fied with that viewpoint until every other cause has been exhausted. Indeed, heredity cannot be the entire cause, for there must be some weakness or tendency upon which heredity plays its rôle.

The nearest approach one can make in this line is upon the endocrine gland theory. In these days of rock-bottom research, glands are beginning to play a part and, with no other better reason to be discovered, the glandular theory can be applied in these cases.

Staffieri⁶ mentions a case of angioneurotic oedema, with which the disease is seemingly associated, in which there was a dysendocrinia with thyroid insufficiency predominating. The only case, which has been reported as hereditary oedema, which could possibly come under this category was one in which there presumably was a testicular hypersecretion. This case was the one reported by Milroy in which a congenitally enlarged foot became normal upon excision of an enlarged testicle. If such cases are congenital, then there must be an inherited insufficiency or hypersecretion of some or all the endocrine glands. However, if this is the case, there should be other manifestations of the disorder. So far, the evidence is lacking.

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RESULTS OF NERVE INJURIES APPARENTLY DUE TO BIRTH TRAUMA.

BY ELI FRIEDMAN, M.D., BOSTON.

THE following is a brief summary of 2,000 consecutive neurological cases seen in the Nerve Department of the Children's Hospital. The purpose of this analysis is to find out approximately what percentage of these unfortunates were caused by trauma in labor, either from allowing a difficult labor to go on too long without interference,—the so-called sins of omission; or from interference, as the application of forceps,—the so-called sins of commission.

I have chosen neurological cases because, while every part of the child's anatomy is subject at times to a certain amount of trauma in transit, the nervous system is the one that always suffers. All the vital organs of the child are well protected, while the brain, which is one of the most important ones, has practically very little

protection. The head, furthermore, being the largest part of the child, is subjected to the greatest amount of pressure in the process of its passing through the parturient canal and consequently suffers the greatest amount of damage. Injuries to the nervous system, furthermore, result in chronic conditions which can be followed for years, and thus afford a better opportunity for study than simple surgical conditions which are of rather short duration, without, as a rule, leaving any permanent damage.

The cases studied in this series of necessity include only those with comparatively mild injuries to the nervous system. The more serious injuries either result in still births or in death in 24 to 48 hours after birth, and there are a good many of them, as we shall see later. Such children, if they came to the hospital at all, were rushed to the surgical service for decompression operations, and unfortunately very rarely reported for after treatment in the Neurologisal Service. What we shall see in these cases will be a large number of unfortunates who, while apparently but slightly injured at birth, still have enough injury to their nervous system to leave them more or less crippled for life.

Foremost of the injuries to the nervous system, as far as numbers are concerned, are the so-called Erb's or obstetrical paralysis. Of the 2000 neurological cases, 101 belong to this class. This condition, as demonstrated conclusively by John W. Seaver,¹ is caused by an injury to the brachial plexus. Traction with forcible abduction and elevation of the arm such as we find in breech delivery, puts the eighth cervical and first dorsal roots on the stretch, and when there is enough force applied complete tearing of the nerve fibres result. Traction and forcible separation of head and shoulder puts the upper cords, the fifth and sixth cervical roots of the plexus, under tension with similar results. Bullard,² W. U., states further that traction of the head in the axis of the body is less injurious than when it is done obliquely; and that asphyxia favors injuries in the plexus because the muscles are completely relaxed and afford very little protection to the nerve structures.

Fortunately the upper arm type is one most common. In this type the muscles of the upper arm, the deltoid, supra spinatus, infra-spinatus, teres minor, biceps, and supinator longus, are the ones involved. Occasionally the serratus magnus coraco brachialis and supinator brevis

are involved. The paralysis is then due to the injury of the fifth and sixth cervical roots. In the lower arm, or rather in the whole arm type, as it is very rare to see the lower arm alone, all the muscles of the arm are involved and there is wrist drop as well as atrophy of the small muscles of the hand. In these cases, the fifth, sixth, seventh, eighth, and sometimes the first dorsal are involved. It is very rare to find the lower nerve roots involved without the upper.

The diagnosis is very easy when one looks for it. Within the first few days after birth, the arm or, as very rarely happens, both arms, are found to lie limp by the side. In the upper arm type, which is by far the most common, the arm is kept in inward rotation and adduction, with inability to abduct, elevate, outwardly rotate, or supinate.

The affected extremity is colder and the muscles undergo some atrophy, though never as marked as in infantile paralysis. The reason for this is that practically no muscle loses its complete enervation as it gets some nerve fibres from another segment of the cord so that the trophic disturbance is not so great. The electrical examination will show a reaction of degeneration in the affected muscles, but this examination is not always satisfactory on account of the excessive development of fat in children which (also hides atrophy).

The only conditions we have to differentiate from obstetrical paralysis are fracture and dislocation of the humerus, cerebral palsies and infantile paralysis. Fractures and dislocations can readily be recognized by careful examination, though we must bear in mind that there is at times some subluxation of the head of the humerus secondary to the paralysis of the muscles around the shoulder. Cerebral palsies are usually hemiplegic, involving the one entire side of the body, or diplegic, involving all four extremities and very rarely limited to one extremity. The cerebral paralysees are furthermore of the spastic type with exaggerated reflexes, while Erb's paralysis being of the peripheral type is flaccid with absent reflexes.

Infantile paralysis can be differentiated by the age of onset and only very rarely, when the patient comes late for treatment, is there any difficulty in diagnosis.

The treatment of these cases belongs mainly to the orthopedic surgeon and I will not dwell on it, but the advice to start treatment early be-

fore contractures and deformity result, lies entirely with the obstetrician. Unfortunately there is a tendency on the part of the obstetrician to minimize the injury and promise the mother that the child will outgrow it. Now it is true that in some mild cases where the injury to the nerve fibres is mild, the outlook for a complete recovery is good, but in the vast majority of instances the tendency to spontaneous recovery is very slight. In the more severe cases, where the injury to the nerve fibres was considerable, the subsequent scar tissue formation caused even extension of the paralysis by involving uninjured nerve in the scar tissue, and in some cases surgical interference apparently accomplished a good deal of improvement. Indiscriminate rubbing by the mother or nurse does not prevent hopeless deformity, and much valuable time can be saved by starting the proper treatment early, within a few weeks after birth.

Next in importance, as indicated by the number of cases, are the so-called cerebral spastics. Of these there are sixty-three. In this number I have tried to include only those, who from the history and physical examination appear to have been caused by trauma at birth. Thus I have only taken those who gave a history either of an excessively prolonged labor or of instrumental delivery, and excluded those that may have been due to intrauterine causes from developmental defects or those acquired after birth from a multitude of causes such as trauma and meningitis. That there is a distinct relation between difficult or instrumental delivery to mental and physical defects that develop later was shown as early as 1861 by Little. Later, in 1885, Sarah McNutt showed that cerebral hemorrhage was the specific cause of a large number of the spastic paralysis developing soon after birth. Post-mortem examination in some of those cases showed distinct evidence of old hemorrhages with scar tissue formation.

Every possible variation, from a slight monoplegia with a little weakness of one extremity to a diplegia with extensive involvement of all four extremities could be seen among those unfortunates. Associated with the paralysis there was also every grade of mental impairment from slight mental backwardness to complete idiocy. The end results apparently depended upon the amount of injury to the brain as well as to the part of the brain involved.

A small hemorrhage in the motor area in the fissure of Rolando manifested itself by signs of

spastic paralysis in the extremities while a much more profuse hemorrhage in a silent area hardly gave any evidence of its presence, except that the child seemed rather late in sitting up and walking. In some cases, no doubt, where the absorption was complete, there were no permanent after effects at all, and then the child is said to have "outgrown" it. The mental condition similarly varied according to the area involved. Extensive involvement of the frontal lobes gave marked signs of mental retardation, while a hemorrhage limited to the fissure of Rolando gave extensive spastic paralysis without any impairment of the mentality.

These unfortunates, large as their number is, represent, however, only a small part of all the cases of cerebral hemorrhage occurring in the new-born, as a result of trauma at birth. In addition to the large number of cases where this condition is not recognized because of the mildness of the symptoms, there is a still larger number of cases of cerebral hemorrhage of the new-born, and I believe that they constitute by far the vast majority, where the bleeding is of such magnitude as to result either in still births or in death in the first 24 or 48 hours. The relation of cerebral hemorrhage to still birth has been studied by various authors with various conclusions. Parrot in a series of thirty-four consecutive autopsies on still births gives the percentage of cerebral hemorrhage as high as 76%; Warwick gives 50% on a series of thirty-six cases; Beneke, on one hundred cases as 14%; and Wehe on a series of nine hundred and fifty cases as 13%. When we remember that about 4% to 5% of all births are still births we can realize how frequent cerebral hemorrhage occurs even if we should accept it to be the cause in only 13% of all cases.

It is true, of course, that not all cases of cerebral hemorrhage are due directly to trauma at labor. There are a great number of cases developing insidiously and not until several days after birth, causing symptoms of intracranial pressure, convulsions and death. Post-mortem examination will then show no demonstrable source of hemorrhage such as torn veins or injury to the sinuses; but in addition to the hemorrhage of the brain will also be found multiple bleedings throughout the body in localities where injury at birth could hardly have been the cause, in such places as the pericardium, peritoneum, and bronchial tubes. The etiology of these cases is undoubtedly, as Rodola³ has

demonstrated, a general hemorrhagic tendency with a delayed coagulation time and prolonged bleeding time. Comparatively mild trauma of normal labor may then be sufficient in itself to set up a massive hemorrhage large enough to cause death. In these cases trauma in labor often serves as the exciting cause, though the trauma need not be so great. The fact, however, remains that trauma at birth is a very important factor in the starting of the hemorrhage in a large number of cases.

The diagnosis in these cases is not very difficult. When an infant in the first few days of life becomes listless, pale, refuses the breast, and shows a slight facial oedema, we can suspect a probable cerebral hemorrhage. The onset of convulsions and nystagmus and bulging fontanelles makes the diagnosis almost certain. To further establish the diagnosis a lumbar puncture is of considerable aid. If the hemorrhage is subtentorial and along the base or intraventricular the fluid will be bloody and thoroughly mixed with the spinal fluid. If the hemorrhage is confined to the convexity and is all above the tentorium the spinal fluid will be clear and then aspiration of the subdural space through a fontanel or a suture is of great importance, both as a means of diagnosis as well as a therapeutic measure. Differentiation from acute spinal affections is as a rule not hard if we study the distribution of the paralysis.

Here again it is very important to start treatment early. Muscle training and early treatment to prevent contractures will save a good deal of time and suffering. A promise that the child will outgrow it if given time is only too readily accepted by the parent and ought not to be given unless one is absolutely sure of his grounds.

Feeble-mindedness, with or without epilepsy, forms another large but rather indefinite group of cases who owe their origin to trauma at labor. Excluding all mentally retarded children who belong to distinct types, such as Mongolian idiocy, cretinism, and amaurotic family idiocy, and all unclassified cases without any apparent etiology, I have found sixty unfortunates who can trace their origin to birth trauma. They all gave a history of either difficult labor or the use of forceps; and physical examination showed some remains of spastic paralysis in one or more extremities. I say these unfortunates form rather an indefinite group because we cannot always exclude many prenatal causes and we can

never say definitely whether any given case would not have been feeble-minded even in a normal delivery. Porter states that approximately 16% of all inmates of institutions for feeble-minded gives a history of a difficult labor.

A few miscellaneous cases complete my series. One is a case of musculo spiral paralysis following a fracture of the humerus. There was complete wrist drop, exactly as we see in so-called Saturday night paralysis of the pre-prohibition days. The trouble was caused by the involvement of the musculo spiral nerve in the callus, —as there was good motion in the wrist immediately after the fracture and the paralysis did not appear until the fragments formed a solid union.

Another is a case of facial paralysis. This was caused by the compression of the peripheral portion of the facial nerve by the blade of the forceps. In a proper application of forceps the blades, as I understand it, should not be in the vicinity of the facial nerve, but accidents do happen and the blades slip occasionally, even when the application is perfect at first. Sometimes there is facial paralysis, not from actual pressure of the forceps, but from compression of an extra vasation of blood in the region of the parotid. The reason for not seeing this condition more often in the clinic is not because of the rarity of the accident, but rather because the vast majority get well too quickly and before the mother gets ready to bring the child to the hospital the paralysis is all gone.

Still another very interesting case was one of complete flaccid paralysis of both lower extremities. Paralysis of the lower limbs due to obstetrical manipulation is very rare and a detailed report of this case will be of interest. As the lumbar and sacral plexuses are so well protected at every point of emergence from the spine and in their course through the gluteal and pelvic regions that they are not disturbed by any amount of manipulation or traction of the legs, the report of this case in detail may be interesting.

This was an infant six weeks of age. Family History—No miscarriages, no history of syphilis. Foetal movements were felt at six months and were rather vigorous immediately before birth. The delivery was done by the Braxton and Hicks manoeuvre because it was found that there was a placenta previa, and everything was well except that the nurse discovered that the child did not move the lower extremities.

Physical examination showed a well-developed and normal infant except for the lower extremities. There was complete flaccid paralysis of both lower extremities with loss of all the reflexes. The sphincter ani was relaxed and there was a complete loss of sensation, as high as the level of the umbilicus. In other words, there was paralysis corresponding to a lesion of the spinal cord at the level of the tenth dorsal vertebra. Upper extremities were perfectly normal; no paralysis or weakness of any sort. No facial paralysis, fontanelles not bulging, pupils equal and reacted normally to light and distance. X-ray examination of vertebra was negative.

The lesion here was, to my opinion, undoubtedly done by a tearing of the spinal cord at about the level of the tenth dorsal vertebra caused by a dislocation of the vertebra and the slipping of one vertebra over the other. Just what part of the manoeuvre caused the dislocation of the vertebra I am not ready to say. Whether it is the extreme force of the pulling or the process of doing the version I do not know. The x-ray examination was negative, because the vertebra slipped back in place after the damage was done.

A similar case was reported by F. H. Kooy in the *Journal of Nervous and Mental Diseases*. The child was born by version and extraction. At the age of two the child's legs were spastic and paretic but could be moved weakly. The reflexes were exaggerated, pain sense was diminished and thermal sense was lost. At the age of seven the legs were completely paralyzed, knee-jerks were diminished, and there was incontinence of feces and urine. The patient died at the age of eight and a half years from pyemia. At the post-mortem it was found that the cord was almost completely ruptured at the level of the ninth and tenth thoracic segments. We have had as yet no post-mortem examination in this case; but if we did, I believe we would find a similar condition.

In summarizing, I just want to call your attention to the fact that in a series of 2000 consecutive neurological cases there were 101 cases of obstetrical paralysis whose cause we know to be trauma in labor and 63 cases of spastic paralysis, 60 cases of feeble-mindedness, and 24 miscellaneous, who in all probability owe their origin to birth injury. In other words, there were 266 cases in all, approximately 13%, where birth injury was the direct cause of the

trouble. This number I believe to be rather a conservative estimate for if we include any of the doubtful cases we should have a much larger percentage. How many of these cases could have been prevented by more efficient obstetrics and more frequent resort to Caesarean section I am not ready to say.

Since most of the cases gave a history of unduly prolonged labor followed by the use of forceps it is impossible to say just what caused most of the damage,—the too prolonged pressure of the foetal head against the maternal soft parts, or the direct trauma of the forceps. Careful and wise interference is very likely the wisest course in the vast majority of cases, but let us remember that just a little extra pull or turn may add another hopeless cripple or idiot to the community, and let us remember, furthermore, that when there is damage done, not to add insult to injury by minimizing its effects but rather warn the parents and advise them to institute treatment immediately, before undesirable complications have set in.

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GOITRE—WITH AN ANALYSIS OF ONE HUNDRED OPERATED CASES.*

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Of the glands that compose the endocrin system the thyroid, today, is perhaps the best understood, and working in harmony with the other ductless organs functionates efficiently to control the metabolism of the body, but when perverted in its action, causes a train of symptoms that has been studied by observers for nearly a century and one half.

William S. Halsted, in the Johns Hopkins Hospital report of 1920, has written a most exhaustive article upon the historical observations of goitre from the earliest writers down to the present day, including such surgeons as Hedenus, who, in 1821, successfully operated six goitres. Thence tracing the progress, by the observations and works of Victor Von Bruns, Theodorus Billroth, Von Mikulicz, Von Eiselsberg and through the time of Theodor Kocher, who did so much in the standardization of the operation upon the strumous gland, ending his

paper with a description of the Halsted operation, which is, and will remain, a classical procedure of sub-total bilobectomy.

Goitre is not a common phenomena along the Atlantic Seaboard, which accounts for the relative rareness of cases treated by the Eastern physicians.

In the series of one hundred operated cases which I report for analysis, I found but one instance in which goitre in a child was correspondent to one in the parent; thus heredity in this locality seems to play a minor role in its production.

Many observers of today are explaining its etiology by association with some autogenous focal infection, but in this series I was unable to find any such correlation, although in several instances the association was present, and this particularly in the younger subjects. In several cases, tonsillectomies and other operative procedures were performed to rid the patient of any local infection without improvement, either in the size or symptoms resulting from an over-active thyroid.

There was no correlation between occupation and goitre, but this was apparent between sex and goitre; there being ninety-one females to nine males. The evidence of the intimate association of the thyroid gland with the reproductive organs of the female was very striking. It is not infrequent for hypertrophy of the gland at puberty, which produces the so-called goitre of adolescence, also the hypertrophy occasioned by pregnancy, when once begun, not to cease and the subsequent atrophy not to take place, leaving the gland abnormally large or over-active. In this series of cases, fourteen followed excessive hypertrophy at adolescence and eight at pregnancy; thus in these cases it is fair to presume, that the exciting cause of the over activity of the gland was due to some temporary change in the function of the reproductive organs, either in the ovaries or uterus, which must be considered as belonging to the endocrin system. What the association may be between these organs has not been, as I know, propounded, but it is evidently the call of one system upon the other to help keep the endocrin balance, and, as often happens, over stimulation leads to perversion and the result is an over active gland.

Five cases had lived for a considerable length of time in well known goitre districts. No