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Modern Surgery - Chapter 19. Diseases and Injuries of the Bones and Joints - Diseases of the Joints

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weight on an inverted foot the heel of which is raised ("Annals of Surgery," June, 1902). When only one bone is broken, displacement is slight, there is severe pain on motion and pressure, and crepitus can generally be obtained. Pain is produced by flexing the toes, putting weight upon the toes, as in walking, and by inverting or everting the foot. A simple fracture of a metatarsal bone is treated by an immovable dressing for four weeks. Fractures from crushes usually demand excision or amputation.

**Fractures of the phalanges of the toes** are due to direct force and are often compound. They may require immediate amputation.

*Treatment.*—In a compound fracture where amputation is unnecessary, drain with strands of catgut for forty-eight hours and dress antiseptically; at the end of this time apply over the bichlorid gauze a gutta-percha or a pasteboard splint extending from beyond the end of the toe to well up upon the sole of the foot, and fix the splint in place with a spiral bandage of the toe and instep. The splint is to be worn for four weeks. In a simple fracture fasten the injured toe to an adjacent toe or toes by a plaster bandage and wear the dressing for three weeks.

### 3. Diseases of the Joints.

**Synovitis** is a primary inflammation of the synovial membrane alone. If other structures besides the synovial membrane are involved, the condition is known as "arthritis." Two forms of simple synovitis exist—namely, *acute* and *chronic*. Some surgeons speak also of *subacute* cases.

**Acute Simple Synovitis.**—The *causes* of acute simple synovitis are contusions, sprains, twists, and overuse. The causative influence of exposure to cold or damp has been much debated. It seems probable that in some cases cold produces vasomotor paresis of the vessels of the synovial membrane, a condition which may be followed by inflammation. In synovitis the synovial membrane is red and swollen, and the joint contains an excess of turbid fibrinous fluid. If the inflammation advances, arthritis arises and sometimes blood is effused.

**Symptoms.**—A prominent symptom of acute synovitis is pain, which is increased by motion of the joint, by pressure upon the articulation, and by a dependent position of the limb, and which is worse at night. Pressure upon the cartilage does not cause pain, but friction of the synovial membrane at once develops it. The patient places the limb in the position which gives the greatest ease, and in this position the part becomes more or less fixed as the muscles about the joint are rigid. A fluctuating swelling is noted in a superficial joint, most marked between the ligaments, which swelling bulges out the synovial area and hides or obscures the articular heads of the bones. The swelling is due early to extensive secretion of synovia, and later to effusion of liquor sanguinis. Bulging takes place at points where the capsule is thin, and at such points fluctuation may be detected. Fluctuation in the elbow is sought for posteriorly. Fluctuation in the knee is sought for on either side in front. A large effusion in the knee floats the patella up from the condyles. A small effusion in the knee can be detected by Fiske’s plan, which is as follows: Tell the patient to bend forward at the hips, resting
Each hand on the front of the corresponding thigh. The anterior structures of the joint are relaxed, and, by tapping the patella, even a small effusion can be discovered. Bulging cannot be distinctly observed in the hip or shoulder, unless effusion is great. The skin over the joint is rarely reddened, but feels hot to the hand of the observer (over superficial joints, but not over the shoulder and hip); the joint is partly flexed; fever exists, varying in degree with the size of the joint, the acuteness of the attack, and the nature of the cause. Suppuration rarely follows simple synovitis, but it may do so, the area of synovitis being a point of least resistance to organisms carried by the blood or lymph. If suppuration takes place, rigors occur, there is a septic temperature, and the joint soon gives evidences of containing pus. These evidences are violent pain, increased tenderness, dusky discoloration if the joint be superficial, greater muscular spasm, periarticular edema, and constitutional symptoms of sepsis. Traumatic synovitis without infection tends toward cure without suppuration if the patient is healthy, and after it ankylosis is rare.

Treatment.—In treating acute synovitis immobilize the joint. In severe cases place it in such a position that the limb will still be useful even if ankylosis occurs. In mild cases immobilize in the position of rest, apply leeches, and use the ice-bag or the Leiter coil. After a day or two apply gentle pressure, intermittent heat, and iodin and ichthyol. If the effusion is very great and persistent, and pressure, heat, and sorbafacients fail to remove it, aspirate with antiseptic care. If effusion recurs after respiration, apply a plaster-of-Paris dressing or use flying blisters and massage. A rubber bandage is often useful toward the termination of a case.

Chronic Synovitis.—Chronic synovitis follows acute synovitis or it may be chronic from the start. Many cases called chronic synovitis are in truth tuberculous disease. The synovial membrane looks nearly natural, but is edematous, and the joint contains an excess of fluid. If the quantity of fluid is large, the disease is called “hydrops articulari,” or “dropsy.” A large amount of fluid in the knee-joint “floats” the patella upward. Tuberculous infection is apt to occur in very prolonged cases. In prolonged chronic synovitis the synovial membrane thickens in some places, softens in others, is often adherent, and the villous processes hypertrophy. If the membrane becomes extensively softened (pulpy degeneration), the softened areas bulge and caseation eventually occurs. In the knee-joint a traumatic synovitis is sometimes linked with inflammation of the semilunar cartilages. Roux tells us that this inflammation may be produced by a squeeze, a twist, or a direct force, but a squeeze is the common cause. Hyperextension of the knee may squeeze the cartilage, and so may attempting to rise from a stooping posture.* If this injury has taken place, the disability will be prolonged.

Symptoms.—In chronic synovitis pain is absent or is only present during exercise or from pressure, and is slight even then; there is some limitation of movement; passive motion may develop creaking or joint-crepitation; fluctuation is apparent; there is atrophy in the muscles about the joint; and the hypodermatic needle will draw out a viscid, straw-colored or bloody fluid.

Treatment.—For hydrops use rest and pressure. Pressure may be obtained by the application of Martin’s rubber bandage. A plaster-of-Paris dressing or use flying blisters and massage.

*Gaz. des Hôp., No. 125, 1895.
Chronic Synovitis

dressing is probably the best way to combine rest and compression. Massage, douches, frictions, passive movements, and flying blisters should be used. Painting the joint with iodin and spreading over it blue ointment, and rubbing in ointment of ichthyol (50 per cent. with lanolin) may do good. Counter-irritation by the actual cautery is a valuable expedient. Chronic synovitis is often greatly benefited by the use of a hot-air apparatus. The limb is wrapped in flannel and is placed in an oven. The oven is heated by Bunsen burners. The temperature is raised to about 300° F., and the limb is subjected to this for one hour. The oven should be used daily, and as the patient becomes accustomed to it even a higher degree of heat can be tolerated. This high degree of heat can be borne only when it is perfectly dry. Any moisture scalds the patient. The Lentz oven has in it ventilation openings to get rid of moisture and the sweat is taken up by the flannel. This flannel must not be applied so thickly as to keep the heat notably from the joint nor must so little of it be used as to permit of its soaking with sweat. Fig. 224 shows the Sprague hot dry-air apparatus, and Fig. 225 exhibits a cross-section of the same apparatus. Dr. H. A. Wilson inserts in the oven humidin, a product obtained in the purification of salt, which material entirely absorbs the moisture. Cotton should not be used to wrap the limb, because, if the bottom of the oven becomes red-hot, the cotton may ignite and burn the patient. A physician or nurse should constantly watch the apparatus during its employment.* Aspiration and the subsequent use of a plaster-of-Paris

*H. A. Wilson, in Annals of Surgery, Feb., 1899
bandage may be tried in some cases. Some surgeons advise aspiration, washing out with salt solution, injecting a 5 per cent. solution of carbolic acid, and immobilizing. Incision and drainage constitute a radical but proper plan, in cases unamended by simpler methods. If pulpy degeneration exists, perform an excision or an erosion. If pus forms, incise at once and drain. Internally, treat any existing diathesis and give nutritious food, tonics, and stimulants.

Arthritis.—By this term is meant not only inflammation of a synovial membrane, but also of other structures composing and surrounding a joint. It may follow a traumatic synovitis; it may be due to pus organisms, to tubercle bacilli, to infectious diseases (gonorrhea and typhoid fever), to rheumatism, to gout, to syphilis, and to lesions of the spinal cord. Arthritis may be either acute or chronic.

Tuberculous Arthritis (White Swelling; Strumous Joint; Pulpy Degeneration).—Pathology and symptoms.—The predisposing causes of tuberculous arthritis may be strains, blows, twists, or cold. The real cause is the bacillus of tubercle. A single joint is attacked. Other joints may subsequently become involved so that several suffer simultaneously, but it is rare that the process is active in more than one joint at the same time. During the course of tuberculous disease of a joint phthisis is not common, although it not unusually develops after the joint is well. The same is true of tuberculous glands. During the existence of phthisis or tuberculous glands tuberculous arthritis does not frequently arise.

The primary infection with tubercle bacilli is usually in the bone, though it may be in the synovial membrane, the joint-capsule, or the structures about the joint. If the primary infective focus is in the bone, and it usually is, a portion of the cartilage is destroyed and the joint is opened, or a sinus forms and perforates the synovial membrane. When tuberculous inflammation attacks the synovial membrane granulation-tissue is formed, and the capsule and periarticular structures soon become involved in the process; the parts thicken and soften from caseation, and they may be covered with tubercles, though but little fluid is usually effused into the joint. Some few cases present large joint-effusions, but in most cases fluctuation is absent and capsular thickening is not manifest. Soon after tuberculous arthritis begins the joint becomes rigid, irrita-
tion having induced muscular spasm. This reflex rigidity fixes the joint more or less completely, and atrophy of the rigid muscles soon begins. There is usually pain in tuberculous arthritis, but it may be referred to a distant part. For instance, in hip-joint disease the pain is often referred to the inner side of the knee, and in Pott's disease of the spine the pain may be referred to the abdomen. Attempts at motion demonstrate the limitation of movement due to muscular rigidity and also produce pain. A child that suffers from a tuberculous joint is apt to be restless in sleep, moaning and tossing, and to wake at times crying out in terror (night-cries and night-terrors). In the ordinary form of arthritis there occurs what is known as "gelatiniform degeneration"; the granulation tissue is formed in large amount as fungous growths; the structures are markedly edematous and softened; the relaxed ligaments yield under pressure; the natural contour of the joint is lost, and it becomes spindle-shaped; all the structures, articular and periarticular, are glued into one mass; the skin about the joint is white, thick, and adherent, and in it one or more large veins are seen; fluctuation or pseudo-fluctuation is noted when caseation has occurred; pain is not often severe, but it can usually be elicited by certain motions or by firm pressure, but the pain will always be severe when the epiphysis is involved; the temperature of the part is somewhat elevated; deformity results from destruction of bone, cartilage, and ligament, from muscular spasms, and from the habitual assumption of certain attitudes to secure relief from pain. There is soon impairment of joint-motions. When the products of a tuberculous arthritis caseate, the thick liquid seeks exit by forming sinuses from which caseous pus flows. If a sinus becomes infected with pyogenic cocci, and the joint itself becomes their prey, acute suppuration arises in the joint, and constitutional involvement is pronounced and perilous to life.

In pannous synovitis a large effusion is formed, there is but little granulation tissue, though the tubercles are present in large numbers, and the ligaments and structures about the joint are slightly or not at all implicated. A non-tuberculous chronic synovitis produces great swelling and distinct thickening of the capsule with obliteration of the outlines of the joint, but there are no spasm, no atrophy, no limitation of motion, no severe pain, and no tendency to subluxation (Shaffer). A tuberculous arthritis rarely causes distinct fluctuation, does not thicken the capsule, causes reflex muscular spasm, rigidity of the joint, muscular atrophy, severe pain on movement, and eventually subluxation (Shaffer). In syphilitic arthritis there is usually some fluctuation, distinct enlargement of the joint, limitation of motion, no reflex spasm, trivial atrophy, but distinct pain on motion (James K. Young, "Therapeutic Gazette," June 15, 1902). Acute rheumatism attacks more than one joint, is very rare in childhood, and produces high fever. The x-rays aid in the diagnosis of tuberculous arthritis and enable us to tell the extent of bone-involvement.

Diagnosis and Prognosis.—The diagnosis in a tuberculous joint is often difficult, and sometimes impossible, and the prognosis is always grave. In only a very few cases, even when recognized early, is a cure obtained without some impairment of joint-function. The best that can usually be accomplished is a cure with more or less ankylosis, fibrous or bony; and often ankylosis is complete. Long after the disease is apparently cured, it may
break forth anew. Tuberculous lesions may arise in a distant organ, or general tuberculosis may occur. Caseation is apt to produce severe constitutional disorder. Infection by pus organisms gives rise to grave danger of septicemia. Death is not unusual from exhaustion, from septicemia, from disseminated tuberculosis, from tubercle in an important organ, or from amyloid disease.

Treatment.—Constitutionally, the treatment is directed against the tuberculous diathesis. The patient should be placed under good hygienic conditions. A change of climate is often of the greatest importance. Many cases do well at the seaside; others require high altitudes. Locally, rest is of the first importance, and it is maintained for many weeks. Rest is best secured by traction, and traction is applied or maintained by splints, by plaster-of-Paris bandages, or by extension appliances. The hot-air apparatus may be of some benefit. If it is employed it should be used daily, the limb being immobilized during the remainder of the twenty-four hours. Bier's plan of inducing congestive hyperemia may do good (page 185). Aspiration can be used for fluid accumulations. Caseous masses are often let alone, or an aspirator is used and the joint drained, washed out with saline solution, and injected with an emulsion of iodoform and glycerin (10 per cent.). From 1 to 2 drams are injected into the joint of a child, from 2 to 5 drams into the joint of an adult (see page 27). This treatment is more serviceable in tuberculosis of the small joints than in disease of the large articulations. Injections of balsam of Peru or of iodoform emulsion about the joint once a week are efficient in some cases. If these means fail, if the patient gets worse, or if the condition of the sufferer renders dangerous the prolonged conservative course, operate, removing the entire diseased area by erasion, by excision, or by amputation. Always remember that an incomplete operation or a partial removal, unless it consists of simple drainage, is worse than no operation, as it opens the portals to systemic infection, and may be responsible for the development of general tuberculosis, septicemia, or pyemia.

Tuberculosis of Special Joints.—Tuberculosis of the Sacro-iliac Joint (Sacro-iliac Disease).—This is an uncommon affection, and is especially rare before the age of fifteen. The disease may begin in the joint, may arise in adjacent bones, or may result from a cold abscess burrowing into the joint. In some cases it is associated with extensive disease of the pelvic bones. The disease, if undetected, may lead to dissemination of tubercle, to abscess, or even to death.

Symptoms are often obscure. The disease is frequently confounded with vertebral caries, hip-joint disease, or sciatica. The patient limps on walking, but can stand on either leg; there is pain in the sacro-iliac joint, about the hip, and down the thigh; tenderness is manifest on pressure over the joint and on pushing the ilia together; there is fulness over the sacro-iliac joint; but the hip is not flexed unless iliac abscess exists.*

Treatment.—Rest in bed for months, using also a felt case for the pelvis. Counter-irritation by blisters and the actual cautery. In some cases injection of iodoform; in others, incision and curetting. I have operated on six cases, with one death. In one case in the Jefferson Medical College Hospital the abscess was pointing in both the back and loin. Both areas were incised,

the diseased bone was removed and the boy ultimately recovered (Fig. 226). In another case the abscess pointed in the loin. The treatment was as previously set forth, and the patient, a woman, recovered.

**Tuberculosis of the Hip-joint** (Hip Disease; Morbus Coxarius; Morbus Coxa; Coxitis; Hip-joint Disease).—The primary lesion may be in the synovial membrane, but it is more often in the bone. It may begin in the acetabulum; it may begin in the femur. If it begins in the femur, it usually arises on "the distal side of the epiphyseal cartilage" (Senn). Sometimes primary tuberculosis arises in the trochanter major, and never involves the joint. When the synovial membrane becomes involved at any point, spreading throughout the joint is rapid. In many cases the articular cartilages are attacked, and in some cases the epiphyseal cartilage is destroyed. It is commonest in children, but it may arise in adults and even occasionally in those of advanced years; 62 per cent. of cases arise in children under ten years of age and 80 per cent. of cases occur before the twentieth year (Bryant). Traumatism and cold may be predisposing causes. The disease strongly tends to caseation and the formation of sequestra.

**Symptoms.**—It has been usual to divide the disease into three stages: (1) the stage of microbic deposition and multiplication, the products of the bacilli causing irritation and new growth; (2) the stage of progression, with formation of masses of granulation tissue and effusion into the joint; and (3) the stage of caseation, with destruction of the joint and often of the structures about it. Bradford and Lovett * protest against this. They say: "It has been customary to divide hip-disease into stages, and to ascribe to these stages certain definite symptoms. Neither from a clinical nor a pathological point of view is it desirable to attempt such a division." As H. Augustus Wilson says: "Tuberculous bone and joint disease should be considered as

* * Orthopedic Surgery,*
the primary invasion or incipiency, and all other symptoms should be regarded as results and not as an integral and necessary part of the trouble."

The symptoms of incipient coxalgia are slight and may be overlooked entirely. In a child there are night-terrors; on getting about in the morning the child shows no lameness, but a limp develops during the day, and the little one soon grows tired while playing and lies down to rest. There is a slight limp; some adductor spasm is noted, and pain may be complained of at night in the hip, in the front of the thigh, or at the inside of the knee. Tapping the sole of the foot, the thigh and leg being extended, may develop pain, just as it will develop pain in any inflammatory involvement of the joint. But the employment of this method is objectionable. It may injure a joint already damaged by the tuberculous process, and it gives no information which cannot be obtained by a safer mode of investigation. After all, pain on tapping the sole of the foot means only what muscular rigidity means, and muscular rigidity is always present and is easily demonstrable by careful manipulation. The diagnosis in this stage is more or less problematical.

As the disease progresses more positive symptoms are observed. The limp grows worse; the adductor muscles are rigid; the hip is broadened by an effusion into the joint, and fluctuation may possibly be detected; the thigh-muscles are atrophied; the extremity is pushed forward, abducted, and everted (the patient tilts the pelvis so as to rest his weight on the sound limb). In some few cases adduction exists rather than abduction. The abduction, which is usual, releases tension of the fascia lata, and thus abolishes pressure upon the joint through lessening of pressure upon the great trochanter (Allis). The thigh is somewhat flexed. This flexion relaxes the psoas muscle and prevents pressure of its tendon upon the front of the joint (Allis). Pain exists, often sudden or starting, and is located in the joint, on the front of the thigh, and to the inner side of the knee in the course of the obturator nerve; the pain is aggravated at night; and full extension and complete abduction are not possible. The gluteal muscles waste, and the gluteal crease is on a lower level than is that of the sound side. The gluteal crease may be nearly or quite effaced, because of hypertrophy of the subcutaneous layer (Alexandroff). Jarring of the heel when the extremity is in extension causes pain in the hip. The above symptoms arise chiefly from unconscious efforts to obtain ease, from joint-effusion, reflex irritation, and involuntary or spasmodic muscular contractions. There is an appearance of lengthening, or shortening, but it is only apparent, not real. The real position is shown on Plate 7, Fig. 4. The fluid effusion may be absorbed or may find its way externally by means of sinuses. The latter condition is known as "abscess of the hip." The absorption of the exudate or the rupture of the capsule permits the contracting muscles to bring the head of the femur into firm contact with the acetabulum or its brim; the bones are worn away and destroyed, shortening results, abduction gives way to adduction, and flexion is increased, as shortening occurs.

In advanced cases of coxalgia the head of the femur passes upward and outward upon the rim of the acetabulum, the thigh is flexed and fixed, and attempts at extension when the patient is recumbent cause the pelvis to tilt forward and occasion a marked lumbar curve (Pl. 7, Fig. 2), which is due to the pelvis moving with the femur as if ankylosed, and which disappears on
Tuberculosis of the Hip-joint

In this condition adduction occurs because of the ascent and movement outward of the head of the bone. Shortening is marked. After a hip-abscess finds an external outlet pyogenic infection is very apt to take place and suppuration arises, which is followed by that state which is designated as "hectic." If a cure follows advanced coxalgia, partial or complete ankylosis takes place; if death ensues, it may be due to septicemia, tuberculosis of the viscera, exhaustion, or amyloid degeneration.

Diagnosis is very easy in well-established cases of hip disease, but very difficult when the disease is incipient. Always make a systematic and thorough examination. Undress the patient and place him recumbent with his legs extended, upon a table or a hard mattress. Note if the heels are level and if the iliac spines are on the same level (a depressed spine on the affected side means abducted extremity, the degree of which is determined by carrying the limb out until the spines are horizontal; elevation of the iliac spine on the affected side means adduction, the amount of which is determined by adducting the limb until the spines are horizontal; Fig. 227). Try all the movements be-

![Diagram of hip-joint movements](image)

Fig. 227.—Positions in hip-joint disease (after the plan of Howard Marsh and Treves): a.—e, f, lumbar spine; b, d, limb fixed in flexion and abduction—useless for walking. b.—e, f, lumbar spine. Patient corrects the condition in Figure a by curving the lumbar spine forward and rotating the pelvis on its transverse axis, thus making the femur point downward. The lumbar spine is curved laterally, the pelvis ascending on the sound side and descending on the affected side (apparent lengthening). c.—b, d, limb fixed in flexion and adduction. c.—e, f, curve of lumbar spine to correct condition in Figure c (apparent shortening).

longing to the joint, to detect any limitations; observe if bringing down the knee produces lordosis (Pl. 7, Figs. 1, 2); look for swelling and for muscular wasting; feel if the head of the bone is enlarged; determine if motion produces pain or if pressure develops tenderness; and always carefully elicit the history of the attack, of the person, and of the family.

Hip disease may be confounded with spinal caries in which a psoas or a lumbar abscess has formed, with sacro-iliac disease, with infantile paralysis, with congenital dislocation of hip, with lordosis from rickets, with gluteal abscess, and with bursitis of the gluteal bursae. In hip disease there is always some lameness; pain may be severe or may be absent entirely, and may be in the hip or be referred to the front of the thigh or the inner side of the knee. Always remember that the pain is not characteristic, and that pain in the same localities may arise from aneurysm of the femoral or iliac arteries, from abscess in Scarpa's triangle, from caries of the lumbar vertebrae, from sacro-iliac disease, and from cancer of the rectum. Altered position of the limb, limitation of movement in the hip-joint, muscular wasting, and swelling soon arise in hip-joint disease.
In disease of the sacro-iliac joint examination shows that the movements of the hip-joint are unlimited and produce no pain, and that pain is developed by pressure over the sacro-iliac articulation and by pressing the ilia together. In infantile paralysis there is no pain, but there is paralysis with great muscular atrophy, which comes on with considerable rapidity. In spinal caries with psoas abscess the evidences of disease of the vertebrae are clear and a collection of pus is located in the groin external to the femoral vessels. The tuberculous pus of hip-abscess generally gathers under the tensor vaginae femoris muscle, but it may reach Scarpa's triangle by passing through the cotyloid notch or through the bursa under the psoas muscle; it may even appear under the glutei. Matter from a caseating acetabulum may reach the interior of the pelvis and appear above Poupart's ligament.

In gluteal bursitis the symptoms last for many months, and do not remit as the symptoms of early hip disease are apt to do. The pain is but moderate, and is aggravated by exercise, but passes away on going to bed, and is felt back of the hip and back of the knee. There are a certain amount of limitation of motion and a positive limp, which arises early. In marked cases fluctuation can be detected in the upper gluteal region.*

**Prognosis.**—If the case of hip disease is seen early, the chances of cure are excellent in children, in whom the disease may be arrested at any stage. The longer the duration of the disease and the older the subject, the more unfavorable is the prognosis. Many months will be required to elapse before a cure can be effected, and advanced cases only get well by means of ankylosis with shortening and deformity. Hip disease may recur years after apparent cure, and a person who has hip disease runs a strong chance of developing visceral tuberculosis.

**Complications.**—The complications that may accompany hip disease are the following: Abscess, as above noted. Tuberculous meningitis, or the condition known as "acute hydrocephalus" or "water on the brain," may arise during the progress of the case or after apparent cure, and is apt to ensue upon incomplete operations. It is almost inevitably fatal. Pulmonitis is a rare complication, but is a common sequence, being apt to arise, sooner or later, after the hip disease is cured. Amyloid, lardaceous, or waxy degeneration of viscera follows upon profuse and long-continued suppurations, and is apt to arise in the liver, spleen, kidneys, or intestinal mucous membrane. Tuberculosis is not the only cause of amyloid degeneration, syphilis being responsible for at least 30 per cent. of all cases. In amyloid disease of the liver this organ is much enlarged, smooth, and of increased consistency; there is no jaundice, the spleen is apt to be enlarged, and albuminuria is the rule. In amyloid kidney large amounts of pale urine of low specific gravity are voided; albumin is usually present in large amount, but may be absent; globulin may often be found, as may also hyaline, fatty, or granular casts; the patient is anemic, and dropsy usually exists. Test the hyaline casts with iodin for amyloid material. Amyloid changes are usually slow in onset, but they may be rapid; they are commoner in men than in women, and are most frequently encountered in individuals between the ages of ten and thirty. Slight amyloid change may be recovered from, but an extensive degeneration brings about a fatal result.

Dickinson's theory of how this tissue-change is caused is that the flow of pus drains off from the body the alkaline salts, especially the salts of potassium, which drainage results in visceral depositions of de-alkalinated fibrin.

**Treatment.**—Antituberculous treatment is used in all cases. In incipient hip disease the treatment consists in rest. Place the patient upon a solid mattress and apply extension. In children under ten years of age, use a weight of from three to five pounds; in individuals between ten and twenty, use a weight of from five to eight pounds. A long splint is often applied to the sound side to keep the patient recumbent and horizontal. Always use a cradle to hold up the bed-clothing. Apply the extension in the long axis of the limb, the extremity being placed in the line of the deformity due to disease and being supported by pillows. In lordosis from thigh-flexion, raise the limb until the iliac spine is straight (Pl. 7, Fig. 6). If the spine is depressed on the affected side, abduct the limb (Pl. 7, Fig. 8); if the spine is elevated, abduct the limb until the spines are horizontal (Pl. 7, Fig. 7). The object of extension is to overcome muscular spasm and so put the part in a condition of physiological rest. Muscular spasm is a great factor in destroying structures. Spasm presses the parts together, and as a result of pressure plus bacterial action destruction occurs. The extension and traction tire out the muscles and cause spasm to cease. Extension will remove flexion in two weeks in a recent case and in the course of some months in an older case. As flexion is relieved remove the pillows and lower the leg, but keep up extension in the long axis of the thigh. Abduction and adduction cannot be removed by extension.

Abduction demands no special treatment. In a movable joint it will disappear, and in an ankylosed joint it is an advantage, compensating by apparent lengthening for the shortening due to bone-absorption or to stunted growth of the limb. Adduction requires an addition of several pounds to the extension weight, the use of a long splint on the sound limb, and the drawing up of the sound side by a rope and pulley toward the head of the bed. The weight used to pull the sound side toward the head of the bed is equal to that used to pull the damaged side to the foot of the bed. This expedient is used for a month or six weeks. In old cases where the weight will not bring about extension, anesthetize the patient, gently straighten the limb a very little, and reapply the weight.

Extension in a mild case must be continued for three months after the symptoms have disappeared, and in a severe case the period must be six months. The weight is gradually taken off; if symptoms recur, the weight is reapplied; if they do not recur, apply a traction splint or a plaster dressing, put a high-heeled boot on the sound limb, and send the patient out on crutches. In young children extension can be made while the child is in a wheeled carriage, thus enabling the patient to go out in the fresh air and sunlight. The general treatment is tonic and restorative. The joint is so deeply placed that external applications are useless. In the treatment of hip disease Thomas's splint (Fig. 228) is used by many, and it may be combined
with weight extension; or Sayre's splint (Fig. 229) may be employed. Wyeth's apparatus (Fig. 230) is a favorite with many American surgeons.

If the limb is in good position, or has been brought into good position, either by weight extension or straightening under ether, plaster-of-Paris is a useful dressing. It is applied from the toes up, and includes the entire extremity and also the pelvis. A patient wearing plaster may get about on crutches when the sole of the foot of the sound extremity is raised by the wearing of a thick-soled shoe. If a case, in spite of treatment, does not improve or becomes worse, use intra-articular injections of iodoform. Always try these injections before doing a resection. Sometimes they succeed, and if they do

Fig. 229.—Sayre's long splint.

Fig. 230.—Wyeth's combination method.

resection is unnecessary. Asepticize the surface, carry a small aspirating needle into the joint, irrigate the joint with salt solution, and inject a sterile emulsion of iodoform and glycerin (10 per cent.). In one week, if reaction has ceased, repeat the injection. In another week repeat it again. It may be necessary to give from ten to twenty injections. The proper spot for puncture is thus determined: Draw a line from a point half an inch outside of the middle of Poupart's ligament to the outer edge of the great trochanter. Puncture at the middle of the outer half of this line (De Vos).

If an abscess forms, incise it with the most thorough antiseptic care, let the fluid drain away, irrigate the cavity with salt solution, remove any sequestra, inject with iodoform emulsion, sew up without drainage, and dress antiseptically. In some cases the sequestrum is extra-articular. In some cases no sequestrum is found. If this method fails drainage must be employed. The
I ITP-JOINT DISEASE. PLATE 7.

old plan of not operating until rupture was seen to be inevitable was bad. To
open early and antiseptically often means rapid healing, the prevention of
burrowing, a lessened danger of visceral infection, and an earlier cure. Hectic
will rarely arise if the abscess is opened with antiseptic care.

Excision of the hip is to be performed when the head of the femur is
detached and lies loose in the joint; when profuse suppuration continues for a
long time, and other methods fail to arrest it; when amyloid disease is begin-
ning; or when very faulty position is inevitable without operation. Excision
is an operation of considerable danger, and the older the person, the greater the
danger. Schede advocates arthrectomy in some cases as a substitute for re-
section. Senn tells us that opinion as to resection has greatly changed of late,
and it is now taught that the operation is advisable in all cases where fixa-
tion, extension, intra-articular and parenchymatous injections have failed to
arrest the disease (Senn on "Tuberculosis of Bones and Joints"). When
there is extensive disease of the femur, when excision has been tried and has
failed, or when the patient has not the recuperative power to withstand the
long siege of illness following excision, amputate.* Amputation of the hip-
joint for tuberculous disease is a very successful procedure.

Knee-joint Disease (White Swelling).—After the hip, the knee is, of all
joints, the commonest site for tuberculous disease. Knee-joint disease can
begin as a synovitis, but oftener begins as tuberculous inflammation of the femoral or
the tibial epiphysis. Tuberculous disease rarely attacks the bone on the diaphys-
eal side of the epiphyseal line; a single focus only exists as a rule, and a seques-
trum is rarely formed. In very rare in-
stances the patella or the semilunar carti-
lage is primarily attacked. It may begin at
any age, but is most common in children
and young adults. If an acute synovitis
ushers in the case, there may be a large
effusion into the knee-joint and partial
flexion, but swelling is usually slight in
knee-joint disease. Pulpy degeneration of
the synovial membrane occurs; the joint
enlarges; the ligaments soften; the skin
becomes edematous, and muscular spasm
arises. The leg becomes flexed; the bones
displaced backward and outward, the foot
everted; and lameness arises, due chiefly to deformity. Pain may be absent,
is often slight, and is rarely severe. When the disease begins in the bone or
an epiphysis there are pain, tenderness, lameness, swelling, inability to extend
the limb completely, sudden spasmodic muscular contractions, and final in-
volvement of the joint. When an abscess forms, it may destroy the joint
very rapidly or it may break externally.

Treatment.—In treating knee-joint disease employ general antituberculous
treatment and locally apply iodoform ointment or guaiacol. A useful plan is to

* See the admirable article of Howard Marsh in Treves's "Manual of Surgery."
make a mixture of guaiacol and tincture of iodin or guaiacol and olive oil (1:4). Once a day the surface of the knee is exposed by removing dressings, is painted with this mixture, and the painted surface is covered with cotton-wool. Rest is of the first importance, and may be secured by the application of splints (Figs. 231, 232), the use of extension (Fig. 233), or the employment of a plaster-of-Paris bandage. In any case the patient must be kept in bed for a few weeks; he may then be permitted to go out upon crutches, wearing a high-heeled shoe upon the foot of the sound limb. In cases in which treatment is begun early the disease may often be arrested in from eight to twelve months. If the symptoms do not abate after a number of weeks, or if the condition grows worse and caseation occurs, aspirate, irrigate, and inject iodoform emulsion. Intra-articular injections are not unusually curative. Insert the needle in the angle between the outer edge of the patella and the ligament of the patella (De Vos). Repeat the injection in one week if reaction has abated, and continue as directed for the injection of the hip-joint. If this plan fails, incise the capsule, remove all fragments and tuberculous foci, irrigate with normal salt solution, inject iodoform emulsion, and sew up without drainage (Neuber's plan). A more severe case requires drainage. If these means fail, or if the case is too far advanced to permit of their use, open the joint and perform an excision or an erosion (page 544). Some cases demand amputation, which, if the patient's health is much impaired, is to be preferred to excision. Amputation is preferred to excision in very young children and aged people.

Ankle-joint disease may begin in the synovial membrane, in the tibial epiphysis, or in the tarsus, but the origin is usually synovial. The symptoms are pain, swelling, lameness, limitation of joint-movements, and atrophy of the calf-muscles. Caseation often occurs, and sinuses form.

Treatment.—The treatment consists in the employment of antituberculous remedies, applications of guaiacol or iodoform ointment over the joint, and rest obtained by means of splints or plaster-of-Paris bandages. Caution the patient to avoid standing upon the diseased extremity. Injections of iodoform emulsion may do good. Insert the needle below the outer malleolus. When caseation occurs, it is advisable to open the joint, wash out with normal salt solution, inject iodoform emulsion, sew up the incision, and put up the ankle-joint in plaster. When joint-disorganization occurs, perform an excision or an erosion. Some cases demand amputation (Syme's amputation being preferred by some, amputation above the ankle being approved by many). Osteoplastic resection is sometimes advised (Wladimiroff-Mikulicz operation).
Elbow-joint Disease

Shoulder-joint disease is not common; it is rare in children and is commonest in adults; it begins either in the synovial membrane or in the head of the humerus. The glenoid cavity is rarely attacked. Pain is slight, atrophy of the deltoid and other muscles is noted, the joint is stiff, and the scapula follows the motions of the humerus. Caries sicca is the usual cause of destruction. In many cases swelling is not obvious, the joint shrinking because of destruction of the head of the bone and contraction of the capsule (Senn). Abscess formation is unusual. If an abscess forms, it may open in the axilla, through the deltoid muscle, or at some far distant point.

Treatment.—In treating shoulder-joint disease employ antituberculous remedies and hygienic measures, and apply to the skin over the joint guaiacol or iodoform ointment. Put on a shoulder-cap, apply the second roller of Desault, and hang the hand in a sling. Maintain rest for at least four months. Aspiration and injection of iodoform emulsion are of great service in synovial tuberculosis. The needle is entered below the acromion, while the arm is held against the side and the forearm is at right angles to the arm and across the front of the chest (De Vos). If caseation occurs, open the joint, remove tuberculous foci, wash with hot saline fluid, inject iodoform emulsion, and close without drainage, or, in a rather severe case, drain. In rare instances dead bone will have to be gouged away. Caries sicca may occur. Excision is sometimes required.

Elbow-joint disease may begin in the humerus or the ulna. The head of the radius is rarely the primary focus. In some cases the synovial membrane is first attacked. The disease is most frequent in young adults. The joint is swollen, its movements are somewhat limited, muscular wasting is pronounced, and pain is generally slight. Tuberculous pus may form.

Treatment.—In treating elbow-joint disease, employ antituberculous foods, drugs, and hygienic measures; iodoform ointment or guaiacol locally; rest by means of an anterior angular splint (Fig. 234) and a triangular sling. Splints are to be worn for from four months to a year. Injection of iodoform emulsion may be useful. Insert the needle for injection by the side of the olecranon. It may become necessary to open the joint. If the condition is found to admit of it, Neuber's plan should be followed; but if there is advanced disease of the joint, drain with a tube or perform an erosion or an excision.

Wrist-joint disease may arise at any age, and is sometimes met with in late middle life, or even in old age. The joint presents a puffy swelling, loses its normal contour, and becomes spindle-shaped. Hand-movements are impaired, pronation and supination cannot completely or satisfactorily be per-
formed, the joint is stiff and partly flexed, the grasp is enfeebled, pain may be severe or slight, the skin is usually hot, and muscular atrophy is marked. This form of tuberculosis may begin in the synovial membrane, in the bones, or in the tendon-sheaths.

Treatment comprises the usual antituberculous measures and drugs, and the local application of guaiacol or iodoform ointment. Apply a Bond splint and sling or put on a plaster-of-Paris bandage, and maintain strict rest for from four to six months. Aspiration and injection of iodoform emulsion are useful. Enter the needle at the dorsal edge of the radial styloid process, and again at the upper edge of the pisiform bone (De Vos). In some cases it is well to incise, wash with salt solution, inject iodoform emulsion, and close without drainage. Severe cases demand incision and drainage with the maintenance of rest. A moderate amount of caries is treated by drainage and rest. Extensive caries requires excision. Necrosis demands removal of sequestra.

Acute Suppurative Arthritis.—This infection is usually due to the staphylococcus pyogenes aureus or to the streptococcus pyogenes, which find entrance by means of a wound, by the spontaneous evacuation into a joint of the products of an osteomyelitis, by extension of suppurative inflammation through contiguous structures or by the blood-stream. In this disease all the joint-structures are involved and suppuration rapidly appears. It is very rarely due to gonorrhea, and sometimes to septicemia.

Symptoms.—The symptoms of acute suppurative arthritis are usually a chill followed by fever and a rapid pulse. There is severe pain, which is aggravated by motion and is worse at night; discoloration, heat, and edema of the skin; partial flexion of the joint; fluctuation; and marked constitutional symptoms of sepsis. The joint tends to rapid disorganization, and fatal septicemia is very apt to occur. In pyemic arthritis several joints become infected.

Treatment.—The treatment in septic arthritis consists in prompt incision, evacuation, antiseptic irrigation, drainage, antiseptic dressing, and immobilization. Cure is followed, as a rule, by ankylosis, but in cases treated early the joint may be preserved.

Infective arthritis arises in the course of an acute infectious disease (such as erysipelas, typhoid fever, pneumonia, influenza, mumps, dysentery, diphtheria, measles, scarlatina, variola), and may be due to pyogenic cocci, to the specific micro-organism of the acute infectious disease, or purely to microbial products. Joint-inflammation arising in the course, or as a sequel, of an acute infectious disease may or may not suppurate.

Symptoms and Treatment.—If no suppuration takes place, the symptoms of the attack resemble those of rheumatism; if suppuration occurs, the symptoms are the same as those of acute suppurative arthritis, with which disease this form of infective arthritis is identical. Suppuration rarely occurs. Ashby has well described the arthritis which sometimes follows scarlatina. It involves the wrists, finger-joints, tendons of the forearms, the knees, ankles, or spine. The joints are painful, but are rarely much swollen or discolored (Howard Marsh). We can distinguish infective arthritis from rheumatism by the fact that it does not migrate, and is uninfluenced by antirheumatic remedies.

Treatment of Infective Arthritis.—The treatment of a mild case is identical with that used for simple synovitis: if there is much fluid in the joint,
aspirate and wash out with normal salt solution. If pus forms, open, irrigate, and drain.

**Typhoid Arthritis.**—This disease is a form of infective arthritis. That the organism of typhoid may inflame the joints is proved, and it seems certain that it can cause suppuration, although its pathogenic power has been disputed. Some claim that mixed infection induces suppuration. The typhoid bacilli enter the bones in many typhoid cases and sometimes cause bone-disease. Joint-disease is more common than bone-disease. Typhoid disease of a joint begins when the fever is abating, and more than one joint may be involved. Typhoid joints may recover permanently, may become ankylosed, may dislocate, or the joint-disease may lead to a fatal sepsis. In slight cases the synovial membrane only is involved; in more severe cases capsule, cartilages, ligaments, and even bones are involved. Some cases suppurate. Keen tells us that septic typhoid arthritis results from a mixed infection with typhoid bacilli and pyogenic bacteria, and is identical in symptoms and progress with an ordinary septic arthritis. The same author points out that typhoid arthritis proper may be monarticular or polyarticular, the monarticular form being the most common, and the hip-joint being the articulation most liable to attack. In most cases typhoid arthritis causes but little pain. The swelling is marked, although in the hip it is concealed. Pus rarely forms. Keen calls attention to the fact that in the eighty-four cases he collected, spontaneous dislocation occurred in forty-three, nearly all in the hip.*

*Treatment.—A mild case is treated as a simple synovitis. If diagnostic puncture obtains fluid free from bacteria, no more radical method than aspiration is required. If the fluid contains bacteria, incision and drainage are demanded.

**Gonorrheal Arthritis or Gonorrheal Rheumatism.**—During the progress of gonorrhea the development of a painful joint does not of necessity prove the existence of gonorrheal rheumatism, for ordinary rheumatism is just as likely to arise when a man has clap as when he has not this malady. Furthermore, the term is inaccurate, as gonorrheal rheumatism is not rheumatism at all, but is an infective disorder of the joints or of the synovial membranes, the infective material being contained primarily in the urethral discharge. Gonorrheal rheumatism is one of the forms of infective arthritis. Occasionally this form of arthritis arises from gonorrheal ophthalmia (Heiman's case); it sometimes, though rarely, arises during the height of a gonorrhea, but it is more frequently met with in chronic cases or when the intensity of the inflammation is abating in acute cases. Men suffer from gonorrheal arthritis far more frequently than women, and the seizure is very apt to recur again and again. In some cases many joints are involved, but in most cases only a few joints suffer. Osler states that the knees and ankles are most apt to be involved in gonorrheal rheumatism, and that this form of arthritis is peculiar in often attacking joints that are apt to be exempt in acute rheumatism ("the sternoclavicular, the intervertebral, the temporomaxillary, and the sacro-iliac"). There are two forms of gonorrheal rheumatism, an acute and a chronic form. The poison reaches the joint by way of the blood. In some cases gonococci are found in the joint fluid; in other cases they are not found. I am inclined

*Keen on "The Surgical Complications and Sequels of Typhoid Fever."
to believe that in the milder cases, which recover without genuine pus-formation, only toxins are present in the joint. In the severe cases the organisms themselves exist in the articular fluid. Osler suggests that the non-suppurative cases are due to the action of toxins taken up from the area of primary infection, and that the suppurative cases are due to infection with pyogenic bacteria. Endocarditis may occur and it is due always to microorganisms and not to toxins.

*Changes in and about the Joint.*—The inflammation of gonorrheal arthritis may be located around rather than in the joint, and especially in the tendon-sheaths. Suppuration is unusual, but it may occur in joints and in tendon-sheaths. Cultivation of the exudate may or may not show the gonococci. Cover-glass preparations stained by Gram's method may show gonococci.

*Symptoms.*—The acute form attacks as a rule but a single joint, but may attack several joints. The joint trouble begins with great suddenness, and is often ushered in by chilly sensations or by a distinct chill. Moderate fever arises. The pain in the joint, severe from the first, becomes atrocious. If superficial joints suffer the skin over them becomes red and hot, and periarticular edema soon presents itself. The fluid in the joint is in most cases serous, but may become purulent. If pus forms the fever becomes very high and chills may occur.

A chronic condition may follow the acute, but the condition, may be chronic from the start. The symptoms resemble those of the acute form, but are far milder, although acute exacerbations may occur. The joint-fluid is usually serous.* In gonorrheal arthritis there may be transitory, intermittent, and wandering pain in and about the joint, without any other symptom; one or more joints may become swollen and painful, and moderate fever may develop. One joint, especially the knee, may swell to an enormous extent, pain, periarticular edema, redness, and fever being absent (hydrarthrosis, or dropsy of the joint). Suppuration in this form of the disease seldom occurs. The tendons, the tendon-sheaths, the bursae, and the periosteum may inflame. Whether the joints are inflamed or not inflamed, the tendon-sheaths about the wrist and ankle and the retrocalcaneal bursae may suffer. In some cases numerous bursae are involved. A case of gonorrheal arthritis is often very hard to check. It may last for a long period, and tends to recur again and again. Iritis, pleuritis, endocarditis, and pericarditis have been observed as complications.

The diagnosis between gonorrheal arthritis and acute rheumatism rests chiefly on the great chronicity, the slight degree of fever, the excessive tendency to recurrence, and the absence of profuse acid sweats in gonorrheal rheumatism; and on the shorter course, the higher fever, the profuse acid sweats, the lesser tendency to rapid recurrence, the greater proneness to symmetrical involvement, and the great liability to cardiac and visceral complications in rheumatic fever. Furthermore, in gonorrheal arthritis a gonorrheal infection (urethral or ocular) certainly exists or recently existed; in ordinary rheumatism a urethral discharge may, of course, happen to be present. Gonorrheal arthritis is apt to affect certain joints which acute rheumatism rarely attacks.

*Treatment.*—The salicylates, the alkalies, and salol are useless; iron,

*See Schuller in Aerztl. Pract., No. 17, 1896.
Acute Rheumatic Arthritis

arsenic, and strychnin are possibly of some benefit. Quinin is helpful in some cases. Iodid of potassium seems to be of a certain amount of value. The inflamed joints should be wrapped in cotton and bandaged, and every day a little blue ointment should be rubbed into the skin about them. If the inflammation lingers, use the hot-air oven, massage, and gentle passive motion, apply blisters, or counter-irritate with the hot iron. If the inflammation still lingers, or if it becomes worse, aspirate, wash out the joint with hot normal salt solution, and inject iodoform emulsion. If pus forms, incise, irrigate, drain, and immobilize.*

Pneumococcus Arthritis.—This is a rare condition, although Herrick has collected 52 cases ("Amer. Jour. of Med. Sciences," July, 1902). Examination of the blood may or may not discover pneumococci, and pneumococci may be found in the blood during pneumonia when the joints are free from disease. The inflammation may attack any joint, but is most apt to arise in a joint weakened by previous injury or damaged by rheumatism or gout. Alcoholics are more prone to suffer than others. In a great majority of cases the disease is associated with lobar pneumonia, but Cole's case proves that the lung may be free ("American Medicine," May 31, 1902). As a rule, a single large joint is attacked, and the knee is most liable to suffer. The synovial membrane alone may be involved or cartilages may suffer and bone be attacked. The fluid may be serous, but is usually purulent (Herrick). I have seen 2 cases: in one case the knee only was involved; in the other, both knees, one elbow and one shoulder were attacked. In Cole's series of 41 cases, 13 exhibited involvement of more than one joint. The inflamed joint is frequently completely destroyed. Pneumococcus arthritis develops, as a rule, soon after the crisis of pneumonia, but Herrick says it may arise as late as three weeks after the crisis.

The diagnosis is made by the history of pneumonia, the development of septic symptoms and the signs of joint inflammation. It is confirmed by aspiration and examination of the fluid. The disease is very fatal. In Herrick's series of cases over 65 per cent. were fatal. In Cole's series of cases there were 28 deaths and 13 recoveries. Even if the patient recovers, the convalescence is prolonged and more or less ankylosis is to be expected.

Treatment.—A non-purulent effusion may be treated by aspiration, if bacteria are not found in the fluid. If the aspirated fluid contains bacteria, the joint should be opened and drained.

Acute Rheumatic Arthritis; Rheumatic Fever or Acute Rheumatism.—Acute rheumatism is a self-limited febrile malady whose characteristic features are polyarthritis, profuse acid sweats, and a tendency to heart-involvement. There is some evidence to indicate that acute rheumatism is a form of infective arthritis. John O'Connor† believes that acute rheumatism is a condition "something similar to gonorrheal arthritis and pyemia, the germ or toxin gaining admission to the body through the tonsil or other microbial trap-door, and that the joint invasion is promptly followed by a form of infective arthritis accompanied with general toxemia; and, furthermore, the infected joints serve as incubators, where the poison is elaborated


†Lancet, Jan. 24, 1903.
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and passed into the circulation and thus conveyed to other articulations and to the heart."

Symptoms of Acute Rheumatism.—In acute rheumatism the case begins with malaise and fever, and one or more joints become affected. The inflammation spreads from joint to joint, is apt to be symmetrical, and when it arises in fresh joints usually disappears quickly in those previously affected. The temperature is high, the skin sweats profusely, the joints are red, swollen, hot, and excruciatingly painful, and the structures about the joints are edematous. After a short time the inflammation subsides in one joint and passes into another, the joint first attacked regaining its functions. Suppuration does not take place. Anemia is pronounced, exhaustion is profound, the sweat is sour, the saliva is acid; the urine is acid, scanty, high-colored, often contains albumin, and is deficient in chlorids. Cardiac disease is apt to be produced (endocarditis, pericarditis, or myocarditis). Nodules may form upon fibrous structures, hyperpyrexia is not unusual, and cerebral or pulmonary complications may occur.

Chronic rheumatism rarely follows repeated attacks of acute rheumatism, but rather arises insidiously in people who have been exposed to cold and damp, who have suffered from poverty, hardship, and privation, or have had much worry. The capsule and tendon-sheaths thicken, and there is usually but little effusion in the joint, but the articulation becomes stiff and painful. The joint-cartilages are occasionally eroded. Muscular atrophy occurs.

Symptoms of Chronic Rheumatism.—In chronic rheumatism the affected joints are stiff and painful and are a little swollen, but not red. Dampness and cold aggravate the symptoms. One joint or many may be affected, but usually several are involved. Passive movements cause the joint to creak and develop crepitus in the tendon-sheaths. The muscles are wasted. The joints may ankylose. Anemia is usually pronounced. There is no fever and no tendency to suppuration, and the disease is incurable.

The treatment of acute rheumatism comprises the use of alkalies, salicylates, etc. (See a book upon practice of medicine.) O'Conor is a believer in incising and draining the inflamed joints; and if the theory of an infective origin is correct, this treatment is rational. I have never ventured to do it, but would consider the advisability of doing so if the ordinary treatment proved futile. O'Conor operates early and believes that this is the real way to arrest the disease and prevent complications, but his views have not met with general acceptance. In chronic rheumatism maintain the general health of the patient, give courses of iron, arsenic, and strychnin, and an occasional course of iodid of potassium or a salt of lithium, and, if possible, send him every winter to a warm climate. Turkish baths give considerable temporary relief. The waters and regimen of Carlsbad and Vichy are of positive though temporary benefit, and the sufferer may obtain relief at the hot springs of Virginia. The patient must avoid damp and must wear woolens. Frictions, the douche, massage, flying blisters, counter-irritation with the hot iron, ichthyol ointment, and mercurial ointment are of benefit. Subjecting the diseased joint to a very high temperature by placing it daily in a hot-air apparatus often does great good. In partial ankylosis it is proper in some cases to give ether and break up the adhesions.

* Lancet, Jan. 24, 1903.
Gouty arthritis, which appears especially in the smaller joints (as the fingers and the metatarsophalangeal joints of the great toes), is due to a deposition of urate of sodium in the joint and in the periarticular structures. The irritant urate of sodium causes inflammation, inflammation leads to the formation of granulation tissue, granulation tissue is converted into fibrous tissue, and the fibrous tissue contracts and thus deforms the joint and limits its mobility. A great mass of urates in a joint constitutes a "chalk-stone."

Symptoms.—The premonitory symptoms may be observed for a day or so, but the acute seizure usually occurs early in the morning, the patient, as a rule, being aroused by excruciating pain in the metatarsophalangeal articulation of one of the great toes. The joint swells, and the skin over it feels hot to the touch and become red and shiny. There is often considerable fever. After a few hours the intensity of the seizure abates, only to recur again with renewed violence early the next morning, these remissions and recurrences taking place for six or eight days, when the attack subsides. In patients with chronic gout many joints are stiffened and deformed as a result of repeated attacks. Chalk-stones form, and the skin above them may ulcerate. Such patients are chronic dyspeptics, have high-tension pulses, their hearts are hypertrophied, and their urine contains albumin and casts.

The treatment of gouty arthritis belongs to the physician, and not to the surgeon, although to the latter the symptoms of the disease should be known, so that it may be diagnosed from other maladies.

Osteo-arthritis (Rheumatoid Arthritis; Arthritis Deformans; Rheumatic Gout; Paget’s Disease).—In this disease, which is not a combination of gout and rheumatism, the synovial membrane and cartilages are affected, the periarticular structures are involved, and masses of new bone are formed. Osteo-arthritis has, as John K. Mitchell pointed out, a probable nervous origin. It arises especially in persons who have been worried, driven, and harassed. There is apt to be muscular atrophy, trophic lesions of the hair and nails are likely to appear, and the symptoms are disposed to be symmetrical. The causative lesion has not been determined. The disease is commoner in women than in men. The greatest liability exists between the ages of twenty and thirty, but children may acquire the disease, and it may also be developed in people beyond middle life. Apes in captivity may develop it. Arthritis deformans may attack the rich or the poor; it does not result from gout, nor does it often follow rheumatism; it is not caused by damp and cold; and only in rare cases does it arise after traumatism of a joint.

Osteo-arthritis differs from gout in the entire absence of urate deposit, and it differs from chronic rheumatism in the extensive alterations in the joint-structures. The changes begin in the cartilage; the cartilage-cells multiply, the intercellular substance degenerates, the pressure of the bone causes thinning, and at length the cartilage is entirely destroyed and the bone exposed. The exposed bone is altered in shape, is hardened, and is worn away in the center, the periphery increasing in thickness by ossific deposit; the center deepening by absorption. The margins are not only thickened, but are bulged and lengthened by deposit. The fringes of the
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synovial membrane hypertrophy and multiply, and some of them are apt to break off (loose cartilages). The capsule and the ligaments of the joint, as a rule, become fibrous and contract; but they may soften, relax, and permit of dislocation. The joint usually contains no effusion, but in some cases there is great effusion (hydrarthrosis). The tendons about the joint may become fibrous and contracted, they may ossify, they may be separated from the bone, or they may be destroyed entirely. Deformity is marked and motion is limited. The fingers, when involved, show nodules on the sides of the joints (Heberden's nodules). The vertebrae may be involved. Almost all the joints may suffer. Suppuration does not occur.

Symptoms.—Charcot divides osteo-arthritis into three forms, and gives their symptoms, as follows:

1. **Heberden's nodosities**, which condition is commoner in women than in men, comes on between the ages of thirty and forty, and is especially common in neurotic subjects. The interphalangeal joints become the victims of attacks of moderate swelling and of some tenderness, which attacks are not severe, but recur again and again. After a time small hard swellings (nodosities) appear upon the sides of the dorsal surfaces of the second and third phalanges, remain permanently, and slowly increase in size. The joints become stiff and creak on movement, the cartilages are destroyed, and contractions and rigidity develop, but there is no fever and the larger joints are not involved. The malady is incurable.

2. **Progressive rheumatic gout**, which may be acute or chronic. The acute form begins as does rheumatic fever. There are moderate fever and swelling, without redness, of a number of joints, of bursæ, and of tendon-sheaths; the joints are stiff and crepitate, and are apt to be symmetrically involved; muscular atrophy begins early and rapidly becomes decided; pain is slight. This acute form is apt to arise in young women after pregnancy, but is not unusual at the climacteric and in children. Anemia always exists. The case is apt to advance progressively until a number of joints are firmly locked, when it may become stationary. Another pregnancy will develop anew the acute symptoms. In the chronic form swelling and pain on movement are noted in certain joints. The involvement is apt to be symmetrical. Attacks of swelling and pain alternate with periods of quiescence, but the disease does not cease its advance. Articulation after articulation is attacked by the malady until almost all the joints are involved; deformity and stiffness become pronounced, and pain may or may not be severe. There is no fever. Muscular atrophy is marked.

3. **Partial rheumatic gout** attacks one articulation, and it is most often met with in old men. It may fix itself on the vertebral column, on the knee, on the shoulder, on the elbow, or on the hip. The joint grates, and becomes stiff, swollen, and deformed; the muscles atrophy; there is usually pain, but fever is absent.

Osteo-arthritis or partial rheumatic gout of the hip-joint seldom occurs before the age of forty-five, but is occasionally, though very rarely, met with in persons under twenty-five. If the disease arises in an elderly person, it is often called morbus coxae senilis. In some cases only the hip-joint is attacked; in many cases other joints are also diseased. Osteo-arthritis of the hip may follow an injury. Usually the disease is unconnected with
Charcot's Disease

traumatism, begins very gradually, and advances slowly. There is pain, often mistaken for sciatica, in and about the joint, and there is increasing stiffness. The pain and stiffness are worse when the patient first moves after resting. Lameness becomes noticeable, and grating can be detected in and about the joint. The symptoms become gradually worse, although at times they may seem to improve for brief periods. The lameness and the stiffness are greatly aggravated, and the pain becomes very severe, even when at rest. Shortening takes place, the great trochanter ascends above Nélaton's line, the limb is usually abducted, but in very rare cases is adducted, and finally ankylosis occurs.

Partial rheumatic gout of the vertebral articulations causing fixation is called "spondylitis deformans" (p. 645).

Treatment.—Osteo-arthritis cannot be cured, but in some cases it remains stationary for many years. Treat the anemia by iron, arsenic, nourishing food, and have the patient be out in the fresh air as much as possible. Debility is met by the administration of strychnin. Hot baths of mineral water do good. It is claimed that the hot-air apparatus is of service. Douches improve these cases, but electricity is useless. Counter-irritants do no good. Massage retards the progress of the case, relieves the pain, aids in the absorption of effusion, and delays fixation. During an acute exacerbation the joint should be put at rest for a time and evaporating lotions applied. In an exacerbation in disease of the hip the patient should be put to bed and have extension applied. The patient is unfortunately liable to develop the opium-habit. If dropsy of a joint arises, try compression with a Martin bandage, and, if this fails, aspirate and wash out the joint with a 2 per cent. solution of carbolic acid. Patients with rheumatic gout do best in a warm, dry climate. Cod-liver oil does good, as it improves nutrition and hence retards the progress of the disease. Do not be tempted to immobilize the joints beyond a day or two: fixation only hastens ankylosis. Howard Marsh * points out that, as a rule, but little good comes from manipulation. He makes the following exceptions: When one joint only is affected; when the joint is very stiff but not very painful; when the patient is in good general health and is not beyond middle age.

Charcot's Disease (Tabetic Arthropathy; Charcot's Joint; Neuropathic Arthritis).—This condition is an osteo-arthritis due to trophic disturbance, arising in a sufferer from locomotor ataxia, and is anatomically identical with osteo-arthritis, which was described above. The knee is most apt to be attacked, and the hip suffers more often than any joint but the knee. The disease begins acutely, often as a sudden effusion, which after a time disappears. Pain is slight or is absent, there is no constitutional involvement, and the condition is unconnected with injury. The bones and cartilages are rapidly destroyed; fracture is apt to occur; the joint creaks and grates; the softening and relaxation of the ligaments permit an extensive range of movement; great deformity ensues; dislocation is apt to occur; muscular atrophy is decided; and pus occasionally, though very rarely, forms.

Treatment.—The treatment of Charcot's disease consists in the wearing of an apparatus to sustain the joint. Resection is recommended by some, but most surgeons do not advise its performance.

* "Diseases of the Joints and Spine."
Osteo-arthropathie Hypertrophiante Pneumique (Marie's Disease).—A condition associated with, and possibly springing from, pulmonary disease, and characterized by enlargement of joints, thickening of the finger-ends, and the formation of a dorsolumbar kyphosis. The joints are painful, the skin undergoes pigmentation, and profuse perspiration is often present. The head entirely escapes in this disease, which immunity marks a distinction from acromegaly.

Hysterical joint (Brodie's joint) is a condition mostly encountered in young women. The disease occurs most commonly in the knee and the hip, and often follows a slight injury which acts as an autosuggestion, a latent hysteria being awakened into action and localized, though severity of the injury does not determine the severity of the symptoms. The disease may ensue upon a synovitis or an arthritis, or may arise without apparent cause. The patient complains of pain in and stiffness of the joint, resists passive motion strenuously, and claims that it causes much pain. There is occasionally some muscular atrophy from want of use, and the joint is a little swollen. The skin is hyperesthetic, and a light touch causes more pain than does deep pressure. The muscles may be rigid. The joint may be maintained either in flexion or in extension, but it is rarely in the exact degree of flexion assumed for ease in a true joint-inflammation, and the position is apt to be changed from day to day or from hour to hour. The skin is usually pale and cool, but may be red and hot, because of hyperemia. A periodically developed heat may be observed, especially at night, accompanied apparently by much pain. The alleged pain in some cases is neuralgia, but in most cases is a pain-hallucination. There is no effusion into the joint, and swelling does not exist, although occasionally there is slight periarticular edema. In some rare cases organic disease arises in a hysterical joint.

Hysterical phenomena are seldom isolated, but are associated with certain stigmata which may be latent. These stigmata are concentric contraction of the visual fields, pharyngeal anesthesia, convulsions, hysterogenic zones, globus hystericus, clavicus hystericus, zones of anesthesia, especially hemianesthesia, and hyperesthetic areas. Such patients are predisposed by inheritance, and have previously, as a rule, had nervous troubles. Hysterical phenomena, be it remembered, lack regularity of evolution, and are produced, altered, or abolished by mental influences and physical sensations which are without effect in causing, modifying, or curing organic disease. The general health, as a rule, is good, but neurasthenia may coexist. In examining these patients the observer will note that the symptoms disappear when the attention is diverted; that they are out of all proportion to the local evidences of disease; that there is no sign of joint-destruction; and that a light touch may cause more pain than does firm pressure. If the patient is anesthetized, perfect joint mobility will be found.

Treatment.—The treatment for a hysterical joint comprises attention to the general health, the employment of nourishing and easily digested food, the prevention of constipation, and the administration of tonics if they are needed. The surgeon must dominate his patient's mind and make her realize that he is master of the case. He is to be an inexorable but just ruler—never a brutal or a cruel one. If possible, send the patient away from the harmful sympathies of her home and let her have the rest treatment
Articular Wounds and Injuries

of S. Weir Mitchell. Local remedies applied to the joint do harm, as a rule, by concentrating afresh the patient's attention upon the articulation, although the hot iron sometimes does good. Suggestion in the hypnotic state may be tried. The use of morphia should be avoided as being the worst of enemies. Never immobilize the joint, and always use massage, passive motions, and frictions.

Neuralgia of the joints as an independent, isolated affection is extremely rare, though as a complication of other diseases it is by no means uncommon. Neuralgia is more common outside of the joints than in them, and periarticular neuralgia is especially frequent about the knee and the ankle. Joint-neuralgia may arise in any person, but it is more commonly present in young neurotic females. The pain may be persistent, or it may occur in periodic storms, and it is often associated with neuralgia in other parts. The pain may be dull and aching, but it is more often sharp and shooting. Joint-neuralgia is associated with tenderness on pressure, soreness on motion, often with transitory swelling without redness, and sometimes with numbness of the extremities. The diagnosis depends on the temperament of the patient, the sudden onset of the pain, the absence of constitutional symptoms, and the free mobility of the joint, especially under ether. Articular neuralgia may depend upon disease or injury of the central nervous system, upon malaria, syphilis, neurasthenia, rheumatism, gout, hysteria, and neuritis, and may be due to reflected irritation, especially from the ovaries, the uterus, or the rectum.

Treatment.—The treatment to be observed in joint-neuralgia is to maintain the general health. Examine for a possible exciting cause, and, if found, remove it. Give a long course of iron, quinin, and strychnin or arsenic. In rheumatic or gouty subjects administer suitable drugs and insist upon the use of a proper diet. During the attack use phenacetin. Morphin must occasionally be given in severe cases, but be careful of it, and never tell the patients they are taking it, as there is a possibility of their forming the opium-habit. Locally, employ frictions, ointment of aconite, heat, and keep upon the part a piece of flannel soaked in a mixture of soap liniment, laudanum, and chloroform (Gross). Never allow the joint to stiffen; any tendency to stiffness should be met by daily massage, frictions, passive motion, and hot and cold douches. In some rare cases nerve-stretching or neurectomy becomes necessary.

Articular Wounds and Injuries.—A penetrating wound is very serious, and it may be due to a compound fracture, to a compound dislocation, to a gunshot-wound, or to a stab. If a bursa near a joint be injured, secondary penetration may occur as a result of suppuration. In a penetrating wound, besides pain, hemorrhage, and swelling, there is a flow of synovial fluid. A small amount of synovia flows from an injured bursa, a large amount from an open joint.

Treatment.—If a joint is opened aseptically (as when incised by the surgeon), the wound heals nicely under rest and antisepsis. If a joint is opened by a septic body, suppurative arthritis is apt to arise, and the surgeon endeavors to prevent it by asepticizing the surface, irrigating the joint, draining, applying antiseptic dressing, and securing rest. Normal salt solution is the best agent for irrigation, as it does not injure joint-endothelium. Active antiseptics are apt to lessen tissue-resistance, and thus may actually favor
infection. In gunshot-wounds inflicted by pistol bullets or sporting rifle bullets, if antisepsis is not employed, suppuration is inevitable; hence military surgeons in the past, as a rule, have advocated amputation or excision in gunshot-splinterings of large joints. Recent experience shows that the wound of a large joint produced by a hard-jacketed and small-caliber bullet may heal with little trouble. In articular wounds the surface is sterilized, and usually the wound is enlarged, the finger is introduced to discover and remove foreign bodies, through-and-through drainage is secured, a tube is inserted, the joint is irrigated, antiseptic dressings are applied, and the extremity is placed upon a splint. Very severe joint-injuries demand resection or even amputation. Ankylosis, more or less complete, often follows a gunshot-wound of a joint. If the joint suppurates, the drainage must be made more free, sinuses must be slit up and packed, sloughs must be cut away, dead bone must be gouged out, and the patient must be placed upon a stimulant and tonic plan of treatment. The above remarks do not apply to wounds inflicted with the modern military projectile. Such wounds are not of necessity infected, and recovery may be prompt and uneventful if the surface is sterilized and antiseptic dressings and splints are applied.

Sprains.—A sprain is a joint-wrench due to a sudden twist or traction, the ligaments being pulled upon or lacerated and the surrounding parts being more or less damaged. A sprain is often a self-reduced dislocation (Douglas Graham). The joints most liable to sprains are the knee, the elbow, and the ankle. The smaller joints are also often sprained, but the ball-and-socket joints are infrequently sprained, their normal range of free movement saving them; they do occasionally suffer severely, however, as a result of abduction. In a bad sprain the ligaments are torn; the synovial membrane is contused or crushed; cartilages are loosened or separated; hemorrhage takes place into and about the joint; muscles and tendons are stretched, displaced, or lacerated; vessels and nerves are damaged; the skin is often contused; and portions of bone or cartilage may be detached from their proper habitat, though still adhering to a ligament or tendon (sprain-fractures). Sprains are commonest in young persons and in adults with weak muscles. They happen from sudden twists and movements when the muscles are relaxed. A large part of the support of joints comes from muscles, and when they are suddenly caught unawares they do not properly support the joint, and a sprain results. A joint once sprained is very liable to a repetition of the damage from slight force. Sprains are common in a limb with weak muscles, in a deformed extremity in which the muscles act in unnatural lines, and in a joint with relaxed ligaments.

Symptoms.—There is severe pain in the joint, accompanied by general weakness. Nausea, vomiting, and even syncope may occur. There is impairment or loss of ability to move the joint. The above-described condition is succeeded by a season of relief from pain while at rest, numbness being complained of, and pain on motion being severe. Swelling arises very early if much blood is effused. In any case swelling begins in a few hours. Extensive effusion, by separating joint-surfaces, produces slight lengthening of the limb. Movements of the joint become difficult or impossible; the tear in the ligament may sometimes be distinctly detected by the examining fingers; pain and tenderness become intense; joint-crepitus will be manifested; and in a day or two
discoloration becomes marked. Moulin and others have pointed out that when a muscle is strained the skin above it becomes sensitive, especially at tendinous insertions over joints. As muscles are invariably strained when a joint is sprained, there is always some cutaneous tenderness. There is also tenderness over a sprained joint due to capsular injury, bands of adhesions, etc. Tenderness is apt to arise at certain reasonably fixed points: in a hip-joint injury it is found behind the great trochanter, in a knee-joint injury by the side of the patella, in an ankle-joint injury to the inner side of the external malleolus (Culp). When the vertebral articulations are sprained, the muscles of the back are rigid, the skin is often sensitive, pain may be awakened by pressure or by certain movements, but there is no sign of cord injury in an uncomplicated case.

**Diagnosis and Prognosis.**—Sprain-fractures can be diagnosticated with certainty only by the x-rays. In the *diagnosis* of a sprain, fracture and dislocation must be considered. In fracture, crepitus and mobility exist; in dislocation, rigidity. The diagnosis of sprain should be made by a consideration of the joint involved, of the age, of the nature of the force, of the length of the limb, of the fact that the patient could use the joint for at least a short time after the accident, and of the local feel and movements of the part. In some cases examine under ether, in some apply the x-rays. Many injuries about the ankle which we would have formerly regarded as sprains, are often shown by the x-rays to be fractures. The *prognosis* depends on the size of the joint, on the extent of laceration, on the amount of intra-articular hemorrhage, and on the age of the patient. The danger is ankylosis. In rare cases after a sprain of the hip-joint osteo-arthritis arises. In some few cases after a sprain of the hip the head of the bone undergoes absorption.

**Treatment.**—In a mild sprain apply at once a silicate or plaster-of-Paris dressing. The first indication after the infliction of a severe sprain is to arrest hemorrhage and limit inflammation. For the first few hours apply pressure and an ice-bag. Wrap the joint in absorbent cotton wet with iced water, apply a wet
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gauze bandage, and put on an ice-bag. After some hours place the extremity
upon a splint and to the joint apply flannel kept wet with lead-water and laudanum, iced water, tincture of arnica, alcohol and water, or a solution of chlorid of ammonium. These evaporating lotions produce cold. Instead of
them, an ice-bag may be used for a day or two. Leeches around the joint do
good. Constitutionally, employ the remedies for inflammation. Morphin or
Dover's powder is given for the pain. Judicious bandaging limits the swelling.

After a day or two, if the symptoms continue or if they grow worse, use hot
fomentations, the hot-water bag, plunge the extremity frequently in very hot
water, or apply heat by Leiter's tubes. When the acute symptoms begin to
subside, rub stimulating liniments upon the joint once or twice a day and
employ firm compression by means of a bandage of flannel or rubber. Fric-
tions should be made from the periphery toward the body. Many cases do
well at this stage under the local use of ichthyol and lanolin (50 per cent.),
tincture of iodin, or blue ointment. Later in the case use hot and cold douches,
massage, frictions, passive motion, and the bandage. Passive motion is begun
day or so after swelling ceases. If massage causes the swelling to return,
abandon it for several days and then try it again. Blister are used when
tender spots persist and stiffness is manifest. If stiffness becomes marked,
move the joint forcibly. Give iodid of potassium and tonics internally, and
insist on open-air exercise. If the person is gouty or rheumatic, use appro-
priate remedies. Van Arsdale treats sprains by massage almost from the start.
Gibney treats them by strapping with adhesive plaster. Gibney's dressing is
of great service in a sprain of the ankle (Fig. 235). Many sprains may be
put up in an immovable dressing the first day or two after the accident. If the
joint contains much blood, aspiration should be practised before the dressing is
applied.

The hot-air oven is a very valuable method for treating recent sprains, and
the swelling, pain, and stiffness which follow sprains, of the extremities. The
sprained extremity is placed in an oven, and the part is subjected to heat for an
hour. The next day the treatment is repeated, and on as many subsequent
days as may be necessary. In an acute sprain the pain often disappears during
the first application of heat. In the intervals between the use of the oven the
extremity should be at rest upon a splint.

**Ankylosis.**—When a joint-inflammation eventuates in the formation of new
tissue in and about the joint, contraction of this tissue limits or destroys
joint-mobility, producing the condition known as "ankylosis." Ankylosis may
be complete (bony) or incomplete (fibrous); it may arise from contractures in
the joint (true or intra-articular ankylosis) or from contractures in the struc-
tures external to the joint (false or extra-articular ankylosis).

**True or intra-articular ankylosis** may arise from any cause which pro-
duces joint-inflammation with formation of new tissue, and may be due to
wounds, contusions, sprains, dislocations, fractures in or near a joint, movable
bodies in a joint, tubercle, gout, rheumatism, or syphilis. Proper immobiliza-
tion of a healthy joint may cause some stiffness, but not ankylosis. Dr. O.
W. Phelps* points out that experiments made by himself in association with
Dr. W. Gilman Thompson and Dr. J. C. Cardwell show that immobilization
of a normal joint will not produce ankylosis in five months, and that when a

* Railway Surgeon, July 26, 1898.
healthy joint becomes ankylosed, it is due to some pathological cause. Improper immobilization may produce and maintain intra-articular pressure, and such pressure may destroy the head of the bone and the socket, and ankylosis will result. Further, Phelps shows that muscular atrophy is sure to follow prolonged immobilization. Even a proper immobilization of a healthy joint will, if prolonged, cause muscular atrophy, but the weakness and stiffness will pass away entirely under the influence of proper treatment. Firm immobilization with pressure may produce disastrous results. Ankylosis is more apt to take place in a hinge-joint than in a ball-and-socket joint. In ankylosis from a general cause (as rheumatic gout) many joints are apt to suffer. Ankylosis may be due to fibrous tissue, and is then usually partial; it may be due to chondrification of fibrous tissue, and is then incomplete; it may be due to ossification of fibrous tissue, and is then complete, the joint being entirely immobile (osseous or bony ankylosis). The entire joint may be converted into bone. Only one small joint-surface may contain adhesions (limited adhesions), or the entire joint-surface may be bound up in them (diffused adhesions). In what is known as spondylitis deformans there is bony ankylosis of the vertebrae. Arthritis ossificans is a progressive bony ankylosis in which numerous joints are involved, and are finally completely obliterated. It is essentially the same disease as spondylitis ossificans and is an ossifying arthritis.*

Fibrous ankylosis may follow aseptic inflammation; bony ankylosis is apt to follow infections. Though slight motion is usually possible in fibrous ankylosis, in some cases it may be impossible. A joint immovable from fibrous ankylosis is distinguished from a joint immovable from bony ankylosis by the fact that in the former attempts at motion are productive of pain, and subsequently of inflammation. The incapacity resulting from ankylosis is due, first, to the impairment or destruction of joint-function, and, secondly, to the fixation at an inconvenient angle (a fixed flexed knee is worse than a fixed extended knee; a fixed extended elbow is worse than a fixed partly flexed elbow).

Treatment.—The effort should always be made to prevent ankylosis by treating carefully any joint-inflammation and by beginning passive motion and massage at the proper time. To limit inflammation is to prevent ankylosis. An inflammatory exudate exists in and about the tendons and ligaments, and even in the joint. Early massage and gentle movements remove this exudate before it is organized, and if organization of the exudate does not occur, ankylosis will not follow the injury or disease. In an acutely inflamed joint, however, passive motions must not be made, the part is kept at rest until acute symptoms subside, but gentle massage can be used daily. When fibrous ankylosis arises it may be improved or cured by the use of the hot-air oven, passive motion, active movements, massage, frictions with stimulating liniments, inunctions of ichthyol or mercurial ointment, hot and cold douches, and electricity. Some cases may be straightened out slowly by screw-splints or by weights and pulleys. Fibrous ankylosis of the elbow is best treated by using the joint. Fibrous ankylosis is often corrected by forcible straightening. If the tendons are much contracted, tenotomy should be performed two or three days before forcible straightening is attempted. Before straightening forcibly always administer an anesthetic. Suppose a case of ankylosis of the knee:

*See Dr. Joseph Griffith, in Jour. of Pathology and Bacteriology, for December, 1896, and March and June, 1897.
administer ether, put the patient upon his back, bring the leg over the end of
the operating-table, grasp the ankle with one hand and the lower portion of the
leg with the other hand, and make strong, steady movements of flexion and
extension until the limb can be straightened. The adhesion will be felt to break,
the snapping often being audible. At once apply a plaster-of-Paris dressing to
the extended extremity, and keep the limb immobile for two weeks. At the end
of this period remove the plaster and begin massage and passive movements,
and, if reaction is not great, soon advise active movements. This procedure is
not free from danger. Vessels may be ruptured, nerves may be torn, skin and
fascia may be lacerated, suppuration may ensue from the admission into the
joint of encapsuled cocci, or of bacteria from the blood or lymph which find
in this area a point of least resistance. Because of the danger of opening up
depots of encapsuled bacilli and cocci, do not forcibly break up an ankylosis
that results from tuberculous or septic arthritis, but use gradual extension by
weights or by screw-splints. Ankylosis of the knee following fracture of the
patella is almost sure to recur after forcible breaking up. The best treatment
for knee-anklylosis is use of the joint. In bony ankylosis of any joint other than
the elbow-joint do nothing if the joint is in a useful position. If the joint is
firmly fixed in an unfortunate position, resort to excision or an osteotomy. In
the elbow excision should be performed, no matter what the position, in the
hope of obtaining a movable joint. In ankylosis of the jaw surgeons formerly
endeavored to remedy the condition by wedging the jaws apart with a mouth-
gag, and afterward inserting boxwood plugs at frequent intervals. This
method is invariably a failure.* Esmarch's operation is sometimes curative
(removal of a wedge-shaped piece of bone). Some operators excise the con-
dyle and a portion of the neck. Swain advocates sawing the bone at the angle.

**False or Extra-articular Ankylosis.**—In this condition the joint is in-
tact, but the contractures are in surrounding parts. The causes are muscular,
fascial, and tendinous contractures, cicatrices (especially from burns), deposits
of bone, muscular parasites, tumors, and aneurysms. Contractions of muscles
or tendons may be due to gout, rheumatism, injury, thecitis, fractures, and dis-
locations. False ankylosis is seen in club-foot and in Dupuytren's contraction.

*Treatment.—The treatment of false ankylosis depends upon the case. Re-
cently contracted muscles or tendons require motion, massage, frictions with
stimulating liniments, hot and cold douches, and the use of the hot-air appara-
tus. Old contractions require division. Whenever possible, excise a cicatrix
that causes false ankylosis, and fill the gap with sound tissue. Bony deposits
are gouged away and tumors are removed. Contractures in cases of paralysis
require electricity, passive motion, frictions with stimulating liniments, the
hot-air bath, and general treatment.

**Loose Bodies in Joints (Floating Cartilages).**—The knee is the
joint oftenest affected. These bodies may be free or each may have a stalk or
pedicle; they may move about and occasionally block the joint, or may lie
quietly in a joint-recess or diverticulum. They may be single or multiple, flat
or ovoid, smooth or irregular, as small as peas or as large as plums, and may
be composed of fibrous tissue, of cartilage, or of bone. There are numerous
different modes of origin of these bodies, many being "detached ecchondroses
or pieces of hyaline cartilage hanging by narrow pedicles" (J. Bland Sutton),

and they result from enlargement and chondrification of the villi of the synovial membrane. Some loose bodies are broken-off osteophytes; some arise from blood-clots; some by projection or herniation of the synovial membrane, which protrusion is broken off; others are detached fringes of tuberculous synovial membrane. Traumatism is the usual exciting cause. Loose cartilages are commonest in adult men.

**Symptoms.**—Many small bodies give rise to no symptoms other than those of synovitis. A large body produces pain and interferes with joint-function. The joint is weak and a little swollen, and the patient can feel the body and often can push it into a superficial area of the joint, where it may be felt by the surgeon. From time to time the body may get caught, thus suddenly locking the joint and producing intense and sickening pain, extension and flexion being impossible until the body slips out. This accident is followed by inflammation and effusion.

**Treatment.**—To relieve locking, employ forced flexion and sudden extension. Cure can be obtained only by operation. Asepticize with the utmost care. Let the patient bring the foreign body to a point where it can be felt; the surgeon then fixes it with a pin or holds it with the fingers, ether being given or cocain being used. The joint is now opened, the foreign body extracted, and an exploration made to see that no other bodies are present. The wound is sutured and the leg is placed upon a splint. Asepsis must be most rigid. The operation does not cure the causative lesion, and these bodies are apt to form again.

4. **Luxations or Dislocations.**

A dislocation is the persistent separation from each other, partially or completely, of two articular surfaces. A self-reduced dislocation is called a sprain (Douglas Graham). There are three forms of dislocations: (1) traumatic; (2) spontaneous or pathological; (3) congenital.

1. **Traumatic dislocations** are due to injury. They are divided into—complete dislocation, in which the two articular surfaces are entirely separated and the ligaments are torn; incomplete or partial dislocation, in which the two articular surfaces are not completely separated and the ligaments are rarely lacerated; simple dislocation, in which there is no wound leading from the surface to the articulation; compound dislocation, in which a wound leads from the surface to the joint; complicated dislocation, in which, besides the dislocation, there is a fracture, extensive damage of the soft parts, an opening which makes the case compound, or damage of a nerve or blood-vessel; primitive or primary dislocation, in which the bones remain as originally displaced; secondary dislocation, in which the dislocated bone assumes a new position; for instance, a subglenoid luxation of the humerus is primary, and it may become secondarily a subcoracoid luxation because of muscular contraction or attempts at reduction; recent dislocation, in which the displaced bone is not firmly fastened by tissue-changes in its new situation, and its old socket is not obliterated; old dislocation, in which the displaced bone is firmly fastened by tissue-changes in its new habitat, and the old socket is to a great extent obliterated (whether a dislocation is old or new depends on the state of the parts rather than on the time which has elapsed since the accident); double dislocation, in which corresponding bones on each side are dislocated; single dislocation, in which only one