A New Operative Treatment for Selected Cases of Cerebral Spastic Paralysis

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NEW YORK

Reprinted from The Journal of the American Medical Association
Feb. 6, 1915, Vol. LXIV, pp. 482-487

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AMERICAN MEDICAL ASSOCIATION
FIVE HUNDRED AND THIRTY-FIVE NORTH DEARBORN STREET
CHICAGO
A NEW OPERATIVE TREATMENT FOR SELECTED CASES OF CEREBRAL SPASTIC PARALYSIS*

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This paper is merely the report of the operative treatment of sixty-five cases of spastic paralysis showing intracranial pressure by an ophthalmoscopic examination. These sixty-five operated cases are the ones selected as being suitable for the operation from the examination of 201 cases of spastic paralysis, that is, one in about every three cases examined. Although only a little more than a year has elapsed since the first operation, which was performed in June, 1913, yet our results have been so gratifying and even startling, that we feel justified in presenting the progress of the cases treated by us up to the present time. Naturally, sufficient time has not yet elapsed to permit us to say whether the improvement in our cases will be a permanent one or not; and yet, in view of the pathologic lesions producing this type of spastic paralysis, we do not see why the improvement should not become more and more marked as the children grow older.

Let us emphasize first, that we are not operating on the mentally deficient, the constitutionally inferior and idiots in the hope of restoring them to a normal mentality; and secondly, that we are not operating on microcephalic children in the belief that the brain will develop and become normal by enlarging their cranial capacity (a belief long exploded); and thirdly that we are not operating in cases of spastic paralysis due

*The preliminary report of this work appeared in The Journal Nov. 29, 1913, p. 1982; at that time, the operation had been performed in only twelve cases.
to a lack of development and malformation of the cortex of the brain and the pyramidal tracts—cases forming at least one-half of the total number of spastic paralyses—the so-called Little's disease in which a cranial operation will do no good, and from the very pathology of which a cranial operation can be of no benefit to the patient. On the other hand, we are operating in those cases of spastic paralysis giving a history of difficult labor with or without instruments, in which ophthalmoscopic examination the definite signs of increased intracranial pressure are to be seen on the fundus of the eye; that is, only those cases of spastic paralysis which show definite signs of increased intracranial pressure, whether this condition is associated with impaired mentality (and it very frequently is the result of prolonged pressure on the cortex of the brain) or whether the size of the head is unusually small or unusually large. If in the latter cases there is an increased intracranial pressure, then that pressure should be relieved in the hope that the spasticity will lessen and the mentality be improved. Naturally, the most satisfactory and desirable cases for operation are the ones with slight impairment of the mentality, but these cases are rare when the intracranial pressure has been present for several years; much more commonly do we find a more normal mentality in those cases of lack of development and malformation of the pyramidal tracts unless very extensive.

The condition of spastic paralysis results most frequently from a lesion of the brain occurring before birth, during birth or shortly after birth. It is characterized by more or less complete paralysis of the part affected, and is associated with a stiffness or spasticity depending on the extent of the involvement of the pyramidal tract; this hypertonicity produces muscular contractures and deformities, usually flexor in type, with a corresponding overstretching of the opposing muscular groups, usually the extensors. In mild cases, however, the spasticity may be so slight as to cause little or no deformity, but merely an awkwardness of the part affected. Frequently, athetoid movements of the arms and legs may be observed, and epileptiform attacks, commonly of the jacksonian type, may occur.

As the child grows older, not only do the spasticity and its resulting contractures increase in a large percentages of cases, but also the mentality of the child becomes impaired, and this impairment continues until the child may be considered a defective, or still further, an imbecile, and only too frequently an idiot.

One of the most common lesions of the brain producing spastic paralysis is that of intracranial hemorrhage of the new-born. It is of venous origin most frequently, especially the veins overlying the cerebral cortex and the venous tributaries of the longitudinal sinus, and in the more extreme cases, even the longitudinal sinus itself may be ruptured; the overlapping of the parietal bones during parturition is the common cause for the injury of the sinus. Naturally, the use of forceps in difficult labor is an important causative factor in a large number of cases. However, any prolonged difficult labor increasing the cranial venous stasis and partial asphyxia of the child may be sufficient to rupture the delicate vessels overlying the cortex of the brain, and in this way a hemorrhagic clot forms over the surface of the cortex. In some cases, the hemorrhage is cortical or subcortical, and therefore, in these cases, direct injury and damage is done to the cortex itself—even a destruction of cortical nerve cells and their fibers whereas in the usual cases in which the hemorrhage occurs on the cortex rather than within the cortex, any damage to the cortex is the result of the pressure of the overlying clot and not a primary destruction of the cortex itself, i. e., if it were not for the pressure of the overlying hemorrhagic clot, the cortex would not be damaged at all, and its nerve cells would be able to function normally; on the other hand, if the hemorrhage is in the cortex or is subcortical, then a real destruction of tissue occurs and once destroyed, there is no regeneration.

According to the extent and pressure of this hemorrhagic clot on the cortical surface, do we find clinically the signs of such interference of the pyramidal tract; if over the upper portion of both motor areas, then both legs are affected, and a spastic paraplegia results; if over the upper two-thirds of both motor tracts, then both the arms and legs are involved and a spastic diplegia results, whereas if the entire motor area of both cortical hemispheres are compressed, then
the extreme form of spastic diplegia results—legs, arms, throat and face are all affected; these extreme cases are the most pitiful ones and fortunately the patients rarely live beyond the age of puberty. In the majority of spastic cases, however, the hemorrhage extends over one cortical hemisphere alone, the other hemisphere remaining unimpaired, so that a spastic paralysis of the leg or arm occurs opposite to the hemisphere affected; if the hemorrhage extends only over the upper portion of the motor area, then a monoplegia of the opposite leg results, and if over the upper two-thirds of the motor area, then a spastic paralysis of both the arm and leg, and if over the entire motor area, then a total spastic hemiplegia of the opposite side of the body occurs. The upper portions of the motor areas are usually more compressed than the lower portion because the hemorrhage is here greater, and as the clot extends down over the cortex it rapidly thins so that we may have a marked spastic paralysis of the leg, and yet the arm may be but slightly affected—merely an awkwardness, and the face not at all involved. Then again, absorption of the clot is a most important factor in lessening the extent of the paralysis; in some cases of mild hemorrhage, the clot may be entirely absorbed only a few fibrous strands remaining as evidences of its existence; these are the cases that later may develop epilepsy in its various forms and show other signs of cortical irritability and instability.

Intracranial lesions due to the various forms of hemorrhage comprise about 70 per cent. of the cases of spastic paralysis in children, whereas agenesis, lack of development and malformation of the cortex and pyramidal tracts, and that group of spastic cases due to a meningo-encephalitis complicating measles and scarlet fever, constitute most of the remaining 30 per cent. of the cases. Those cases due to agenesis or lack of development of the cortex all show marked impairment of the mentality, whereas the ones due to lack of development and malformation of the pyramidal tracts beneath the cortex may show little or no impairment of the mentality; naturally, these spastic children as they grow older all become more or less impaired mentally, but this impairment, when the pyramidal tract alone is affected, is one of “deprivation”—in that they cannot develop their faculties by associating with other children, playing games and using all the means so essential for the normal development of children. Their lives are so restricted by their physical disability that they shrink within themselves until their condition in the milder forms becomes one of mental inferiority and backwardness, and may even reach that of imbecility. Naturally, these cases of absence or lack of development of the cortex or pyramidal tract cannot be improved by an operation; they do not and cannot show signs of increased intracranial pressure, and therefore, they are easily excluded by an ophthalmoscopic examination from the preceding cases due to hemorrhage.

A meningo-encephalitis resulting from measles or scarlet fever produces a large number of cases of spastic paralysis occurring in the earlier years of youth. In this condition, the cortex itself is involved to a greater or less degree; an infective process occurs and the cortex itself is usually damaged. It is a very frequent cause of epilepsy in children and a condition most difficult to improve by any treatment. A number of cases of spastic paralysis in children occur after a severe attack of whooping-cough; whether this is the result of meningo-encephalitis or a rupture of a cortical vessel due to the increased venous stasis at the time of the severe coughing spells is not known; I have, however, operated on one child of 8 years of age who had developed Jacksonian epilepsy with temporosphenoidal “fits” immediately following a severe attack of whooping cough; there was neither paralysis nor spasticity; over the anterior portion of the left temporosphenoidal lobe was a bluish clot, the size of a silver dollar, in the pia-arachnoid meshwork and was undoubtedly due to a rupture of one of its cortical vessels.

In cases of intracranial hemorrhage either in children or adults following a fracture of the skull, unless the hemorrhagic clot depresses the motor area of either hemisphere or interferes with the pyramidal tracts, then there will be no paralysis, and it is possible for large intracranial hemorrhages to occur and yet there is no resulting paralysis unless the motor tract is involved; that is, the impairment of the mentality itself may overshadow the paralysis, and may even exist alone. In this manner, it is possible for
the impairment of the mentality to be the chief complaint. However, as in adults with intracranial lesions, a definite disturbance or even the more silent areas of the brain tends to increase the deep reflexes of the extremities, and if the motor tracts are still more affected, then a definite spasticity results.

The treatment of spastic paralysis has been most discouraging and unsatisfactory. These cases have not only been the despair of the general practitioner, but the bane of existence to the neurologist and especially to the orthopedist; naturally, little if anything can be accomplished in the extreme cases due to lack of development and malformation of the cortex and the pyramidal tracts; it was only in mild cases that any improvement could be expected, and unfortunately the percentage of these cases permanently improved was very small indeed.

A number of years ago, there were many theories regarding the cause of spastic paralysis. These theories were usually grouped among the mentally defective and classified as defective, imbeciles and idiots with or without paralysis. Those cases of spastic monoplegia or hemiplegia without marked signs of mental impairment were very puzzling. For many years, it was believed in cases of imbeciles with unusually small heads, that their mental impairment and possible spastic paralysis were due to a premature closure of the sutures of the skull which prevented the normal development of the brain—that is, the skull was too small for the brain. The truth was not ascertained until later that the skull did not enlarge because the brain itself did not enlarge and develop normally—that is, the size of the cranium is an index to the size of the brain—only quantitatively, however, not qualitatively. Many cranial operations were devised to offset this supposed premature closure of the sutures of the skull and so allow the brain to develop—as they thought it would. Trephine openings of various sizes were made in the cranial vault in the hope that the brain would have more room to develop; at times, the dura was incised, but more frequently the dura was left intact. There was no selection of cases made—the fact that the cranium was small was considered sufficient cause for the undeveloped brain; whether or not there was present an increased intracranial pres-
enings, sections of the posterior nerve roots, alcohol injections of peripheral nerves, nerve resections and other operations, are, in our opinion, of only temporary benefit, and we have yet to see a case in which the spasticity has not returned, in some degree, within one year. In all of our cases treated by the operations just mentioned during the past two and one-half years, the spasticity began to reappear within one year after operation.

Tenotomies and tendon lengthenings alone are satisfactory in only very mild cases. Foerster's operation for sectioning of the posterior nerve roots of the spinal cord is advocated merely to lessen the irritability and the instability of the cortex of the brain by decreasing the number of afferent stimuli reaching the spinal cord and also to affect the reflex mechanism of the spinal cord; besides being a rather formidable and long operation for a child, the lessening of the spasticity is only temporary, few cases being reported improved longer than one year; our experience with seven cases has been the same. The injection of alcohol into the peripheral nerves (the Allison and Schwab operation) produces immediate paralysis and a temporary relief from spasticity; in our experience of thirty-one cases, however, the spasticity has returned within one year. With nerve resections (Stöffell's operation), we have had no experience. Besides, in these operations, we do not in any way "get at" the primary cause for the spastic paralysis, namely, the lesion of the brain, but they are merely peripheral operations to relieve the spasticity temporarily, in the hope that, before the recurrence of the spasticity, sufficient power will have returned to the opposing muscular groups to reestablish the muscle balance.

Little, if anything, has been done to improve permanently the condition of spastic paralysis, and we offer our observations in the hope that they may lead to a more satisfactory solution of the treatment of these cases. Our attention was first centered on the importance of relieving the increased intracranial pressure as a means of lessening the spasticity and improving the mentality of these children by a decompression operation performed by one of us at the Nassau Hospital, Garden City, Long Island.

The case, referred by Dr. L. B. Rogers, was one of a child, aged 9 years, who after an easy delivery was apparently normal in every way until the ninth month of age, when it suddenly had a series of epileptic attacks; after these attacks had subsided, it was observed that there was a total left hemiplegia with exaggerated reflexes; the left arm and left leg became spastic and gradually assumed the flexor contractures so typical of these spastic cases. Three years ago, the patient had another series of convulsions and since that time these convulsive seizures of greater and lesser severity have continued almost daily. The mental impairment was moderate. Every method of treatment had practically been given up as useless. Last June, another series of convulsions began and during the four days preceding the examination of the patient, 302 attacks had occurred; the child was in a condition of status epilepticus—one convolution following another; the almost continuous administration of chloroform was of little value. In addition to the typical left spastic hemiplegia, the patient had at this examination double choked disks, as revealed by an ophthalmoscopic examination—that is, a high intracranial pressure; the pulse was 54 and the respiration was very irregular and of the Cheyne-Stokes type. As artificial respiration and oxygen were being used, a right subtemporal decompression was advised in the hope that a relief of the increased intracranial pressure might improve the condition of the patient. The operation was performed at the Nassau Hospital, Garden City, June 18, 1913. No anesthetic was necessary—the patient being unconscious. On incising the dura, which was exceedingly tense, the cerebrospinal fluid spurted to a height of 6 inches; the cortex was edematous and swollen, and on enlargement of the opening upward, a fibrous mass, apparently the residue of an old cortical hemorrhage, was exposed, lying on the cortex and extending upward beneath the margin of the decompression opening. As the condition of the child was bad, I decided to remove the mass at a later operation. Owing to the mere relief of the intracranial pressure, the child became conscious at the end of the operation and an uneventful recovery occurred, the child leaving the hospital on the eleventh day after operation.
The striking feature of the case, however, was the gradual lessening of the spasticity and of the contractures of the face, arm and leg, and this improvement continued until the child began using the leg freely and the left arm and hand for picking up articles for the first time in its life; there was also a definite mental improvement. The improvement in this case has been continuous.

The thought then occurred, "Why not do a decompression operation in those selected cases of spastic paralysis having a possible hemorrhage on the brain and showing any signs of intracranial pressure?"

And so we began having the eyes of spastic children examined carefully with an ophthalmoscope for signs of increased intracranial pressure. It was very surprising to ascertain that of the cases examined, a large number did show mild though distinct signs of intracranial pressure—that is, a dilatation of the retinal veins, and a hazy edematous blurring of the nasal margins of the optic disks; many of them showed even mild signs of old secondary optic atrophy—rather whitish disks and the physiologic cup shallow from scar tissue formation. We then began to select for operation such cases having these definite signs of increased intracranial pressure, especially the extreme cases and the ones which had received the usual treatment of tenotomies, tendon lengthenings, alcohol injections, braces, massage, etc. Since then, we have operated in 65 cases, most of them being of the extreme type, and the results have been very gratifying. Of these 65 cases 34 were diplegics, both arms and legs being affected; 11 were paraplegic, only the legs being involved, while the remaining 20 cases were hemiplegic—the leg usually being more affected than the arm of the one side. Epilepsy in its various forms was present in 26 of these 65 cases; the improvement in 7 of these 26 epileptic patients has been complicated because the epilepsy has continued but in a less severe degree.

Six of our patients operated on have died and each of them within ten hours after the operation; four of these were under 2 years of age, of the extreme diplegic type, emaciated and therefore very poor operative risks; it seems that in them any alteration of the high intracranial pressure and circulation was sufficient to upset the patient—the temperature rising to 108 degrees within two hours after the operation; possibly, a too rapid escape of the cerebrospinal fluid interfered with the circulation of the basal ganglia and therefore the high temperature resulted. We are now controlling this loss of cerebrospinal fluid by elevating the head and shoulders of the patient according to the rate of flow and with much better results; it is an interesting observation that the temperature in these cases can be either raised or lowered by elevating or lowering respectively the head and shoulders.

Not only has there been a lessening of the spasticity of the arms and legs effected in these cases selected for operation, but there has been a definite amelioration of the mental condition of the patient to such a degree that we obtain the cooperation of the child in the carrying out of the after-treatment—a very important advantage of this operation. Naturally, the younger the patient is at the time of operation, the better the prognosis; that is, the longer the general and local increased intracranial pressures have persisted, just so much more will the delicate nerve cells be compressed, their blood-supply interfered with and therefore the cells themselves impaired.

The ideal time for the operation would be immediately after birth; then, merely a small opening need be made to allow the subdural blood to flow out in liquid form with little or no resulting impairment of the cortex. However, it is extremely rare for a definite diagnosis to be made at this early date—the impairment usually not being ascertained until several months later when the child is from 9 to 12 months of age. It is to be hoped that routine ophthalmoscopic examinations of the fundi in suspected cases following difficult labor will be of great assistance.

METHOD OF PROCEDURE

In those cases of spastic paralysis of the hemiplegic, paraplegic or diplegic type, with a definite history of difficult labor with or without the use of instruments, in which, on ophthalmoscopic examination, signs of intracranial pressure are shown in the dilated retinal veins and a blurring and haziness of the optic disks, especially of their nasal halves, a large right subtemporal decompression is performed to relieve the intra-
cortical fibers or cystic formations resulting from cell and their fibers must have been damaged, so that cystic formation, and the resulting spasticity and mental impairment. In four cases, the hemorrhagic cyst was cortical and subcortical; naturally, the local nerve cells and their fibers must have been damaged, so that a physical improvement cannot be expected in that part of the body controlled by the cells or fibers destroyed; however, the cells and fibers at the periphery of the lesion are merely impaired functionally by the local pressure of the cyst and the cystic formation, so that the functional impairment in these cases has improved very much.

The after-treatment, briefly, consists in the correction of deformities by tendon lengthenings if necessary, or merely stretchings of the contracted muscles, the maintenance of corrected positions through the employment of especially adapted braces, skilled massage and faradism, particular attention being given to the weakened and overstretched muscle groups. A careful, systematic course in muscle training is carried on daily.

The improvement in our cases selected for operation has been so marked—not only a lessening of the spasticity, but also a definite amelioration of the mental condition of the patient—that we believe a cranial decompression is indicated in those cases of spastic paralysis showing intracranial pressure by the ophthalmoscopic examination; of those cases of spastic paralysis which we have examined, about 40 per cent. have shown signs of intracranial pressure, and are, therefore, in our opinion, cases that can be very much improved; all of our operated cases had previously had the routine orthopedic treatment of massage, muscle training, tendon operations, etc., with little or no permanent improvement. The operation of cranial decompression is not a formidable procedure for one trained in neurologic surgery; all of our patients have improved (four only slightly), and we have had six deaths. The anesthetic should be administered by an expert; cyanosis and coughing are very dangerous complications, especially after the dura has been opened. Dr. C. S. Hunt used a mixture of ether and oxygen in all of our cases reported in this series, and in only two of them was any difficulty encountered; fortunately, the dura had not been opened. Dr. Hunt has observed the tendency of patients to become conscious as soon as the dura is incised and the intracranial pressure relieved; it is important to deepen the anesthesia, therefore, just before the dura is incised in order to prevent coughing, etc.

For lack of space, we report in this paper only every sixth case in which operation was performed, since the preliminary report in November, 1913, until May, 1914; the record of each case in detail will be published later.

Case 12.—Erma, aged 26 months. Diagnosis: Left spastic hemiplegia. Right suprachoroidal hemorrhagic cyst. Operations: First, right subtemporal decompression; second, left subtemporal decompression.
History.—Admitted to Stern's Private Hospital, Sept. 29, 1913. Referring Dr. George E. Brewer, Family history negative. Four older children well and strong. Personal History: Fifth child; nine months' baby; birth normal; requiring the use of instruments. Patient remained "quiet" for three days, then began to have convulsive twichings of head to the right, lasting from three to five minutes; then quiet, possibly for the entire night. Since then, irritible "spells," crying for five hours at a time. Paralysis and flexor contractures of the entire left side of the body, including the face. No convulsions since. Poor appetite; constipated with much mucus in stools. Has never attempted to walk or talk; apparently oblivious to its surroundings. Past Treatment: Massage, electricity and general hygiene. No improvement; spasticity and flexor contractures becoming worse.

Examination.—Typical left spastic hemiplegia of face, arm and leg. Leg flexed and adducted; fingers clenched, especially thumb. Right eye diverges slightly. Poorly nourished child with definite mental impairment. Fundi: Dilated retinal veins and blurring of nasal halves of optic disks, especially the left disk, which is distinctly pale. Reflexes all increased on left side; left Babinski. Unable to talk a word. Has never walked or attempted to walk or crawl. Wassermann test negative.

First Operation.—Oct. 8, 1913. Right subtemporal decompression. Usual incision and bone removed; no complications. Dura very thick—1/8-inch—and under marked tension. Cerebrospinal fluid spurted half an inch—a large amount escaping. The pia-arachnoid adhered to the dura, and when the dura was widely incised, a large bluish cyst an inch in thickness extended upward beyond the superior border of the decompression opening where the cortex appeared normal; this cyst extended downward to the base of the skull. It was bluish white and contained many new vessels. The cyst was punctured and a portion of its outer wall excised; much straw-colored fluid escaped so that the underlying cortex now became convex instead of concave; the cortex was pale but otherwise normal. Usual closure; no complications. There was some oozing of cerebrospinal fluid from the lower angle of incision for eight days (the longest in any case). On the second day after operation, it was noticed that the left hand was no longer clenched. All sutures removed on the seventh day after operation. Oct. 24, 1913, sixteen days after operation, the patient was discharged surgically.

Nov. 1, 1913, twenty-three days after operation, there was much improvement. Patient is now using left hand and tries to pick up things (right hand being tied). Is walking some (supported). Says "Ida" (the name of her nurse). Notices objects and her surroundings.

Dec. 1, 1913, fifty-three days after operation, there is great improvement. Uses left hand; can extend fingers. Walks well, but still needs a "finger-support." Says "Papa, Mama, Daddy" and a number of other words.

Dec. 20, 1913; seventy-three days after operation, the child is walking alone; drags left leg slightly. Decompression area is tense; fundi still reveal dilated retinal veins and some blurring of disk margins.

Jan. 15, 1914: Still improves, especially mentally; can now say several more words. Difficult to advise second operation on account of the great improvement, but it will relieve the pressure effects of the cyst still more.

Second Operation.—Jan. 24, 1914. Left subtemporal decompression. Usual incision and bone removed; no complications. Dura rather tense, but not so thickened as on right side. When the dura was incised, much cerebrospinal fluid escaped; an old hemorrhagic cyst formation extending down over upper one-fourth of the decompression opening was exposed; it was very shallow, however, and had been practically absorbed, little more than a thickened discoloration being present, so that there were no clinical signs of its presence. (Mighty interesting in that the paralysis clinically indicated a hemorrhage only on the right cortex—the hemorrhage over the left cortex being practically absorbed). Usual closure. All sutures were removed on the sixth day after operation; the child was discharged surgically Feb. 8, 1914, 12 days after operation. Treatment: massage and exercises as before operation.


May 4, 1914: Patient uses left leg very well now; impairment of left hand much less so that she uses it now. Mentally very bright. Has learned a number of German words from her nurse.

July 10, 1914: Improvement continues both physically and mentally.

Sept. 2, 1914: Marked improvement. Patient is walking with but a slight limp and uses the left hand fairly well. Speaks several small sentences now. Child is becoming well nourished; no digestive disturbances.

Remarks.—The rapid improvement in this case was simply amazing. It seems that children aged 2 years or less improve much more quickly than the older ones; this is what we should expect from the pathology of the condition—the cortex not being primarily damaged but merely its function impaired by the pressure of the overlying hemorrhage and resulting cyst formation. Naturally, the longer it remains, the greater the impairment.

History.—Admitted to the New York Orthopedic Hospital, Jan. 4, 1914. Referred by Dr. R. A. Hibbs. Family history negative. Two brothers and two sisters all well. Personal History: Third child; nine months' baby; very difficult labor requiring the use of instruments. Child “semicomatose” for one week. Scarlet fever, whooping-cough and diphtheria as a child. At 10 months of age, it was noticed that child was unable to stand and that it did not try to walk. When 2 years of age, child would drag the left foot, which had become stiff as well as the left hand; this stiffness has increased. Rather stupid and apathetic; memory is poor. No convulsions.

Past Treatment: Massage and exercises; tenotomy of left Achilles tendon. No permanent improvement.

Examination.—Typical spastic diplegia, especially affecting the left side, with flexor contractures. Reflexes all increased; greater on left side; double Babinski (interesting observation in view of the lesion found at operation). Right leg was used rather awkwardly. Left internal strabismus. Fundi: Definite dilatation of retinal veins and distinct blurring along the nasal margins. Mentally impaired. Simon-Binet test: Mentally, a child of 5 years of age. Moving picture, Oct. 12, 1914.

First Operation.—Jan. 5, 1914. Right subtemporal decompression. Usual incision and removal of bone, which was very spongy, thick and vascular. Dura under high tension and very vascular; when it was incised a hemorrhagic cyst was exposed, at least 1 inch in thickness, pressing down on a pale anemic cortex. Much cerebrospinal fluid escaped under tension. Outer wall of cyst removed. Usual closure; no complications. Postoperative recovery negative. All sutures removed on the sixth day after operation. Spasticity of left arm and leg lessened and patient seemed brighter mentally. Decompression area was tense.

Second Operation.—Jan. 31, 1914. Left subtemporal decompression. Usual incision and removal of bone, which was not so vascular or spongy as on the right side. Dura under tension; and on being incised, the upper half of the exposed cortex was covered by a cystic formation half an inch in thickness; many adhesions. (Cause for Babinski on the right foot and also the awkwardness of the right foot. Other than this, no signs of the hemorrhage on this side clinically.) Usual closure; no complications. All sutures removed on the seventh day after operation.

Feb. 21, 1914: Condition at Discharge: Spasticity very much improved; mentally much brighter. Treatment: Massage and exercises as before the operation. March 6, 1914, moving picture.

First Operation.—Jan. 19, 1914. Left subtemporal decompression. Usual incision; much bleeding in rongeur bone, apparently due to sinuses in bone, and to adhesions of dura to bone. Dura tense, but not much cerebrospinal fluid escaped. Very dark-reddish hemorrhagic clot on cortex, ½ inch in thickness, extending beyond the bony margins of decompression. Large cortical vessels. Usual closure; no complications. All sutures removed on the seventh day after operation.

Second Operation.—Jan. 20, 1914, ten days after first operation. Right subtemporal decompression. Usual incision; moderate bleeding in bone. Dura under fair pressure. Cortical vessels enlarged; pia-arachnoid “sweated.” At upper area of cortex, definite signs of old hemorrhage—even on this side homolateral with paralysis—practically all absorbed and thus showing no clinical signs of its presence; numerous adhesions were severed between arachnoid and dura. Usual closure. All sutures removed on the sixth day after operation.

Feb. 22, 1914: Condition at Discharge: Arm and leg straighter. Can extend right wrist and right fingers. Walks with a limp due to shortening of right leg. Treatment: Massage and exercise, as before operations. March 6, 1914, moving picture.

April 18, 1914: Much improvement, especially in the arm; easily bends right hand at the wrist.


Sept. 9; 1914: Marked improvement. “Uses arm much better; can grasp things and use them, which was impossible before the operation. Patient can see much better than before. If not irritable and nervous.” Mentally “very bright.” No convulsions. A much more intelligent looking child.

Moderate flexor contracture of right leg with apparent anatomic shortening of the tendon; a tenotomy may be necessary; walks better. Patient can now extend the right wrist; uses the fingers much better. Decompression areas tense; partially covered with a layer of bone which bulges slightly. Reflexes increased on the right side; no Babinski. Fundi: retinal veins normal; some new tissue formation about the disk margins; disks rather pale. Simon-Binet test: Mentality is that of a child of 11 years of age.

Remarks.—Although this patient is 12 years of age, yet his improvement has been very definite. Naturally, the younger the children, the greater the improvement to be expected from an early operation. The oldest case has been of a man aged 21; his improvement has been less marked than the younger patients having lesions of similar extent and pressure.


History.—Admitted to Polyclinic Hospital, March 24, 1914. Referred by Dr. Royal Whitman. Family history negative. Three younger children well and strong. Personal History: First child; nine months’ baby; difficult labor requiring the use of instruments. Entire head contused; laceration of scalp behind left ear extending forward to top of head. “Doctor thought child would die.” Blue for one week; could not swallow; comatose. On the third day, general convulsions began, lasting two hours until child was thought “dead.” Gradual improvement until 2 years of age. From 2 to 7 years of age, patient had “spasms”—became “blue around mouth.” and twitching of left side of body until entire body became stiff and rigid—more on right side; no loss of consciousness. These spells lasted two or three minutes and occurred only when child was irritated or frightened. Patient has never walked. No disease of childhood. Constipated during past three years. Past Treatment: All kinds of treatment; braces at 2 years of age for one year. Osteopathy for one year; electricity for one year. Massage, exercises and gymnastics for past five years; no improvement.

Examination.—Typical spastic diplegia of extreme degree with flexor contractures of arms and legs; left side worse; extreme adductor spasm. Poorly developed. Speech is very difficult to understand. Respiration is noisy and difficult because of a laryngeal spasm. Right pupil larger than left. Fundi: Dilated retinal veins; marked blurring of nasal halves of optic disks. Tongue large and protrudes; continuous dribbling and drooling of saliva. Reflexes all increased, left possibly more; double Babinski. Mentality much impaired. Simon-Binet test: A child of 6 years mentally. Moving picture, March 6, 1914.

Operation.—March 26, 1914. Right subtemporal decompression. Very difficult case for anesthesia; impossible to pass tube into larynx because of spasm. Usual incision; bone vascular and spongy. Dura was much thickened and very tense so that cerebrospinal fluid spurted out under high pressure. A hemorrhagic supracortical cyst was exposed extending beyond the decompression opening; it tended to protrude on account of the very high pressure. While a small portion of the outer wall of the cyst was being incised the child “went bad”—respirations became labored and spasmodic; and brain pulsed feebly about 30 or 40 per minute. Heated oxygen; artificial respiration; hot coffee by rectum; improvement. Usual closure in haste. While applying dressings and bandage, child again ceased to breathe and it seemed that child was dead; edema of lungs apparently. After ten minutes of artificial respiration, rhythmic tongue traction, oxygen, atropin and camphor in oil, the child improved; patient was
"blue"—no corneal reflex—pupils widely dilated and no pulse for half an hour, but child gradually rallied. Three doses atropin 3/100 grain, 5 minims of camphor in oil and 3 ounces of hot black coffee by rectum after child reached the ward. Six hours later, child was in good condition. Conscious. Temperature, 100. Pulse, 130. Respiration, 20. After the operation respiration slightly improved. All sutures removed on sixth day after operation.

April 5, 1914: Condition at Discharge: Ten days after operation, respiration quiet now and not difficult. Spasticity much lessened; patient can use the hands much better. Treatment: Massage and exercises as before the operation.

May 10, 1914: Patient walking with finger-support but with difficulty; less spastic. Speech much improved.

July 27, 1914, moving picture.

Sept. 14, 1914: Much brighter mentally. Legs and arms much more limber. Walks alone 20 to 25 feet. No convulsions. Less irritable and restless. Less spasms of legs and arms. Can go up and down stairs alone now, which she could not attempt before. Talking improved but the breathing is about the same. Has not had massage for past two months but has improved right along.

Marked lessening of the spasticity and contractures; left Achilles tendon still shortened—undoubtedly anatomic shortening of tendon itself owing to its long contracture; a tendon lengthening is advisable. Reflexes are still increased; double Babinski not so definite. Fundi: Retinal veins still slightly dilated and some edema still remains along the nasal margins of the optic disks. Marked improvement mentally. Simon-Binet test shows a child of 7 years of age.

Remarks.—A second decompression on the other side of the head is advisable in this case to lessen further intracranial pressure. The operation has been delayed in the hope that the respiration will still improve and thus lessen the risk of the operation.


History.—Admitted to Polyclinic Hospital, May 3, 1914. Family History negative. One sister, aged 5 months, alive and well. Personal History: First child; nine months' baby; difficult labor—"three days and three nights"; non-instrumental. Child has been "weak" from birth; no convulsions. Child did not lift its head until 16 months of age. Has never talked or walked. Cries constantly and moves arms and legs continuously when awake; "never quiet." Does not understand; does not notice. Very "rigid" at times. Little strength in legs; more strength in arms. No convulsions. Fontanels not closed at 26 months. Child becoming "stiffer" and more "foolish." Past Treatment: Massage, electricity, exercises, etc., at several hospitals; no improvement.

Examination.—A typical case of spastic diplegia. Child lies in bed "stiff and straight"—eyes turned up to the ceiling; frequently jerking of arms and legs. Cries constantly. Reflexes: Knee jerks increased; double Babinski present. Fundi: Dilated retinal veins; nasal halves of optic disks obscured. Mentally: Apparently an imbecile. Moving picture, March 6, 1914.

Operation.—May 7, 1914. Right subtemporal decompression. Usual incision and bone removed; no complications. Characteristic "cracks" in bone which oozed freely. Dura moderately tense; not thickened, although whitish and rather pale. Cortex bulged through dural opening and much cerebrospinal fluid escaped; edematous pia-arachnoid ½ inch in thickness, forming a sort of "blanket" over cortex. Cortex pulsating normally at end of operation. Usual closure; no complications.

Recovery uneventful. All sutures removed on the sixth day after operation. Child much quieter.

May 14, 1914: Condition at Discharge: Seven days after operation, child cries only at times. Legs do not seem so stiff. Reflexes still increased; double Babinski present. Fundi: Retinal veins less dilated; only the nasal margins of the optic disks are blurred. Treatment: Daily massage and exercises as before the operation.

July 10, 1914: Marked improvement, both physically and mentally. Child is now trying to walk; seems to notice his surroundings.

July 27, 1914, moving picture.

Sept. 15, 1914: Improved in every way. Now walks alone. Says a number of words. No convulsions. Mentally very much better; now plays with toys; cries very infrequently. Decompression is bulging slightly; tense. Reflexes: Knee jerks increased; no Babinski now present. No adductor spasm. Fundi: Retinal veins less dilated; no edema of the optic disks but some new tissue formation along its margins.

Remarks.—The improvement in this case is most apparent. For a child of 32 months of age which has never talked or walked, and then four months after the operation to be walking alone and even talking a number of words, is truly remarkable. As there are still signs of increased intracranial pressure as shown by the tense decompression area and by the ophthalmoscopic examination, a bilateral decompression is advisable. The absence of a definite walled-off cyst at the site of the decompression opening and merely an edematous pia-arachnoid of varying thickness producing, with its many adhesions, a cystic formation or blanket overlying the cortex has been observed in a number of our cases; the relief of the general intracranial pressure, however, apparently succeeds.

Case 42.—Mollie, aged 7 years. Diagnosis: Left spastic hemiplegia. Supracortical cystic formation. Operation: Right subtemporal decompression.
History.—Admitted to Polyclinic Hospital, May 10, 1914. Referred by Dr. John A. Wyeth. Family history negative. Two younger children well and strong. Personal History: First child; nine months' baby; breech delivery; very difficult labor but no instruments used. Baby "dead" for half an hour; artificial respiration. Nursed with difficulty; cried continuously. When 8 months old, it was noticed that child did not use its left arm and left leg, which were "stiff." At 3 years of age, child began to walk but only a few steps and then would fall; would trip constantly. Cannot run even now, trips frequently; left leg drags. No convulsions. Child feeds itself, but is unable to use left hand. Patient was not allowed in public schools as authorities said it was "crippled"; the School for Crippled Children refused to admit it because patient was "nervous." Past Treatment: Massage, exercises and electricity during past four years; no improvement. Moving picture, March 6, 1914.

Examination.—Typical left spastic hemiplegia with flexor contractures. Reflexes increased on left side; left Babinski. Fundi: Dilated retinal veins; distinct haziness of nasal margins of optic disks. Mentality impaired; speech fair. Simon-Binet test: Mentally a child of 4 years of age.

Operation.—May 11, 1914. Right subtemporal decompression. Usual incision and bone removed; no adhesions. Cerebrospinal fluid spurted 2 inches and much fluid escaped. Cortex edematous, with many adhesions, producing a cystic formation half an inch in thickness; large cortical veins extended downward vertically over temporoparietal lobe. Cortex tended to bulge under such great tension that bony opening was enlarged upward 1 inch and dura likewise opened; cortex protruded so much that a ventricle puncture was attempted but not successful. Usual closure; no complications. All sutures removed on the seventh day after operation.

May 24, 1914: Condition at Discharge, thirteen days after operation: spasticity has lessened. Brighter mentally. Treatment: Massage and exercises as before operation.

July 6, 1914: Marked improvement. Patient walks with but a slight limp, the heel touching the floor. Uses the left hand well. Mentality much improved; speech good. July 27, 1914, moving picture.


Decompression opening not closed; bulging slightly. Knee jerks; left greater than right; no Babinski. No adductor spasm; no shortening of the Achilles tendon. Fundi: Negative; optic disks have assumed distinct margins; normal pinkish color.

Remarks.—Here again, the improvement has been very rapid. Within four months, the child is walking with the heel touching the floor, the left arm is being used and the mentality has so changed that a Simon-Binet test records an improvement of one year. In this case, the unilateral decompression has apparently relieved the intracranial pressure to such an extent that a bilateral decompression will not be necessary.

CONCLUSIONS

Naturally, we do not believe that all cases of spastic paralysis should have a cranial decompression; in some mild cases tendon lengthenings alone are sufficient, and this is especially true in the absence of mental impairment. But those selected cases of spastic paralysis, particularly of the hemiplegic and paraplegic types, which show signs of increased intracranial pressure by an ophthalmoscopic examination, are the cases that can be very much improved by such a procedure. The cases of agenesis and maldevelopment of the cortex of course cannot and do not show signs of increased intracranial pressure, and are therefore easily excluded by an ophthalmoscopic examination; besides, the cases of lack of development of the cortex and pyramidal tracts are frequently premature babies, being born the seventh or eighth month, so that a careful history is very important.

We are having moving pictures taken of the patients before operation, and at regular intervals after the operation, in order that the physical impairment of posture and gait may be accurately recorded.

Likewise, a Simon-Binet test of the mentality is being recorded before operation and at regular intervals after operation; the mental improvement in our cases has been very impressive.

A lumbar puncture is being made before operation in order to estimate the intraspinal pressure as a means of corroborating the signs of increased intracranial pressure as shown by an ophthalmoscopic examination.

A Wassermann test of both the blood and cerebrospinal fluid is made in all suspicious cases.

We wish to repeat that this paper is merely a report of work being carried on to improve the condition of selected cases only of spastic paralysis. It is by no means a cure, and possibly the improvement in our
selected cases is only a temporary one—we cannot tell. But from the pathology of these selected cases in which operation has been performed and the general continuous improvement which has resulted and is still progressing, we feel justified in making a report of the work in the hope that it may throw some light on the treatment of this very pitiful condition.

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