# CEREBRAL INJURIES IN THE NEW-BORN.*

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THE advances in obstetrics during the past decade have been chiefly in operative procedure upon the mother. While I do not wish to detract from the prestige of Cesarean section, pubiotomy, symphysiotomy, and vaginal Cesarean section, I do believe that progress along one other line, if not neglected, has at least not been developed to the level of the surgical measures upon the mother. Surgery upon the infant has been neglected in the brilliancy of other achievements in the surgical field. It has occurred to me that in our zeal to deliver a living child, we have lost sight of the fact that the ideal condition is not fulfilled unless the offspring is healthy and has the right to live. Physically,

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surely, all men are not born equal, and it is often a pelvis or forceps that shapes our ends. It is to the question of injuries to the fetal head during labor that I wish to invite your attention.

The head bears the brunt of the labor. Upon good authority, Holt(1), it is stated that not less than one-third of the deaths of infants which occur during parturition are caused by cerebral hemorrhage. It is generally conceded by pediatricians and obstetricians that rapid as well as tedious labor is a potent factor in compressing the fetal head, and in precipitate labor, serious injury may be done the child by contact with the floor, sidewalk, etc. Tedious labor involves tremendous pressure and perhaps excessive flexion or extension, causing constriction of the veins of the neck and consequent engorgement of the cerebral sinuses. Long forcible contraction of the uterus probably increases the blood-pressure by exerting a positive peripheral pressure upon the fetus.

Instrumental delivery, especially the low or medium forceps operation, deserves less blame than is generally ascribed to it. The high forceps cases suffer the greatest amount of injury and the morbidity is well recognized. It is difficult to accurately estimate the force exerted upon a fetal head, and while the amount of compression by forceps *per se* may be slight, in traction through a narrow pelvis we have the principles of a wedge put into operation, and the actual compression on the parietal eminences by forceps blades, especially should they not have been perfectly applied, is necessarily great. I have attempted to approximate this in a crude way, for crude it must be as we cannot duplicate the living pelvis or the fetal head. I placed a Sargent dynometer between the blades of forceps and attempted to deliver the instrument through an improvised pelvis, and did so with less exertion than is usually required in an actual living case. The dynometer registered twenty-five pounds. By diminishing the outlet of the imitation pelvis, more traction was necessary and the effort usually required to deliver a child registered from sixty-five to seventy pounds. With very great resistance, the compression runs up to 155 pounds.

Hemorrhage is the principal result of brain injury at parturition. It is usually from the arachnoid and pia, and therefore under the dura, and probably as often basilar as cortical. It is unusual to find the extravasation within the cerebrum. The quantity of the effusion varies from a dram to several ounces, and as a rule is spread out in a thin layer, extending at times

over the entire hemisphere. Hemorrhage is caused by direct pressure and rupture of the small veins, but it may follow rupture of the longitudinal sinus from overlapping of the parietal bones. With fracture of the vault, epidural hemorrhage is likely to occur, in fact, the vessels of the dura are rarely damaged without fracture. Continued high intracranial pressure retards the venous circulation, and thrombosis of the sinuses is not uncommon. Edema of the brain is also a possibility. Pressure of the forceps blade may be so intense as to cause a depressed fracture or an indentation of the vault. Newton(2) reports such a case with operation and recovery. In this instance the depression was 1 1/2 x 2 3/8 inches over the left parietal bone, and forceps were not used.

It is at least interesting to note the relation of forceps to mortality of the fetus. From a compilation by Dr. Julian M. Cabell(3), of the records of Columbia Hospital from 1874 to 1904, comprising 5,760 cases, forceps (high, medium, and low not always specified) were applied 236 times, and in twenty-four of these cases no mention is made of the child's condition or even whether it survived; but considering such cases as having recovered, I found that twenty-four died within a month and thirty-four were still-born, a mortality of 10.2 per cent. and 14.9 per cent., respectively, or 25.1 per cent. collectively. I would not interpret these statistics to mean that one-fourth of the infant mortality is due to forceps, because unquestionably the fetus was dead before delivery was attempted in some cases, while in others death may have been purely coincident with and not dependent upon instrumental delivery. But these figures indicate that forceps make an impression upon infant morbidity and mortality and must be reckoned with.

Williams(4) holds that the high forceps operation is attended with a very high fetal mortality.

Aside from the immediate effects of the hemorrhage, we find the blood-clots later replaced by fibrous tissue slowly organized or succeeded by single or disseminated cavities, known as porencephalitis. The presence of a large clot prevents the normal development of the brain, and atrophy and shallow convolutions are unwelcome inheritances, giving rise in early life to imbecility, arrested development or athetosis.

The symptoms of intracranial hemorrhage lack the distinctiveness of the same condition in the adult, yet are sufficiently characteristic for a positive diagnosis. A prominent and very

reliable symptom is convulsions. These may be unilateral, bilateral, tonic or clonic and appear from the first to the third day, rarely as late as the sixth. McNutt(5) states that general convulsions are seen in the vertex presentations, while local spasms are more likely to be associated with breech cases. There may be one or many. Twitching of the muscles may precede the spasms. The convulsions may be the forerunner of monoplegia or hemiplegia, while at other times the onset of paralysis is insidious. Paralysis is more common in the breech than in the vertex cases. Death may follow the motor disturbances, or the paralysis may be succeeded by spasticity of the muscles with increased reflexes.

Turnbull(6) reports a case in which labor occupied three days and forceps were eventually used. The position was L. O. A. The child was apparently healthy. Twenty-four hours later it cried strangely, had a tonic convulsion involving the entire body; the pupils were equal but moderately contracted, and no squint was present. The respirations were irregular and stridulous, deglutition was imperfect. The slightest movement of the child or lightest sound caused renewed crying and convulsions. Coma and death followed twenty-one hours after the onset of the first symptom. At the necropsy no fracture was found. The base of the skull on both sides, but chiefly on the left, was filled with dark fluid blood and blood-clot as high as the level of the Sylvian fissure. No trace of a ruptured vessel could be found. The lateral ventricles were distended with clear fluid. Pressure of effused blood on the veins of Galen and cranial sinuses had given rise to edema of the brain and internal hydrocephalus.

The asphyxia of the new-born is more frequently ascribed to pulmonary than circulatory pathology, yet intracranial hemorrhage during parturition stands in the rôle of a prominent etiological factor. Cheyne-Stokes breathing is often present, but frequently an irregular type is substituted. The pulse is relatively slow, less than a hundred, firm and bounding. I have not had an opportunity to note the blood-pressure in these cases. From observation in a limited number of normal infants, irrespective of color and sex, all less than twenty-one days old, I found the blood-pressure (Riva Rocca) to average 56—the highest 80, in an infant of sixteen days, which was crying frantically at the time, and the lowest 43, in a female of sixteen days, weighing 6.5 pounds. One breech case and one mid-

forceps case were among the number, but both were near the average. The presence of plus blood-pressure in intracranial hemorrhage in the adult is rather a constant symptom, and theoretically, at least, should be found in similar conditions in early life. Tense fontanelles, without pulsation, is an additional symptom, which, in conjunction with the above enumerated signs, confirm the diagnosis.

Seitz(7) lays great stress upon the constant screaming of the infants as a valuable sign. The crying is not of the usual type of early life, but is an almost incessant effort. He points to vomiting, failure to suckle, and lividity as corroborative symptoms.

Dercum(8) reports a case of local pachymeningitis hemorrhagica in which bulging of the eye and the Gorden reflex were present. This reflex is obtained by striking or stroking the gastrocnemius at its insertion into the tendon, causing extension of the toes.

What is the future for cases that do recover from the immediate effects of intracranial hemorrhage? We may look for slight or marked arrested mental or physical development or even imbecility. On the other hand, Little's disease may appear, which he defines as "spastic rigidity of the limbs of the new-born." Athetosis is a symptom that is not infrequent, and there is no question in my mind whatsoever that not a small percentage of the defects in our asylums are examples of intracranial hemorrhage at birth.

The prognosis of intracranial hemorrhage of the new-born may properly be classified as immediate and remote.

The mortality in the first ten days is high. In Seitz's(9) series of twenty-three cases but five recovered, of which number one has since died and another is an imbecile. This is the largest number recorded by any single observer, and his mortality was more than 78 per cent.

Recovery from the acute condition does not warrant a roseate prognosis. Seeds have been sown for slower but irreparable changes. In the wake of intracranial hemorrhage is left the defective intellectuality of the epileptic, the pervert, degenerates, imbeciles, and idiots. It is beyond dispute that milder cases may completely recover, but in the pronounced type the prognosis of the ultimate result must be purely conjecture.

We have not found a panacea for this affection, but a better understanding of the condition warrants the belief that the mortality can be materially decreased. Operative measures point the way in which we can accomplish this by removal of the clot

and consequent pressure and by the control of hemorrhage. Very few cases have been given the benefit of this rational treatment. In the largest series of cases in America, nine were operated upon with four recoveries (Cushing(10)), a mortality of 44.5 per cent. or a reduction of 33 per cent. in the death rate over the nonoperative treatment. While the number of cases is few, yet the results are so encouraging that operative interference must become popular.

Early operation gives the best results, and, contrary to the general opinion, infants stand the operation well. The head is shaved and cleansed and chloroform administered. A large horse-shoe flap is cut base down over the parietal bone, through skin, muscle, fascia, and periosteum, then these tissues are slightly elevated along the incision to admit the introduction of bone cutting forceps at the coronal suture. Some operators remove a button of bone with a trephine, then cut the soft bone with scissors. Cushing elevates the edge of the parietal bone and cuts the osseous flap with a specially constructed forceps. The bone flap is broken across the base, and turned back with the skin and fascia. If a hemorrhage exists, the translucent dura appears bluish-black. The dura should be incised about a quarter of an inch from the edge of the bone, reflected, and the clot removed by irrigation with warm salt solution and the gentle use of the finger or instrument. The dura must afterward be accurately approximated with fine catgut and the wound closed without drainage. Should difficulty arise in closing the dura from pressure within, a lumbar puncture will be found serviceable. Should operation upon one side fail to disclose hemorrhage or pressure, exposure of the opposite hemisphere is justifiable. Recurrence denotes renewed bleeding, and a second operation should be undertaken with the same promptness as the first.

Closer study of the infant with attention to the details of its mental and physical imperfections, will do much to place labor in its proper relation to the morbidity and mortality of infancy, and a consideration of the child's welfare should play an important part in deciding on the method by which to assist the mother.

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