. The improvement in this case was very great, and the hand is a very useful one.

CASE II.—E. W., a colored girl, first brought to the Children's Hospital as an out-patient in March, 1883. She was a year and a half old. She presented a right-sided hemiplegia, which had been noticed for about one year. The arm was flaccid, and the leg had been stiff for about six months. She did not return after her first visit until she was ten years old, when she was admitted by Dr. Burrell to the hospital for operation. At that time (September 9, 1890) the arm hung by the side, and the thumb was flexed stiffly on the palm, and all attempts to extend it beyond a certain point caused great pain. The hand at the wrist was drawn over to the ulnar side and somewhat flexed, and the elbow was also a trifle bent. Under ether the Esmarch bandage and tourniquet were applied, and three incisions were made by Dr. Burrell as follows: first incision, along the web between the thumb and forefinger, dividing the tendons of the flexor brevis pollicis; second incision, three-quarters of an inch long, made in the palm at the base of the thenar eminence and dividing the palmar fascia, which was tense; the third incision was a small one over the flexor carpi ulnaris tendon just above the bend of the wrist, dividing that tendon and several adjacent ones which felt tightly stretched. The wounds were closed by continuous catgut

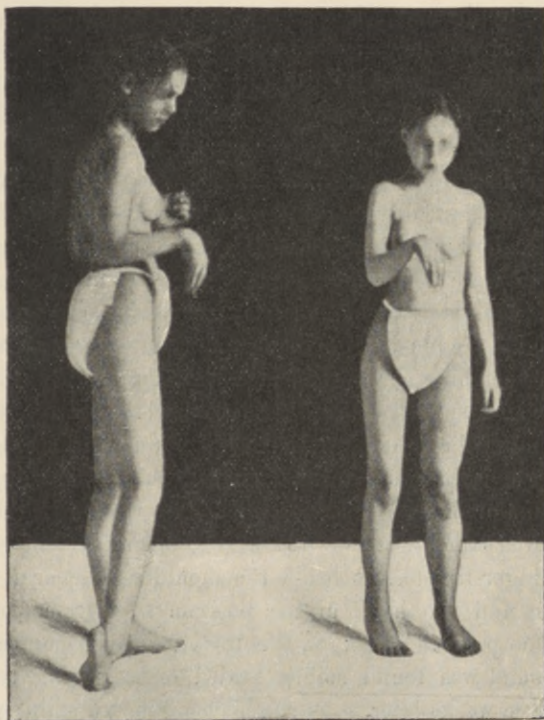
sutures in the skin; a baked dressing was applied, the deformity reduced, and the hand bandaged to a straight palmar splint with the thumb abducted. The incisions healed without mishap; she continued to wear the splint for about two months. When last seen in January, 1891, four months after the operation, she was gaining in power in using her thumb. I have since heard, through Dr. Bullard, from the child's mother. She came to see him, and in reply to his questions said that the thumb still remains extended, with very little grasping power. The hand is still a little drawn over. She goes to school, but is backward mentally. She still holds her elbow somewhat bent, although she can extend and use it. In this patient the improvement was not very great; but it is possible that had she not been mentally deficient she might have learned to use her hand to better advantage; for there is no doubt that much of the improvement in my own case, which follows, came from the after-treatment—electricity and training the muscles by mild exercises.

CASE III.—M. C., aged fourteen years, was referred from the Children's Hospital to the House of the Good Samaritan, on account of her age. She entered on March 3, 1891, and the following history was obtained. She was a well child until two years ago, when after vaccination she had a copious eruption of boils, during which she was suddenly seized with convulsions lasting over an hour, and on coming out she was found to be paralyzed over the right side of her body. In a few weeks power began to return, first in the hip and shoulder, then in the elbow and knee, but she has never gained much in her foot or wrist. The stiffness has been there almost all this time. She was a large, well-nourished girl, not especially bright, but not much below the average of her age in school attainments, and certainly not mentally deficient. There was no facial paralysis. The habitual position of the arm, hand, and leg may best be seen by referring to the accompanying photographs. Both leg and arm were extensively atrophied, and the hand was held flexed at right angles with the wrist; the thumb was folded on the palm and usually the fingers closed over it. On attempting to open the fingers or bend the wrist, resistance was encountered unless the force was applied very gradually and gently, when all resistance immediately vanished. All deep and superficial reflexes on the right side were increased. The fingers were neither

blue nor cold; the right shoulder was a little the higher, and there was a slight lateral deviation of the spine. In the leg the knee-jerk was much increased, and the ankle clonus was very troublesome, as it came on at every step. There was half an inch of absolute

FIG. 1.

FIG. 2.



Shows the position.

Shows the atrophy.

shortening in the leg and a still greater difference in the arms. The atrophy is shown by the following measurements :

Measurement around the upper arms : right, $8\frac{1}{4}$ inches ; left, $9\frac{1}{4}$ inches.

Measurement around the forearm : right, 7 inches ; left, $8\frac{3}{4}$ inches.

Measurement around the thigh : right, $16\frac{1}{2}$ inches ; left, $18\frac{3}{4}$ inches.

Measurement around the calf : right, $11\frac{1}{2}$ inches ; left, $13\frac{3}{8}$ inches.

The right humerus measured $10\frac{1}{2}$ inches, the left 11 inches.

The right ulna measured $8\frac{3}{4}$ inches, the left $9\frac{1}{4}$ inches.

A large amount of shortening for the arm, considering the comparatively brief duration of the affection—two years.

The foot was first corrected by a subcutaneous tenotomy of the tendo Achillis and plantar fascia. Plaster-of-Paris bandages were immediately applied and kept on for three weeks, after which a Taylor club-foot shoe was worn. She now wears a light outside steel shoe with a right-angled catch at the ankle, and a high sole on her boot compensates for the shortening, so that she now walks without limping.

After correcting the foot, a second operation was performed, one month after the first, on the arm, following the same incision which Dr. Bradford had used in Case I. of this series. The median and ulnar nerves were found by dissecting for them, and the line of incision was carried straight down to the interosseous membrane so as to divide all the muscles of the flexor-pronator group, leaving the two nerves stretching across the space between the divided ends of muscle—a dead space of about an inch and a quarter, which was left to fill in and heal by blood-clot. The ulnar artery was not to be found; the radial was large and was drawn aside with the belly of the supinator longus muscle. The skin was united by catgut sutures, and a baked dressing and plaster-of-Paris bandage applied from the finger-tips to just below the shoulder—the arm bent at a right angle and the hand in the position of extreme supination. There was no pain to speak of, the temperature remained normal, and the wound was found solidly healed on removing the plaster bandage three weeks later. After this a millboard splint was worn, and the child encouraged to use her hand without the splint for an hour or two daily, gradually lengthening the periods of exercise until the splint was wholly discarded. The arm was at first very weak, but a little voluntary flexion of some of the fingers was possible, and there was no stiffness. In a few days, however, there appeared a tendency for the hand to return to the old position of pronation and for the fingers to flex, and this tendency progressively increased in a most discouraging fashion. The extensor group of muscles was weak, and what was at first parietic wrist-drop gradually became stiff and contracted as before, only not to so great an extent. Under electricity and careful teaching she nevertheless learned to

use her hand a little, and could even hold a crochet-needle and do simple crochet-work before leaving the hospital.

Since then she has been to the Out-patient Department for Nervous Diseases at the Children's Hospital, where Dr. Bullard and Dr. Burr have continued the electrical treatment begun at the House of the Good Samaritan. I saw the patient twice in April of this year—one year after the second operation. Her mother had died meanwhile, and the young girl had taken her place, doing all the housework and cooking for her father and the two younger children. She had improved a great deal in using her hand, could feed herself, sweep the floor, stir the saucepans, and make the fire, using her right hand to a certain limited degree; but she could not lift more than one or two pounds with her right arm. This case also, like Dr. Bradford's, shows a great gain in the utility of the hand.

In conclusion, let me call to your attention that in the first case, Dr. Bradford's, where the best result was obtained, the patient was younger, only three and a half years old, instead of ten and fourteen, the ages of the other two respectively. Massage had also been carefully tried for two years, with very little success prior to the operation, and the exercises and massage have been carefully followed out ever since. In Dr. Burrell's patient, however, the final gain was very slight, according to the mother's statement to Dr. Bullard. This child was certainly gaining at the time she ceased to attend the Children's Hospital clinic; but owing to her mental deficiencies she had been unwilling to persevere in following out the exercises, and when left to her own devices she omitted them entirely, and her hand speedily relapsed very nearly into its former state. My own case also emphasizes strongly the necessity for care and perseverance in the after-treatment, for there is no doubt in my mind but that she would have followed in the footsteps of Dr. Burrell's patient had she not been a bright and willing girl, ready to persevere and work in exercising her fingers and to come regularly for her electrical treatment.

These cases are too few to draw conclusions from, nevertheless they do appear to show that improvement may be obtained after tenotomy or myotomy of muscles of the forearm. Also that much of the success should be attributed to careful training of the divided muscles for months after the operation.

