

and the deformity characteristic of destruction of the vertebral bodies is often absent. Paralysis is a frequent and often an early symptom.

Malignant disease of the spine is a fatal affection and the treatment can be but palliative.

ACUTE OSTEOMYELITIS.—Infectious osteomyelitis of the spine is uncommon. The characteristic symptoms are similar to those of acute infectious processes elsewhere, namely, sudden onset with fever and constitutional depression. There are local pain and tenderness about the spine. Abscess quickly forms, and paralysis, from the rapid extension of the disease to the spinal cord, is a frequent complication.

The later symptoms due to pyogenic infection are often pyæmic in character. Necrosis of the affected vertebral bodies may result in the formation of large sequestra. The death rate is about fifty per cent.

Treatment.—The immediate evacuation and drainage of the abscess is indicated together with the removal of the necrosed bone if possible. Subsequently the spine should be supported.

A more chronic and more localized form of osteomyelitis may occur, but it is practically impossible to distinguish its symptoms from those of tuberculous disease. In this class of cases an abdominal or pelvic abscess may be the first indication of disease.

ACTINOMYCOSIS.—Actinomycosis of the spine is an extremely rare disease. Its diagnosis may be made by the microscopical examination of the discharge from the sinuses that almost always form early in the course of the disease.

TRAUMATISM.—Severe sprains, rupture of ligaments, or fractures of the spine may simulate disease, particularly when the injury is of the cervical region. Diagnosis is in some instances practically impossible until the effect of local support has been tested, when as a rule, if disease be absent, the symptoms, even though of long standing, quickly subside.

Fracture of the spine in the middle region without displacement may cause angular deformity, and when proper support has been neglected, symptoms of pain and weakness similar to those of Pott's disease may persist indefinitely.

Sudden forcible compression of one or more of the vertebral bodies without displacement and without severe immediate symptoms, other than the slight deformity, may be the result of injury, especially falls from a height. These cases are not uncommon and are usually mistaken for Pott's disease, especially as the deformity may not be evident until several weeks after the injury.

The *diagnosis* should be made clear by the history. **Treatment.**—In all such cases and whenever weakness of the spine persists and when motion causes pain, a support should be applied. Fracture of the spine should be treated as are fractures elsewhere, by reposition if possible or practicable, and by support until the integrity of the parts has been reestablished.

TRAUMATIC SPONDYLITIS.—Kummell has described a form of rarefying osteitis of the spine induced apparently by injury. It is characterized by symptoms of pain and weakness, referred to the back, and by a rounded kyphosis of the dorsal region. Motor disturbances of the lower extremities are frequent. Such cases may be explained either as direct effects of injury, or as due to subsequent infection—tuberculous or otherwise—of the weakened parts.

The *treatment* is similar to that of Pott's disease. **THE RACHITIC SPINE.**—The rachitic spine has been mentioned in the consideration of the differential diagnosis of Pott's disease, and it is described in more detail elsewhere. (See *Spine, Tuberculous Disease of the*.) It is a deformity that appears, usually during the first or second year of life, in children who do not walk. The typical rachitic kyphosis is a rounded projection of the middle and lower region of the spine. It is in fact simply an exaggeration of the contour that is normal in the sitting posture. The deformity is more or less rigid according to its duration. If it is extreme, it may be accom-

panied by a compensatory backward inclination of the head—"posterior torticollis."

Treatment.—Aside from the constitutional treatment of the predisposing disease the indications are to overcome the rigidity and the limitation of motion of the spine, to support it if necessary by a light back brace, and to avoid, as far as possible, the postures that favor the deformity. In severe cases of rickets the recumbent posture on the stretcher frame which has been described under Pott's Disease (see article entitled *Spine, Tuberculous Disease of the*), is the treatment of selection.

THE "TYPHOID SPINE."—During the course of, or during convalescence from, typhoid fever symptoms of pain, weakness, and stiffness of the back may appear, induced in certain instances apparently by sudden movements or strains. Often there may be local sensitiveness to pressure or motion; and a slight posterior projection in the lumbar region of the spine, the part most often involved, is not unusual.

The cause of the symptoms is apparently infection of the fibrous coverings and attachments of the spine similar to the more common and more severe forms of periostitis in other situations that may complicate this disease. It may be stated also that in exceptional instances typhoid infection may be accompanied by abscess, by destruction of bone, and by actual deformity.

Treatment.—The treatment should be symptomatic. During the active stage if the pain is severe the patient should be kept in the recumbent position. Locally the application of the Paquelin cautery is of service in relieving pain, and the application of adhesive plaster strapping over the sensitive area may add to the comfort of the patient. As soon as it is practicable a back brace or corset should be applied. Recovery is the rule, although a certain amount of restriction of motion may persist.

The same symptoms may follow other forms of contagious disease, notably scarlet fever, but as a rule they are less persistent and severe.

GONORRHOËAL ARTHRITIS.—Gonorrhœal infection is uncommon. Its symptoms resemble those of the preceding affection; ankylosis is, however, more common as a result; in fact, gonorrhœal arthritis is supposed to be one of the causes of spondylitis deformans.

The treatment consists in support for the purpose of preventing deformity and relieving discomfort.

CERVICAL ARTHRITIS.—The joints of the occipito-axoid region are sometimes involved in what appears to be a form of infectious arthritis, sometimes following diphtheria or other contagious disease. It may be distinguished from tuberculosis by its acute onset, and from acute torticollis by the fact that all the motions of the head are restricted.

Treatment.—The treatment consists in support during the acute stage, as by a collar or jury mast, followed by massage and manipulation to overcome the stiffness.

SPONDYLITIS DEFORMANS.—Spondylitis deformans is a chronic affection of the spine terminating in ankylosis and deformity.

The disease is apparently a chronic inflammation which affects primarily the ligaments and the periosteal coverings of the spine, a form of ossifying periostitis which binds the vertebrae firmly to one another. It may begin on the lateral or on the antero-lateral aspect of the spine. It may be limited to a particular region, but in most instances it progresses until it involves the entire spine, and often the articulations of the ribs as well. The intervertebral discs atrophy, but in some instances the margins of the cartilages proliferate and become ossified in a manner characteristic of osteoarthritis.

Under the general term of spondylitis deformans are included, in all probability, several varieties of disease. For example:

1. The ankylosis of the spine may be simply a part of a general rheumatoid arthritis involving the larger and smaller joints—rheumatoid arthritis of the spine.

2. The spine may be involved together with one or more of the adjacent joints, which show the characteristic

symptoms of the so-called hypertrophic form of arthritis deformans—osteoarthritis of the spine. This form has been designated by Marie as spondylose rhizomélique (*σπονδυλος* spine, *ρίζο* root, *μελος* extremity), implying a disease of the spine, together with the adjoining "root" joints.

3. The disease may be limited to the spine and even to a particular region; in such cases it may be quite different from rheumatoid arthritis or osteoarthritis. This form may follow acute rheumatism; it may be induced

apparently by gonorrhœa or by other forms of infection. It may begin acutely like inflammatory rheumatism, or it may be chronic in character and progress slowly.

In the cases of spondylitis deformans, as distinct from general involvement of the joints, there is often an acute onset, called lumbago, from which the patient dates the beginning of his trouble. This is followed by a gradually increasing stiffness of the spine and accompanying deformity, with intercurrent attacks of so-called lumbago. In the well-marked cases the patient complains of stiffness,



FIG. 4422.—Complete Ankylosis of the Entire Spine. The patient, about one year before coming under observation, fell down a flight of stairs, rupturing the bony adhesions between the vertebral bodies at the points of greatest deformity (as seen in the picture). The accident was followed by great pain and marked sensitiveness at and near the points of injury, and these symptoms persisted for many months.

weakness, pain in the loins, pain radiating forward along the ribs; sometimes of weakness in the limbs, of headache, nervousness and the like, symptoms that may be caused directly by the inflammatory process, or by implication of the nerve roots, or by an accompanying neurasthenia. The direct symptoms are increased by jars which are exaggerated by the inelasticity of the spine. The disease is usually progressive and terminates finally in complete rigidity of the spine, which is bent into a long kyphosis most marked in the upper dorsal region, the lumbar lordosis being obliterated in many instances.

When the disease is limited to the spine or to the spine and larger joints, the occipito-axoid articulations are not usually involved; but in the cases of general rheumatoid arthritis, stiffness of the neck may be an early symptom.

Treatment.—The local treatment is symptomatic. The application of the cautery adds to the patient's comfort, and self-suspension at intervals may relieve the dragging sensation in the muscles. Rubber heels are of service in lessening the jar. A brace or plaster corset may be applied if the pain is aggravated by motion. It should serve also, together with the avoidance of predisposing attitudes, to prevent extreme deformity of the spine. Such protection is of great service if it is applied early in the course of the disease, especially in those cases in which it is localized, as it sometimes is in the lumbar region.

ADOLESCENT KYPHOSIS.—A form of extreme kyphosis, accompanied by stiffness and discomfort, is not infre-

quently seen in adolescence. It appears to be a static deformity induced by overwork. It can hardly be classified with spondylitis deformans, although there may be some difficulty in distinguishing between the two. The treatment is, if possible, prevention in avoiding predisposing postures and in strengthening the muscles. In more advanced cases, forcible correction after the Calot method, followed by support, massage, and exercise, may be of service.

The kyphosis of old age is a familiar deformity that does not require special mention.

OSTEITIS DEFORMANS.—Osteitis deformans is described elsewhere. It is a general disease characterized by hypertrophy and softening of the bones. The deformity of the spine is similar to that of spondylitis deformans, but the local discomfort is far less marked.

THE NEUROTIC SPINE.—This affection is far more common in adolescence and adult life than it is in childhood, and in females than in males. The subjects are usually of a nervous or neurasthenic type, often overworked and physically depressed. In certain instances, however, the exciting cause appears to be direct injury. The patient usually complains of a dull pain in the back of the neck, or in the lumbar or sacral region, of a constant tired feeling, and not infrequently of sharp neuralgic pain localized about a certain point in the spine, often the vertebra prominens. The contour of the spine may be normal, but there is usually a well-marked tendency toward a forward droop, the curve of weakness. A common symptom of the neurotic spine is the extreme local tenderness, or hyperæsthesia of the skin over certain spinous processes. Thus, if one passes the finger gently along the spine the patient will often shrink or cry out when the sensitive point is reached. The pain is usually localized about the spine, and there is no limitation of movement or especial discomfort on motion. The symptoms are distinctly subjective, thus differing from those of actual disease.

Treatment.—The treatment of the neurotic spine must include, of course, the general condition of the patient. Locally, a light back brace or a long corset, reinforced with steel bands, adds to the comfort of the patient. The application of the cautery lessens the local sensitiveness. Massage and exercises may be employed with advantage. Complete recovery is usually long delayed.

THE HYSTERICAL SPINE.—The hysterical spine is usually classed with the neurotic spine. The local subjective symptoms may not differ particularly from those of the neurotic spine, but in certain instances actual deformity may be present. This is usually exaggerated lateral distortion of the lumbar region. This deformity may appear after injury, but, except as a possible cause of a particular manifestation of the mental condition, it is usually apparent that injury cannot explain the symptoms or the deformity.

Treatment.—The local treatment is similar to that of the neurotic spine.

PAIN IN THE LOWER PART OF THE BACK.—Pain, discomfort, and weakness are sometimes symptomatic, being caused by disease or displacement of the pelvic or abdominal organs. Similar discomfort is a common symptom among overworked women. It is usually present also whenever the lumbar lordosis is exaggerated, as a compensatory deformity for dorsal Pott's disease, or because of flexion of the thigh after hip disease.

The *treatment* must be directed to the conditions of which it is a symptom.

Pain and weakness in the lumbar region may be induced by strain or other injury. In such instances it is usually increased by sudden motion or overexertion, and it may be persistent and disabling. Such cases are often classed as chronic lumbago. The cause is apparently strain of the deep ligaments or muscles of the spine, but the symptoms may be exaggerated, doubtless in certain instances by gout, rheumatism, or other disease of this character.

When motion causes pain and when the symptoms are persistent, support in the form of a back brace is indi-

cated, the Knight brace or plaster corset being convenient forms. During the more acute stage the cautery, followed by the application of intersecting straps of adhesive plaster covering a wide area, will often relieve the pain. Later, massage, electricity and the like, may be of service.



Fig. 4423.—Sciatic Scoliosis.

ten observed among laborers. The effect of the displacement is to exaggerate the lumbar lordosis and to increase the prominence of the sacrum and of the iliac crests. The deformity is most often seen in women, causing no particular symptoms; in fact, its chief interest lies in its effect upon childbirth.

Treatment.—Support may be required if the symptoms indicate it. In the slighter grades of deformity a strong corset reinforced by steel bands is efficient.

DEFORMITY OF THE SPINE SECONDARY TO SCIATICA.—Persistent sciatica often induces a change in the attitude and contour of the spine. As a rule the patient habitually inclines the body away from the painful part, in order to relieve the limb from weight, and bends the body slightly forward to relax the tension on the sensitive nerve or plexus of nerves. Thus the pelvis on the affected side projects, there is a lateral lumbar convexity toward the opposite side, and often the normal lumbar lordosis is lessened or lost, so that the final result may be a permanent lateral curvature together with a flattening of the lumbar region. If the sciatica is a symptom of a more widespread neuritis of the lumbar plexus, muscular weakness and muscular spasm may cause variations in the typical attitude, but this is unusual.

Aside from the direct treatment of sciatica support may be indicated if movements of the spine aggravate the pain. This is always indicated when there is danger of persistent distortion. The patient should be suspended and corrective jackets applied at frequent intervals. As

the attitudes and symptoms described may be caused by disease or injury of the sacro-iliac articulation, this region should in all instances be carefully examined.

Neuritis of spinal nerves in other regions of the spine may cause symptoms of reflected pain and local sensitiveness. These are increased by motion, and a certain amount of deformity, similar in character to that due to sciatica, may be present.

The treatment is similar to that indicated for the former affection.

Royal Whitman.

SPINE, SURGERY OF THE.—It is essential, before we enter upon the study of the surgery of the spine, that we should have a fairly thorough acquaintance with the most salient points in its anatomical construction.

The spinal column is not a straight structure, but presents a series of curves corresponding to its various portions. The cervical portion presents a concavity; the dorsal a convexity; the lumbar a concavity; while the sacrum and coccyx are slightly convexed. On account of its being made up of a large number of vertebrae, which are separated from each other by intervertebral substance and are held together by elastic ligaments and muscles, it presents a flexuous and flexible column, capable of a considerable degree of motion, without injury either to its muscles or ligaments or to the spinal cord itself. The spinal canal is about twenty-seven inches in length, larger in the neck and loin where it presents a rather triangular shape, and narrower and more nearly round in the remaining portions of the canal. It is also to be remembered that the spine has a slight lateral curvature, the convexity of which is toward the right side; an exception to this rule exists in left-handed individuals.

The spinal cord is seventeen or eighteen inches in length and occupies only about two thirds of the canal—hanging loosely in it and not by any means filling up the whole contour of the canal. It extends from the upper border of the atlas to the lower border of the first lumbar vertebra, at which point it terminates in a slender filament of gray substance, known as the filum terminale. The spinal cord is vested by three membranes: the dura mater, the arachnoid, and the pia mater. The dura mater is separated from the spinal canal by loose areolar tissue and a plexus of veins—this membrane being a continuation of the one which surrounds the brain. Special attention should be given to this plexus of veins, as in many injuries of the spinal column these veins are ruptured by hyperextension, thus forming clots of blood, which impinge upon the spinal cord, producing symptoms of paralysis. Attention is also to be paid to the fact that the dura mater is not adherent to the spinal canal, which has its independent periosteum; nor does the dura mater send any of its prolongations into the fissures of the cord as occurs in the brain. The arachnoid is a continuation of the same membrane that surrounds the brain, and is connected with the spinal nerves, so as to form a sheath for them as they pass into the intervertebral foramina. The outer surface of this membrane is connected with the dura mater to a limited extent, thus leaving a considerable space, known as the subdural space, while the inner surface is connected with the pia mater by slender filaments of connective tissue. The inner surface of the arachnoid is separated from this membrane by a considerable interval known as the subarachnoidean space. The pia mater covers the entire surface of the cord, being intimately adherent to it, forming its neurilemma and sending a process into its anterior fissure. It also forms a sheath for each of the filaments of the spinal nerves and invests the nerves themselves.

There are thirty-one pairs of spinal nerves divided according to the corresponding regions of the spinal canal. In the cervical region there are eight; in the dorsal, twelve; in the lumbar, five; in the sacral, five; in the coccygeal, one. A spinal nerve arises by two roots, the anterior or motor root and the posterior or sensory root. We should bear this latter division in mind, as pressure upon the anterior root in any region will produce loss of motion or paralysis in that region where the nerve is dis-

tributed, while pressure only upon the posterior root will cause loss of sensation or anesthesia in the part to which the nerve is distributed. Our attention is also called to the fact that the roots of the spinal nerves from their origin in the cord run obliquely downward to their point of exit from the intervertebral foramina, the amount of obliquity varying in different regions of the spine and being greater in the lower than in the upper portion.

Diseases and injuries of the spine may be classified under two heads—congenital and acquired. Under the first of these divisions occurs spina bifida, while under the latter we have the following classification: First, pathological changes produced by disease, and secondly, those produced by traumatism.

Spina Bifida.—Spina bifida, or hydrorrhachis, is a congenital deformity due to the non-development of the posterior vertebral arches, thus leaving an aperture through which the membranes protrude, this condition resembling hernia as seen in other portions of the body. The varieties of this affection are known as meningocele, where the contents of the sac are composed of the spinal membranes only; meningocele, where the contents of the sac consist of the cord and its membranes; and lastly syringomyelocoele, where the central canal of the spinal cord is dilated, thus forming the tumor. The tumor varies from the size of a small cherry to that of an adult's head, and occurs most frequently in the lumbar and sacral regions, as these portions of the spinal column are later in their development than those in the upper regions. The shape is usually round and the surface smooth; at times there is, in the median line, a furrow which presents a pit-like depression above and below. The tumor occasionally is covered with skin, either of a red color or normal in aspect, but thin and translucent; while in other cases there is an absence of skin altogether, the outside covering being derived from the dura mater. It is very important that this affection should be correctly diagnosed, and in most cases this can readily be done. The affections simulating spina bifida may be mentioned as lipomata, and dermoid cysts or other varieties of cysts in this locality. A large per cent. of children affected by this condition die soon after birth. It is a congenital

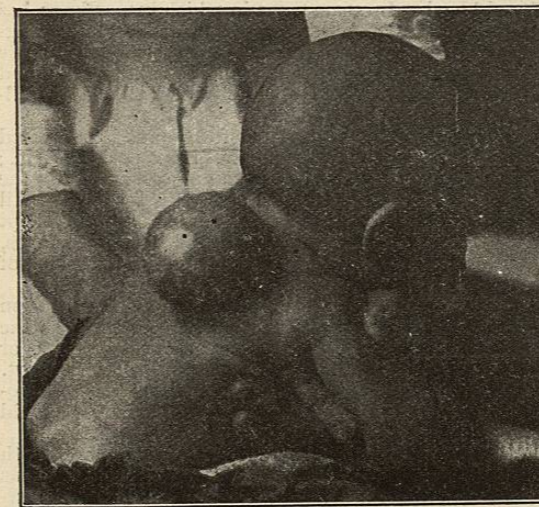


Fig. 4424.—Case of Spina Bifida; Showing the Sac before Operation.

trouble and always occupies the central position of the canal, and its fluid communicates with the fluid of the brain. Pressure upon the tumor diminishes it in size and promotes tension of the fontanels, and, when continued for any given length of time, it is followed by stupor or convulsions. By an examination around the

base of the tumor, the outer lining of the bony partitions of the spinal canal can be made out, and by the use of a hypodermic syringe it is possible to withdraw a small quantity of fluid—cerebrospinal fluid, as will be found upon examination. Should the case prove to be a dermoid cyst, or cyst of any other kind, or a lipoma, all of these symptoms will be found wanting.

The treatment of spina bifida may be divided into palliative and operative. In the palliative treatment, pads of absorbent surgeon's wool or gauze saturated with lanolin are applied, and gentle pressure used, either by the roller bandage or by a properly applied apparatus. The sac is sometimes enveloped with a

solution of collodion, the purpose being to constrict the sac and thus diminish the bulk of the tumor.

Among operative measures, one plan is to draw out a small quantity of fluid at a time, either through a puncture or by an aspirator (a very small quantity of the fluid being drawn off at a time, say about ten or fifteen drops), and then, after sealing the opening with collodion, to apply slight pressure over the sac. This plan is to be repeated every twenty-four or sixty hours, depending largely upon the symptoms which develop. When an incision is made at the side of the tumor, it must always be in an oblique direction, and every precaution must be taken to make the parts perfectly aseptic.

Besides evacuating the contents of the tumor, injections of iodine or of alcohol are sometimes made into the sac. This treatment, however, is very unsatisfactory, as the majority of cases thus treated prove. On account of the many fatal terminations which have occurred as a result of this mode of treatment, a complete excision of the sac has been resorted to. The sac is first opened and its contents evacuated, and then, if the nerves and filaments of the cords are found in it, they are pushed back into the spinal canal and the sac ligated. If the tumor is covered with skin, an elliptical incision is made on each side of the growth, the two flaps are dissected down to the neck of the tumor, the membrane is punctured and the fluid let out, the sac is opened as suggested above, and a sufficient amount of it cut away to approximate the edges closely. Great care should be taken not to injure the nerves or the cord if they appear in the tumor; they should be carefully replaced in the spinal canal, and the edges of the membrane should be closely approximated by a separate row of catgut sutures and the skin flaps brought together by silk or silk-worm-gut sutures. If after opening the sac the nerves are found to be adherent to the posterior part of the sac, they should be separated by careful dry dissection, and pushed back into the spinal canal. Should the tumor be devoid of skin, it is best to borrow some skin from the adjacent region and make a skin graft over the surface of the wound left by such transfer.

Should the opening be a large one, bone grafts may be taken from the adjacent bone, or borrowed from an inferior animal, the chiasm being thus filled up, or, as has been suggested by a recent writer, large silver wire may



Fig. 4425.—The Same Case as that represented in Fig. 4424; Showing the Results of the Operation.