

## HÆMORRHAGE INTO THE SPINAL MEMBRANES; HÆMATORRHACHIS.

In meningeal apoplexy, as it is called, the blood may be between the dura mater and the spinal canal—extrameningeal hæmorrhage—or within the dura mater—intrameningeal hæmorrhage.

(a) *Extrameningeal Hæmorrhage* occurs usually as a result of trauma. The exudation may be extensive without compression of the cord. The blood comes from the large plexuses of veins which surround the dura. The rupture of an aneurism into the spinal canal may produce extensive and rapidly fatal hæmorrhage.

(b) *Intrameningeal Hæmorrhage* is rather more common, but is rarely extensive from causes acting directly on the spinal meninges themselves. Scattered hæmorrhages are not unfrequent in the acute infectious fevers, and I have twice, in malignant small-pox, seen much effusion. Bleeding occurs also in death from convulsive disorders, such as epilepsy, tetanus, and strychnia poisoning. The most extensive hæmorrhages occur in cases in which the blood comes from rupture of an aneurism at the base of the brain, either of the basilar or vertebral. In several cases of this kind I have found a large amount of blood in the spinal meninges. In ventricular apoplexy the blood may pass from the fourth ventricle into the spinal meninges. There is a specimen in the medical museum of McGill College of the most extensive intraventricular hæmorrhage, in which the blood passed into the fourth ventricle, and descended beneath the spinal arachnoid for a considerable distance. On the other hand, hæmorrhage into the spinal meninges may possibly ascend into the brain.

The *symptoms* in moderate grades may be slight and indefinite. In the non-traumatic cases the hæmorrhage may either come on suddenly or after a day or two of uneasy sensations along the spine. As a rule, the onset is abrupt, with sharp pain in the back and symptoms of irritation in the course of the nerves. There may be muscular spasms, or paralysis may come on suddenly, either in the legs alone or both in the legs and arms. In some instances the paralysis develops more slowly and is not complete. There is no loss of consciousness, and there are no signs of cerebral disturbance. The clinical picture naturally varies with the site of the hæmorrhage. If in the lumbar region, the legs alone are involved, the reflexes may be abolished, and the action of the bladder and rectum are impaired. In the dorsal region there is more or less complete paraplegia, the reflexes are usually retained, and there are signs of disturbance in the thoracic nerves, such as girdle sensations, pains, and sometimes eruption of herpes. In the cervical region the arms as well as the legs may be involved; there may be difficulty in breathing, stiffness of the muscles of the neck, and occasionally pupillary symptoms.

The prognosis depends much upon the cause of the hæmorrhage. Recovery may take place in the traumatic cases, and in those associated with the infectious diseases.

## II. AFFECTIONS OF THE BLOOD-VESSELS.

(a) *Congestion*.—Apart from actual myelitis, we rarely see post mortem evidences of congestion of the spinal cord, and when we do it is usually limited either to the gray matter or to a definite portion of the organ. There is necessarily, from the posture of the body post mortem, a greater degree of vascularity in the posterior portion of the cord. The white matter is rarely found congested, even when inflamed; in fact, it is remarkable how uniformly pale this portion of the cord is. The gray matter often has a reddish-pink tint, but rarely a deep reddish hue, except when myelitis is present. If we know little anatomically of conditions of congestion of the cord, we know less clinically, for there are no features in any way characteristic of it.

(b) *Anæmia*.—So, too, with this state. There may be extreme grades of anæmia of the cord without symptoms. In chlorosis and pernicious anæmia there are rarely symptoms pointing to the cord, and there is no reason to suppose that such sensations as heaviness in the limbs and tingling are especially associated with anæmia.

There are, however, some very interesting facts with reference to the profound anæmia of the cord which follows ligature of the aorta. In experiments made in Welch's laboratory by Herter, it was found that within a few moments after the application of the ligature to the aorta paraplegia came on. Paralysis of the sphincters developed, but less rapidly. Within fourteen days contractures of the limbs set in with atrophy and fibrillar twitchings. Histologically it was shown that within thirty-six hours there were marked changes in the ganglion cells of the anterior horns in the lumbar segments, and later there were signs of a definite myelitis. This condition is of interest in connection with the fact of the rapid development of a paraplegia after profuse hæmorrhage, usually from the stomach or uterus. It may come on at once or at the end of a week or ten days, and is probably due to an anatomical change in the nerve elements similar to that produced in Herter's experiments.

In this connection may be mentioned the interesting observations of Lichtheim upon the degeneration of the posterior columns of the cord in pernicious anæmia, of which he has reported three cases. He regards it as a form of toxic myelitis, due to the altered condition of the blood.

(c) *Embolism and Thrombosis*.—Blocking of the spinal arteries by emboli rarely occurs. It may be produced experimentally, and Money found that it was associated with choreiform movements. Thrombosis of the smaller vessels in connection with endarteritis plays an important part in many of the acute and chronic changes in the cord.

(d) *Endarteritis*.—It is remarkable how frequently in persons over fifty the arteries of the spinal cord are found sclerotic. The following forms may be met with: (1) A nodular peri-arteritis or endarteritis associated



with syphilis and sometimes with gummata of the meninges; (2) an arteritis obliterans, with great thickening of the intima and narrowing of the lumen of the vessels, involving chiefly the medium and larger-sized arteries. Miliary aneurisms or aneurisms of the larger vessels are rarely found in the spinal cord. In the classical work of Leyden but a single instance of the latter is mentioned.

(e) *Hæmorrhage into the Spinal Cord (Hæmatomyelia)*.—The existence of a primary hæmorrhage into the cord has been denied on the ground that in all instances it is preceded by a condition of softening. A majority of authors, however, admit the existence of a primary form. About forty-two cases are on record, which are collected in the thesis of Hayem\* and in the article of Berkeley.† It is more common in males than in females, and at the middle period of life. The cases have followed either cold and exposure or overexertion, and, most frequently of all, traumatism. It occurs also in tetanus and convulsions. Hæmorrhage may be associated with tumors, with syringo-myelia, or with myelitis; it is often difficult to determine whether the case is one of primary hæmorrhage with myelitis, or myelitis with a secondary hæmorrhage.

The *anatomical condition* is very varied. The cord may be enlarged at the site of the hæmorrhage, and occasionally the white substance may be lacerated and blood may escape beneath the meninges. The extravasation is chiefly in the gray matter, and may be limited or focal, or very diffuse, extending a considerable distance in the cord. In a case which occurred at the Montreal General Hospital under Wilkins the hæmorrhage occupied a position opposite the region of the fifth and sixth cervical nerves and on transverse section the cord was occupied by a dark-red clot measuring twelve by five millimetres, around which the white substance formed a thin, ragged wall. The clot could be traced upward as far as the second cervical, and downward as far as the fourth dorsal.

The sudden onset of the *symptoms* is the most characteristic feature in hæmatomyelia. The loss of power necessarily varies with the locality affected. If in the cervical region, both arms and legs may be involved; but if in the dorsal or lumbar, there is only paraplegia. There is usually loss of sensation, and at first loss of reflexes. Myelitis frequently develops and becomes extensive, with fever and trophic changes. The condition may rapidly prove fatal; in other instances there is gradual recovery, often with partial paralysis.

The diagnosis may be made in some instances, particularly those in which the onset is sudden after injury, but there is great difficulty in differentiating hæmorrhagic myelitis from certain cases of hæmorrhage into the spinal meninges. The question of diagnosis has been carefully considered by Hoch‡ in a recent report of two cases from my clinic.

\* Paris, 1872.

† Brain, 1889.

‡ Johns Hopkins Hospital Reports, vol. ii, fasciculus 6.

(f) *Caisson Disease; Diver's Paralysis*.—This remarkable affection, found in divers and in workers in caissons, is characterized by a paraplegia, more rarely a general palsy, which supervenes on returning from the compressed atmosphere to the surface.

The disease has been carefully studied by the French writers, by Leyden and Schultze in Germany, and in this country particularly by A. H. Smith. The pressure must be more than that of three atmospheres. The symptoms are especially apt to come on if the change from the high to the ordinary atmospheric pressure is quickly made. They may supervene immediately on leaving the caisson, or they may be delayed for several hours. In the mildest form there are simply pains about the knees and in the legs, often of great severity, and occurring in paroxysms. Abdominal pain and vomiting are not uncommon. The legs may be tender to the touch, and the patient may walk with a stiff gait. Dizziness and headache may accompany these neuralgic symptoms, or may occur alone. More commonly in the severe form there is paralysis both of motion and sensation, usually a paraplegia, but it may be general, involving the trunk and arms. Monoplegia and hemiplegia are rare. In the most extreme instances the attacks resemble apoplexy, and the patient rapidly becomes comatose and death occurs in a few hours. In the cases of paraplegia the outlook is usually good, and the paralysis may pass off in a day, or may continue for several weeks or even for months. Identical features are met with in the deep-sea divers.

The explanation of this condition is by no means satisfactory. Two careful autopsies have been made. In Leyden's case death occurred on the fifteenth day, and in the dorsal portion of the cord there were numerous foci of hæmorrhages and signs of an acute myelitis. In Schultze's case death occurred in two and a half months, and a disseminated myelitis was found in the dorsal region. In both cases there were fissures, and appearances as if tissue had been lacerated. It has been suggested that the symptoms are due to the liberation in the spinal cord of bubbles of nitrogen which have been absorbed by the blood under the high pressure, and the condition found at the autopsies just referred to is held to favor this view.

A large majority of the cases recover. The severe neuralgic pains often require morphia. Inhalations of oxygen and the use of compressed air have been advised. When paraplegia develops the treatment is similar to that of other forms. In all caisson work care should be exercised that the time in passing through the lock from the high to the ordinary pressure be sufficiently prolonged. According to A. H. Smith, at least five minutes should be allowed for each additional atmosphere of pressure.