CHAPTER XXXVII

INJURIES OF THE VERTEBRAL COLUMN

We have repeatedly touched upon isolated diseases of the vertebral column. I recall to your attention dislocation of the cervical vertebræ, cervical Pott's, retro-pharyngeal and retro-esophageal abscesses, psoas abscesses, etc. There now remains only a general survey of the diseases of the vertebral column.

It is well known that the vertebral column is composed of an extremely complicated system of joints, and consequently it would seem fair to suppose that *traumata* would cause extremely varied injuries. The peculiar kind of joints met with, however, account for the fact that this expectation is not fulfilled, and physicians, from the time of Hippocrates down, have doubted whether a simple dislocation ever took place. Observations have since taught us that simple traumatic dislocation of the vertebræ may occur, and if it does, the site is in the cervical spine. Blasius has collected eighty-one cases of undoubted dislocation of the cervical vertebræ from literature, in which it is found that the dislocation most frequently takes place between the fifth and sixth cervical. It has been noticed that these two bones are also most often the seat of fracture.

The most striking symptom of dislocation of the cervical spine is the pathognomonic position of the head, which has been fully described—including both the symptomatology and the varieties of dislocation—in a previous chapter.

In the thoracic and lumbar portion of the spine dislocation never occurs without fracture, at least of the articular processes. The statistics collected by Gurlt show that in addition to the two above-mentioned cervical vertebræ, the fifth and sixth, the last dorsal and first lumbar vertebræ are most frequently injured. The symptoms of these fractures vary greatly. Simple *fissures* and *incomplete fractures* are not open to direct examination in the living subject; on the other hand, they produce no threatening symptoms. More serious are the *compression fractures* described by Middeldorpf, which consist of complete crushing, or severe bruising, of the spongy portion of the bodies of the vertebræ. These injuries may narrow the lumen of the spinal canal and crush the spinal cord. The severest type of injury is *fracture combined with dislocation.* Either the body is fractured (most frequent in the dorsal or lumbar spine, in which case the upper fragment is dislocated forward) or the lamina is broken, usually seen in the cervical spine. In the latter case one of the fragments is displaced. In both forms narrowing of the canal and compression of the spinal cord result, which alone or in conjunction with the extravasation produce paralysis. The disability is of varying extent and distribution. The *extent* of the paralysis, of course, affects all the nerves which take their origin below the site of injury. The upper limit, therefore, is formed by a line drawn about the thorax or abdomen, which corresponds to the

peripheral distribution of the set of spinal nerves situated immediately above the injury. The higher the situation of the lesion the greater is the extent of the paralysis. The following is a more detailed description:

Fractures of the lumbar spine, passing through or below the third lumbar vertebræ, ordinarily produce no paralysis if the dislocation is not extreme. This is due to the fact that the spinal canal at this level incloses only the cauda equina, composed of strong and freely movable nerve fibres, which readily escape compression.

Fractures situated between the third dorsal and third lumbar vertebræ injure the spinal cord below the origin of the brachial plexus. The arms, therefore, escape, but the *lower extremities*, the *bladder*, and the *rectum* are paralyzed. Retention of urine and fæces results; later, when the sphincters of the bladder and rectum no longer can control the accumulated contents of their respective viscera, incontinence of urine and fæces develops. If the fracture is situated at a higher level, the abdominal muscles are paralyzed. This is promptly followed by tympanites, consequent crowding upward of the diaphragm, and impairment of respiration. Paralysis of the abdominal muscles especially impairs the phase of expiration. Injury still higher up may paralyze some of the intercostal muscles, thus further increasing the respiratory difficulty.

Fractures which pass above the level of the third dorsal vertebræ cause more extensive paralyses. Their great practical importance requires a still more detailed description. The brachial plexus is formed by the fifth to eighth cervical and first dorsal nerves.

Fractures below the fourth cervical will, therefore, *paralyze* the *upper extremities*. But, as all the intercostal and abdominal muscles are also paralyzed, so-called *diaphragmatic respiration* results. All the respiratory muscles, with the exception of isolated muscles of the neck, are now functionless; the diaphragm alone performs the act of inspiration. Expiration is carried on solely by the mechanical forces, of which the elasticity of the thorax is the chief factor. The immediate result of this disability shows itself in that all actions requiring an active expiratory effort, especially the acts of coughing and sneezing, are almost completely abolished. The condition becomes still more serious if bronchitis is present. The main fibres of the phrenic nerve pass out through the intervertebral foramen formed by the third and fourth cervical vertebræ. If a fracture involves these parts the phrenic may be injured, causing instantaneous death, or death shortly after the accident. Gurlt's statistics show that this fatal outcome has in some cases been due not to the fracture itself, but to passive movements undertaken at a later period. One patient's death was due to the fact that his daughter clasped her arms about his neck; another, because his wife placed her hand beneath his head to support it; a third died instantaneously when the barber turned his head while shaving him.

Fractures of the first and second cervical vertebræ cause instant death if the primary dislocation is of sufficient extent to crush the spinal cord. If the primary displacement is less marked, the patient may continue to live for days, until some sudden movement brings about the catastrophe. We know of one case of fracture of the atlas, without dangerous displacement,

in which life was prolonged for a considerable period of time.

The completeness of the paralysis varies. As a rule, although motor symptoms are well marked, the sensibility of the skin is entirely unimpaired or only slightly affected. It must be emphasized that fractures in the region of the origin of the brachial plexus may cause complete paralysis of the lower portion of the body, and yet the upper extremities may escape all injury, or, at best, merely suffer incomplete pareses, for instance, of one arm or both forearms. In addition, it should be mentioned that in some cases reflex movements are almost completely preserved, so that tickling of the sole may produce movement of the toes in the paralyzed limb.

Paralyses have been mentioned before other symptoms, as they are most striking and important. The extent of the lesion furnishes some clew to the nature of the injury. In lateral displacement of the fragments, one side of the body suffers greater disability than the other, etc. We must assume, however, that the dislocation alone produces the paralysis. This will hold good in the majority of instances, but in isolated cases it may be next to impossible to exclude an extravasation as the partial cause of compression.

In addition to paralyses, *symptoms of irritation* may be present—hyperæsthesiæ, neuralgic pains, tonic and clonic spasms, and fibrillary twitching of the skeletal muscles. Fractures in the region of lower cervical and upper dorsal vertebræ may produce mydriasis or narrowing and immobility of the pupil, of which I saw an instance in the department of Professor Mosetig in Vienna. This phenomenon is explained by the fact that

the nerve centre which controls the size of the pupil lies in this part of the cord, and is therefore exposed to irritation.

Vaso-motor disturbances are at times of special interest. In addition to blanching or reddening of certain regions of the skin, excessive rise in body temperature is sometimes observed after injury to the cervical part of the spine. Observations made on such cases have led to much (and as yet by no means complete) investigation upon the control of the central nervous system over the body temperature. Of similar interest is a case in which the sweat excretion suffered local impairment, for, though the lower extremities remained dry, the upper, uninjured portion of the body was covered with drops of sweat. Of theoretical importance is the ejaculation of semen which may take place immediately after an injury in the cervical region. Erections may occur shortly after the accident, and persist for days, either strongly marked or partial. These erections may regularly reappear after each catheterization, although the urethra is insensitive. Olivier, and later Goltz, have attempted to discover the physiological significance of this phenomenon by experiments performed on animals.

We have therefore a considerable number of symptoms which may accompany fracture of the spine. In some cases the diagnosis may, however, be difficult. The diagnosis is easy in those cases in which crepitus can be elicited, or where striking deformity of the spinal column can be demonstrated by palpation along the posterior surface of the body (or in injury of the cervical spine by examination through the mouth). Only in the cervical region will there remain a doubt whether

dislocation is simple or complicated by fracture. If the deformity is slight it may be difficult to decide, in spite of palsies, whether we are dealing with a fracture or merely with compression due to hemorrhagic effusion. In many cases a positive diagnosis is not possible.

CHAPTER XXXVIII

TUBERCULOSIS OF THE VERTEBRAL COLUMN

Tuberculosis of the vertebræ occurs only in certain well-defined portions of the bones. In the cervical segment the disease is in some cases situated in the articular processes; as a rule, however, the bodies, and, still more definitely, the anterior surface of the bodies, are affected. In children the erosion of the vertebræ makes rapid progress; the corresponding spinous process becomes prominent early in the disease, causing what is known as the Pott's hump or angular kyphosis. As soon as this is present, no further doubt need be entertained about the nature of the trouble, for the kyphosis seen in rachitis is *arcuate*; the column is arched, with convexity directed backward, and a slight lateral curvature is usually present. In Pott's, in addition to the painful, prominent vertebræ, the symptoms of a gravitation abscess may often be found. Such a symptom-complex is unmistakable. In the initial stages an expert may fail to recognise the disease. I therefore emphasize that the most trivial symptom must receive due attention. The mother usually draws our notice to the first symptoms. She relates that the child now maintains a strained, uncertain posture, and that the gait has become staggering. Turning or sitting grows difficult; the child sits down