

A CASE OF TRAUMATIC CERVICAL HEMATOMYELIA AND  
COMPLETE DIVISION OF THE CORD, WITH PROBABLE  
DISLOCATION OF THE FIFTH CERVICAL VERTE-  
BRA. REMARKS ON THE LOCATION OF THE  
CENTER FOR THE BICEPS REFLEX.<sup>1</sup>

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*Summary.*—A white male aged 56 years, who after a fall down stairs was immediately rendered unconscious for about twelve hours. On recovering from which, with the exception of some delirium several days later, mentality was good. Complete motor and sensory paralysis involving the legs and trunk and partially involving the arms. Loss of all tendon reflexes excepting the biceps, which, however, was lost temporarily on the right side. Preservation of the cilio-spinal, cremasteric and plantar reflexes, the latter disappearing shortly before death. No Babinski phenomenon. Death on the ninth day. At the autopsy was found a possible slight displacement of the fifth cervical vertebra; marked compression of the cord, so as to practically divide it between the sixth and seventh cervical segments. Hemorrhage into the gray matter extending from the eighth cervical up to and partially destroying the right posterior horn of the fifth segment. There was also a fracture of the right side of the skull, with extensive extradural hemorrhage compressing the motor area, which, excepting the early period of unconsciousness, had caused no symptoms.

*History.*—A. C., aged 56 years, was admitted to the Nervous Wards of the Philadelphia General Hospital on September 11, 1904. His temperature being 101 degrees, pulse 90, and respiration 35 to the minute. He stated that about twenty-four hours before admission, after drinking several glasses of ale, he had fallen down stairs, and was immediately rendered unconscious, remaining so for about twelve hours. When he recovered consciousness it was found that the legs and arms were paralyzed. Examination September 12, about 36 hours after the receipt of the injury, showed a well-developed man,

<sup>1</sup> From the Neuropathological Laboratory of the University of Pennsylvania and from the Philadelphia General Hospital. Read before the Philadelphia Neurological Society, Dec. 27, 1904.

who answered questions intelligently and stated nothing of note concerning his previous or family history. The temperature, pulse and respiration were normal. He lay in bed on his back with the arms elevated about 15 degrees from the body, the forearms flexed on the arm and somewhat supinated, and the fingers flexed.

The pupils were equal and responded to light and accommodation. There was no paralysis of any of the cranial nerves. He could elevate each arm to a right angle with the trunk, and

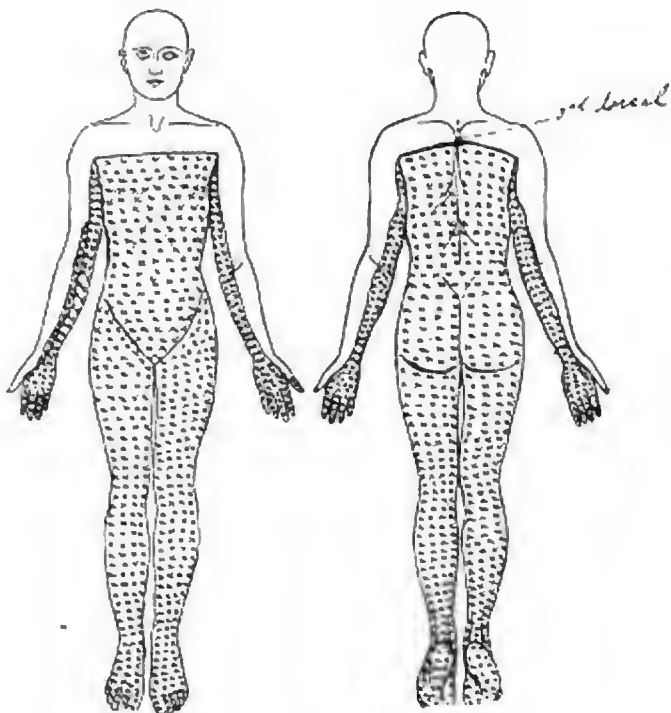


FIG. 1.

FIG. 2.

they could be rotated. Flexion of both forearms could be performed, but not with normal strength, the forearms could be slightly supinated. The abdomen was somewhat distended. The legs were completely paralyzed. No atrophy was noticed. Electrical reactions were not taken. The muscles were flaccid.

The cilio-spinal reflex was present on both sides, the biceps jerk was present and active on both sides, the triceps, wrist, knee and Achilles tendon jerks were absent, there was

an active cremaster reflex, and when the soles of the feet were stroked there was slight flexion of the toes. Retention of urine and constipation were present and at times there was slight priapism.

The distribution of the sensory paralysis (tactile, pain and temperature) was as is indicated in Figs. 1 and 2.

The patient complained of pain in the back of the neck, and there was some tenderness in the lower cervical region, but no deformity was visible, either to the eye or in the skiagraph. Bed sores were beginning over the right trochanter and the scapulæ, and the stick of a pin was followed by an area of hyperemia which persisted for some time.

The urine was acid and contained albumin and hyaline and granular casts.

On September 14 it was noted that the patient was delirious, but could be made to answer questions and obey commands. The abdomen was distended and tympanitic. During respiration the abdominal muscles did not contract for several seconds; they then contracted spasmodically one or more times, to be followed by a period of rest as before. The arms could be elevated, and rotated outward further than at the first examination, otherwise there was no change. On September 16 it was found that the toes were neither flexed nor extended when the soles of the feet were irritated. On the right side the biceps jerk was absent, but was very active on the left side. He was delirious at times but answered questions intelligently when spoken to. The peculiar respiratory movements noted on the 14th had disappeared. The left pupil was slightly dilated, but both responded to light and in accommodation. The cilio-spinal reflex could not be obtained. The temperature was 96, pulse 40; on the 17th these again became normal; respiration normal. On Sept. 18 Dr. Weisenburg noted that the patient's face was cyanotic, the left pupil dilated, and the left palpebral fissure slightly narrowed. His voice was weaker, and he could not cough as well, but he could swallow. A slight biceps jerk on the right side was obtained. The patient died on September 19, 1904. The autopsy was made about twenty-four hours after death by Dr. A. G. Ellis, Dr. Weisenburg being present, to whom I am indebted for the following report:—

The scalp in the left frontal and the left parieto-occipital region is ecchymosed. There is a fracture of the skull, starting from a point one-half inch to the right of the median line, at the junction of the parietal with the occipital bone. The line of the fracture is to the left, forward and downward, and ends in the squamous portion of the temporal bone just in front of the ear.

The skull is unusually and uniformly thin, at its thickest

portion not measuring more than one-eighth of an inch. Inside of the skull, in the distribution of the left middle meningeal artery there is an extensive extradural hemorrhage. This lies behind the central fissure. The brain, when removed, shows a depression in the region of the hemorrhage, but otherwise nothing is found macroscopically.

The tissues surrounding the upper cervical vertebræ are congested. There is apparently no fracture or dislocation of the cervical vertebræ<sup>2</sup>. at least the vertebræ are not movable and crepitation is not felt. The cervical vertebræ from the seventh to the third inclusive, were removed intact, and show

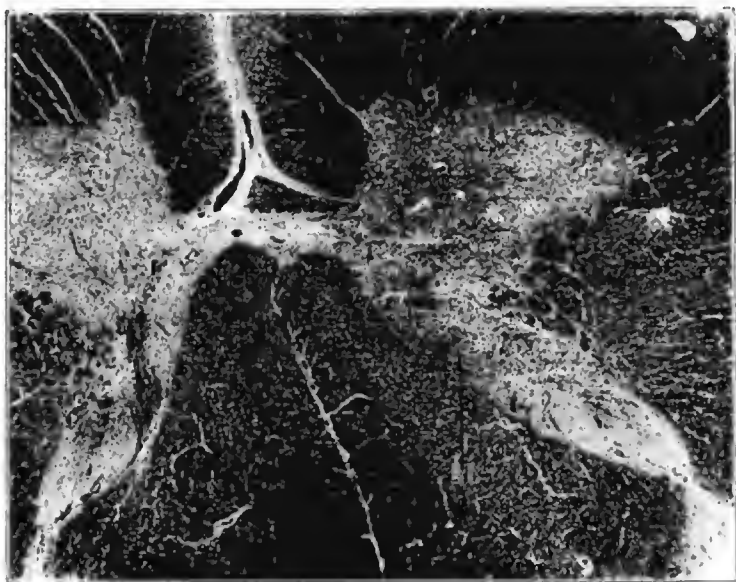


FIG. 3.—Photograph of a section from the fifth cervical segment showing an area of softening and hemorrhage in the right posterior horn (A).

nothing abnormal, except that opposite the fourth and fifth cervical vertebræ there are adherent clots of blood. The upper portion of the third cervical and the second cervical vertebræ were removed piece-meal.

The spinal cord in its upper portion, between the sixth and seventh cervical segments, showed a transverse depres-

<sup>2</sup> Dr. Ellis thought that the fourth cervical vertebra was displaced slightly backward, but from the location of the compressed area of the cord it is more likely that the fifth had been displaced and then was spontaneously reduced.

sion, the cord measuring here about one-eighth of an inch. For an inch both above and below this part the cord was soft to pressure.

*Microscopical Examination.*—The compression, which is very intense, is between the sixth and seventh cervical segments. Sections were made through the lower part of the fifth cervical segment, which was the utmost limit of the area of softening. The area of compression was not cut, as it was unnecessary and it was not thought advisable to destroy uselessly a valuable gross specimen.

At the level of the second and third cervical segments the spinal cord shows no alteration. There is no ascending or descending degeneration even by the Marchi method, as the patient only lived one week after the accident.

At the level of the fifth cervical segment the right posterior horn is destroyed in its ventral half by softening and hemorrhage. (Fig. 3) The posterior half appears to be normal. Fibers are seen entering the right posterior horn and stopping a little short of the area of softening within the horn. The softening seems to be almost confined to the right posterior horn. This is the only portion of the cord at this level which seems to be pathologically altered, the left posterior horn apparently being normal. It is presumable from a study of the sections that the posterior root supply of the fifth cervical segment must have been impaired on the right side.

Sections taken from the lower part of the fifth cervical segment stained by thionin show considerable alteration of many of the nerve cells. In a number of these the nucleus is displaced to the periphery and the chromophilic elements are disintegrated and appear as fine granules, and some of the cells are swollen. This alteration is seen in the anterior horn of each side.

In the lower part of the eighth cervical or the upper part of the first thoracic segment the cells of the anterior horn are very little diseased.

The spinal cord at the first thoracic segment and below appears to be normal. The twelfth thoracic and the second and fourth lumbar segments are perfectly normal. Special attention has been directed to this part of the cord, because of the loss of all the tendon reflexes.

The most interesting feature of this case is the evidence that it affords of the location of the center for the biceps jerk. This is usually given as the fifth and sixth segments. On the left side in this case the biceps jerk was very active until the death of the patient, while on the right it was active for the

first couple of days, then disappeared, to again become feebly present two days later. Microscopic examination of the specimen shows that on the left side the fifth segment is intact, while on the right side the posterior horn is partially destroyed by hemorrhage and softening. (Fig. 3). It seems probable therefore that at first this segment was not involved on the right side, but later became so by the hemorrhage gradually extending upward, at which time the reflex disappeared; then as some absorption took place, the functions of the segment partially returned, and it again became feebly present. As the biceps jerk was very active while the fifth segment was intact, it seems likely that this segment has most to do with the biceps jerk, and that the sixth plays only a subordinate part, if any.

The fact that the eighth cervical and first dorsal segments were intact accounts for the preservation of the cilio-spinal reflex.

While Bastian claimed that both superficial and deep reflexes are abolished in complete transection of the cord, this case conforms to what has usually been noted by observers, i.e., the cremaster and plantar reflexes were present, it differs however in the fact that the plantar reflex gave the flexor and not the extensor response, which according to Turner is the rule. This possibly might have developed if the patient had lived longer. Attention is called to the fact that there was no lesion in the lumbar cord.

The distribution of the motor paralysis corresponds to the muscles usually regarded as supplied by the affected segments.

The area of sensory paralysis does not correspond to the diagrams of Head, but with the exception of the non-involvement of the thumb is similar to those of Starr and Kocher.

That there was an extensive extradural hemorrhage over the motor area of the left side which gave no symptoms, if we except the period of unconsciousness present immediately after the fall and a possible weakness of the muscles about the angle of the mouth in the right side when the man was admitted, but which had disappeared the next day, is a fact of interest.

NOTE—Since the foregoing was written Dr. Morton Prince has

reported in the *JOURNAL OF NERVOUS AND MENTAL DISEASE*, Feb., 1903, p. 81, a case in which one side of the cord was severed between the sixth and seventh cervical segments. The area of anæsthesia in his case is similar to that in the above case, i.e., the thumb is not involved, and in this regard differs from the diagrams of Starr, Kocher and Wichman.