CLINICAL DEPARTMENT

HEMORRHAGE INTO THE SPINAL CORD AT BIRTH*

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REPORT OF CASES

CASE 1.—W. D., a boy, 4½ months old, was admitted to the service of Dr. Gittings at the Children's Hospital, Oct. 10, 1919, having had four convulsions in the preceding twelve hours, and fever and diarrhea for one week. The family history revealed nothing of interest, except that of nine brothers and sisters, three were stillborn, three died of "summer complaint," and three survive in good health. The birth was a breech presentation and in delivery the right shoulder was slightly hurt. The injury was trifling. Weight at birth was said to be 10 pounds, the same as on admission. (I suspect that the weight at birth was guessed at, not taken by scales.) The child was breast fed for one month and then was put on Mellin's food. The mother's mental level is shown by the fact that she never noticed the vitally important symptoms described below and undoubtedly present since birth. Even when shown the palsy of the child's arms and legs, she did not comprehend it.

The temperature in the rectum on admission was 102 F., and throughout the boy's illness it ran a very variable and irregular, see-saw course, sometimes going as high as 102 F. in the evening, often falling in the morning to 97 F. and sometimes even to 95 F., never remaining normal longer than a few hours.

Dr. F. H. Leavitt, who made the preliminary examination, reported the following findings: "The child lies in bed with the head held rigidly backward and rotated to the left. His appearance is typical of that seen in acute transverse cervical lesions of the spinal cord. His arms are held in the characteristic position. There is palsy of the external muscles of respiration. The pull of the diaphragm causes retraction of the lower ribs and bulging of the abdomen. There is a flaccid palsy of both legs, reflex movements in which are caused by sticking with a sharp pin. All tendon jerks are abolished in both legs. Stroking the sole of either foot causes fanning of all the toes but no extension. (Extension is normal at his age.) When fretful, his cry is weak because of the palsy of the chest muscles. Deglutition is normal. Both pupils react to light; the left is widely dilated, the right normal in size. The child probably is too young to accommodate. (At what age a healthy child begins to accommodate is still a disputed question.) There is anesthesia of the skin and deeper tissues of both legs and trunk."

Physical Examination.—The general examination revealed the following. There were crepitant râles throughout the chest. The heart was normal. There was no deformity of the spine; no pain on pressure along its course, and a roentgenogram revealed nothing abnormal. The fluid obtained by lumbar puncture came out under slight pressure, was clear at first and at the end slightly tinged with blood. The cell count was ten and the fluid was free from bacteria. The urine was normal; the blood Wassermann and the von Pirquet skin reaction were negative. There was no leukocytosis. The clinical diagnosis was

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lobar pneumonia and hematomyelia from birth injury. Notwithstanding the mother's statement that she had noticed nothing wrong with the child till a few days before coming to the hospital, the history of the birth and the answers given by her to questions as to how long the arms and legs had been useless (i. e., palsied) made the diagnosis of birth palsy positive. The patient died Oct. 19, 1919.

Necropsy Report.—At the necropsy, made by Dr. G. M. Mitchell, there was found a right-sided lobar pneumonia with complete consolidation of the lower lobe, middle lobe and lower half of the upper lobe. The left lower lobe behind was congested. (It is probable that the palsy of the chest walls was an important mechanical predisposing cause of the pneumonia, increasing susceptibility to bacterial infection of the lung.) There was no evidence of any injury to the vertebrae nor were there any signs of an old extradural hemorrhage. The spinal cord, with the membranes, formed, from the fourth cervical nerve root to the first dorsal, a soft, apparently fibrous band; above and below this area both cord and membranes were grossly normal. The dura nowhere showed gross disease on the other surface (Fig. 1). The brain was not removed. There were no old or recent hemorrhages in any of the abdominal or thoracic viscera.

Microscopic examination of the spinal cord by Dr. A. J. Smith showed the dura mater in the narrowed area to be the seat of a fibrous thickening and induration which was more marked posteriorly than anteriorly. The fibrous

Fig. 1.—Spinal cord from Case 1. A indicates the level of hemorrhage.

stroma contained more young cellular elements than elsewhere and there were a number of blood vessels with rather swollen endothelial lining and rather cellularized walls. The dura mater here, too, was adherent to the pia mater which was thickened. On cross section of the cord the gray matter could not be recognized, there were no multipolar cells, and only a few patches of degenerated white matter were seen. There was no normal white matter. Practically, the cord at this level was completely destroyed. The nerve roots outside the cord, and arising above the level of the section, stained well and normally. There was ascending degeneration above the area of destruction and descending degeneration below. There was no disease of the lumbar swelling, barring the descending degeneration.

CASE 2.—J. D., an Italian boy, 3 months old, was admitted to the Children's Hospital, July 22, 1919, with a palsy of both legs which had existed since birth. His parents and three other children are living and well. His birth was by breech presentation at full term and, according to the mother, "the doctor had pulled too hard." He almost died at birth and was completely palsied from the neck down. When two months old he had one slight convulsion. Dr. Leavitt referred him to my clinic at the Orthopedic Hospital.

Physical Examination.—Examination revealed the following: There was total and complete flaccid palsy of both legs. All deep reflexes and the plantar jerk were absent. The heart beat was 140. In the back, in the region of the fourth to sixth cervical vertebrae there was a marked valleylike depression.

At rest the forearms were flexed on the arms, the hands extended at the wrist, and the middle phalanges flexed. The shoulders were somewhat extended. The lower right facial movements were more marked than the left. The fontanelles were open. The head was hyperextended. There was some voluntary movement of the shoulders, less of the arms, none of the forearms and hands. Breathing was diaphragmatic. The chest was drawn in and the belly ballooned. He moved the tongue well. There was complete anesthesia in the legs and trunk.

He was returned to the Children's Hospital. No new symptoms appeared. Breathing was diaphragmatic. The abdominal muscles were toneless and palsied. The palsy of the legs continued flaccid with absent knee jerk, Achilles jerk and plantar reflex. The pupils responded to light but there was no accommodation. The roentgenogram of the spine showed no disease or deformity of the bones. (The depression mentioned above was muscular, not bony.) The child died Sept. 9, 1919. A necropsy was refused.

DISCUSSION

There is not a very large literature on the subject and in America almost no attention has been paid to it. Herbert R. Spencer¹ reported a series of 130 autopsies on fresh, mostly stillborn fetuses in a study of visceral hemorrhages in stillborn children. The spinal cord was examined in forty-four cases. "In no case was there separation of the vertebrae." (I interpret this to mean that there was no evidence of injury to the spine.) "In 5 cases the cord, membranes, and surrounding cellular tissue were normal; in none of these was traction employed. Three were apparently natural vertex deliveries; in one case version was employed, followed by natural delivery; in one case the forceps was employed to hold the head in the pelvic brim, but not to deliver." In eighteen cases there was congestion or edema of the spinal cord. (The personal equation plays a large part with everyone in diagnosing edema and congestion at necropsy.) In thirty cases there was hemorrhage somewhere within the spinal canal. In six cases it was within the spinal cord; in one case into the whole thickness of the cord; in four cases into the anterior cornua, in one case into Goll's column in the lumbar region. Six were naturally delivered cephalic cases; thirteen were breech or footling cases; four were delivered artificially by forceps; one was delivered by cephalotripsy. In one case no record was kept of the method of delivery. Spencer concludes that "spinal hemorrhage is greatly favored by the presentation of the lower extremity." This is, he states, "probably due partly to the greater compression undergone by the soft parts, and to the consequent driving of the blood to the central organs, and partly to traction sometimes employed."

Discussing the causes of visceral hemorrhage in stillborn children, Spencer states: "The hemorrhage must have as cause one or more of three factors: (1) Thinness and weakness of the wall of the blood

1. Tr. Obstetrical Soc. Lond. **33**:203, 1892.

vessels. (2) Alteration of the blood rendering it more prone to escape. (3) Increased blood pressure from (a) asphyxia or other vasomotor disturbance or from pressure on veins; (b) squeezing of blood into some parts of the body in the act of birth; (c) external violence rupturing the vessels at the point pressed upon." He thinks that syphilitic disease of the blood vessels plays little part in the production of hemorrhages. He regards "the normal delicacy of the fetal vessels as the one essential feature in the causation of hemorrhage." In his view, asphyxia plays little or no part, except that, combined with other causes, it renders hemorrhage more frequent. "Mechanical squeezing of blood into some parts of the body during the act of birth is probably a frequent cause of hemorrhage." External violence may rupture a vessel, as in a case of apoplexy of the lung produced by pressure of the rigid cervix on the child's thorax.

Drs. A. H. Davisson and D. J. McCarthy² report a case of transverse myelitis in a new-born infant. The child could move its head and arms, but the rest of the body remained an inert mass. Sensibility was surely lost up to the level of the xiphoid cartilage. The arm reflexes were present. The plantar, knee and abdominal jerks were absent. At necropsy, the cervical and highest dorsal cord and the lumbar enlargement seemed to be normal. There was flattening from the second to the eleventh dorsal. The case is most interesting from the point of view of physiology, namely, as regards the much disputed question as to whether total transverse lesion of the cord above the lumbar swelling causes abolition or increase in intensity of the reflexes of the legs. In this case they were absent. The deep reflexes were absent in both my cases (normally, the knee jerk is present from birth; the abdominal skin reflex appears later), and there was undoubtedly a total transverse cervical lesion in both. This is strong evidence, but the cerebrospinal apparatus is not complete at birth, the reflexes appear at different ages, and in the case of the plantar jerk what is normal in babyhood is pathologic later, and it may be that the effect of a total transverse lesion is not the same then as in adult life.

In my first case, the necropsy proves that there was a hemorrhage within the cord and a subsequent myelitis. The second case clinically so resembles the first that it is safe to conclude it had the same cause.

The fact that in thirty out of forty-four of Spencer's cases of stillbirth (or death almost immediately after birth) there were hemorrhages within the spinal canal, while it was within the cord itself in only six, is of great interest. It would be interesting to know in what proportion of hemorrhages within the cord at birth there are hemorrhages elsewhere in the body, because when hemorrhages are present

2. Phila. M. J. 11:357 (Feb. 21) 1903.

elsewhere, it is safe to conclude that the spinal hemorrhage was not caused by direct trauma to the cord, nor the consequence of a vertebral dislocation, but that it was the result of asphyxia or squeezing of an excess of blood into the organ, thus putting such pressure on the walls of the vessels as to rupture them. The explanation of the cause of spinal hemorrhage is complicated by the fact that it seems fairly well proven, in the adult at any rate, that a momentary dislocation of the vertebrae may occur, and if it causes death, the necropsy may not reveal any injury to the ligaments, but only a crushed cord. This is an accident not likely to happen, however, in a breech presentation. In the case here reported, notwithstanding the careful examination made, I am still uncertain as to the immediate cause of the hemorrhage. There were signs of inflammation in the dura mater which could not have, or one would not expect them to have, resulted from a hemorrhage spontaneously arising within the cord, from squeezing of an excess of blood into the vessels. On the other hand, there was no evidence that the dura mater had sustained any direct injury, such as a bruise or tear by spinal dislocation, nor did the spinal ligaments show any injury. Balancing all the evidence, I incline to the belief that the hemorrhage was spontaneous and not caused by direct violence, but by rupture of over-full vessels from pressure on the soft parts during birth.