1903

Modern Surgery - Chapter 6. Suppuration and Abscess

John Chalmers Da Costa
Jefferson Medical College

VI. SUPPURATION AND ABSCESS.

SUPPURATION is a process in which tissues and inflammatory exudates are liquefied by the action of pyogenic organisms, and it is a common result of microbic inflammation. The organisms which are responsible are referred to on page 37. Staphylococci produce local suppuration; streptococci cause spreading suppuration. Pyogenic bacteria liquefy exudate by peptonizing it. The pyogenic organisms are very irritant, and when deposited cause inflammation; inflammation leads to exudation, but the exudate cannot coagulate or coagulates but imperfectly, because it is peptonized by the ferment of the micro-organisms. If an area of embryonic tissue is invaded by the pyogenic micro-organisms, it is promptly peptonized. The peptonizing action is upon the fibrinous elements of an exudate and upon the intercellular substance of embryonic or granulation tissue. Cells are separated from intercellular substance, and in consequence degenerate and die. Peptonized exudate or embryonic tissue is called pus. In suppurations induced by staphylococci a barrier of leukocytes is first formed around the region of irritation; this barrier is reinforced by fibroblasts, the pus is imprisoned, and rapid spreading and wide diffusion are prevented. In inflammations induced by streptococci the peptonizing action of the organisms is so great that no barrier of white blood-cells or of proliferating connective-tissue cells forms in time to imprison the micro-organisms; hence the suppuration spreads rapidly and widely. Suppuration can be induced by the injection of pyogenic bacteria, by their entry through a wound, and by rubbing them upon the skin. In some rare instances, especially when the diet has been putrid, they may enter through the blood and lodge at a point of least resistance. When a medullary canal suppurates after a chill to the surface or after a blow that does not cause a wound, we know that the organisms must have arrived by means of the blood. Organisms which reach a point of least resistance through the blood come from some atrium of infection which may be discoverable or which may not be found. The entry of pyogenic bacteria does not necessarily cause suppuration, as the healthy human body can destroy a considerable number, even if given in one "dose"; but a large number in a healthy, or even a small number in an unhealthy, organism almost certainly leads to pus-formation. The pus of all acute abscesses contains bacteria of suppuration, but the pus of tuberculous abscesses does not, unless there be a mixed infection; in other words, pure tuberculous pus is not pus at all.

Can suppuration be induced without micro-organisms? It is true that the injection of irritants can cause the formation of a thin fluid which contains no organisms; but this non-bacterial fluid is not pus. A purulent fluid is formed by injecting cultures of pus cocci which have been rendered sterile by heat, the organisms being killed, a ferment contained in the bacterial cells being the active agent. It is known as *spurious* or *aseptic pus*. It concerns us but little as surgeons, except in cases of pyemia in which thrombi containing toxins induce limited secondary abscesses.

Impaired health or an area of lowered vitality predisposes to suppuration. Diabetes and albuminuria are common and influential predisposing

causes, because in these diseases tissue resistance is at a low ebb. The lymphatic glands, medulla of bones, serous membranes, and connective tissue are especially prone to suppurate.

Pus may form within twenty-four hours after bacteria have been deposited, or it may not be formed for days. The older surgeons claimed that pus could do good by protecting granulations and separating disorganized tissue. It is now held that it is absolutely harmful by melting down sound tissue and poisoning the entire organism. Modern surgery has to a great degree abolished pus.

If pus stands for a time, it separates into two portions—(1) a watery portion, the liquor puris or pus-serum, containing peptone, fat, microbic products, osmazone, and salts, and not tending to coagulate; (2) a solid portion, or sediment of micro-organisms of suppuration, pus-corpuscles (Fig. 44), and

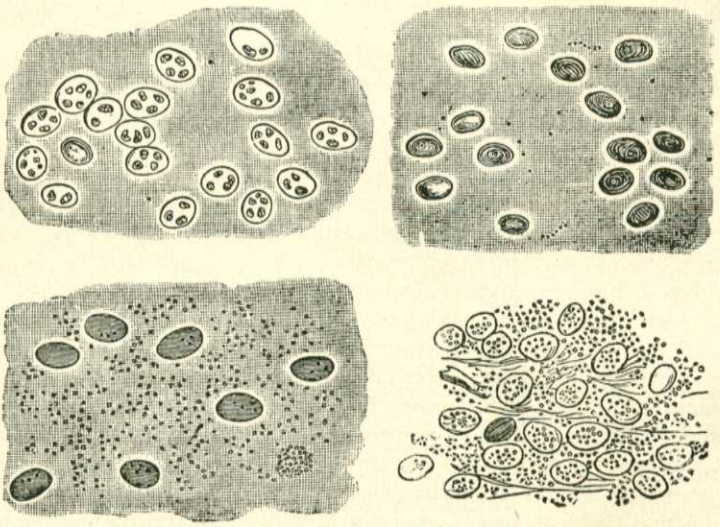

Fig. 44.—Fragmentation of nucleus in leukocytes undergoing transformation into pus-corpuscles (Senn).

broken-down tissue. The pus-corpuscles are either white blood-cells or altered connective-tissue cells. Some of them are dead, some have ameboid movements, some are fatty, others are granular and contain more than one nucleus, and all are degenerating. A pus-cell is waste matter, and it cannot aid in repair.

Forms of Pus.—*Laudable* or *healthy pus*, a name long in vogue, is a contradiction, no pus being healthy. In former days free suppuration after an operation was regarded as a favorable indication, and when it occurred the surgeon congratulated himself that surgical fever was at an end. At the present day suppuration after an operation is an evidence of previous infection, of lack of care, or of infection by the blood. The so-called *laudable pus* is seen coming from a healing ulcer, and is an opaque, yellowish-white, or a greenish fluid of the consistence of cream, without odor or with a very slight odor if it is not putrid, and having a specific gravity of about 1030.

Malignant, watery, or *ichorous pus* is a thin, watery, putrid fluid. It is pus filled with the organisms of putrefaction.

Stinking pus may be ichorous. If due to the bacterium coli commune, it is very foul, but not thin. Pus of this nature is met with in ischiorectal abscess and appendiceal abscess.

Sanious pus is a form of ichorous pus containing blood coloring-matter or blood. It is thin, of a reddish color, and very acrid, corroding the parts that it comes in contact with. It is found notably in caries and carcinoma.

Concrete or *fibrinous pus,* which contains flakes of fibrin or coagulated fibro-purulent masses, is met with in serous cavities (joints, pleura, etc.). These masses are found in infective endocarditis.

Blue Pus.—The color of blue pus is due to the bacillus pyocyaneus.

Orange Pus.—The color of orange pus is due to the action of sarcina aurantiaca, and appears in violent inflammations.

Serous pus is a thin serous fluid containing a few flakes.

So-called *tuberculous, scrofulous,* or *curdy pus* is not pus at all, unless the tuberculous area has undergone pyogenic infection.

So-called *gummy pus* arises from the breaking down of a gumma which has outgrown its own blood-supply. It is not pus.

Muco-pus is found in purulent catarrh—that is, in suppurative inflammation of an epithelial structure. It contains pus elements and epithelial cells.

Caseous pus comes from the fatty degeneration of pus-corpuscles or inflammatory exudations. It occurs especially in tuberculous processes. A caseous mass may calcify.

Suppuration is announced by the intensification of all local inflammatory signs. The heat becomes more marked, the discoloration dusky, the swelling augments, the pain becomes throbbing or pulsatile, and the sense of tension is greatly increased. The skin at the focus of the inflammation after a time becomes adherent to the parts beneath, and fluctuation soon appears. This adhesion of the skin is a preparation for a natural opening, and is known as *pointing.* An important sign of pus beneath is edema of the skin. This is always observed in a superficial abscess, and is sometimes noticeable in empyema or pyothorax, in appendiceal abscess, and in perirenal suppuration. The above symptoms can be reinforced and their significance proved by the introduction of an aseptic tubular exploring needle and the discovery of pus. Irregular chills, high fever, and drenching sweats are very significant of suppuration in an important structure or of a large area.

Diffused Cellulitis or Phlegmonous Suppuration; Purulent Infiltration.—This process may involve a small area or an entire limb, and is due to infection by the streptococcus pyogenes or streptococcus of erysipelas, usually associated with mixed infection with other bacteria. The streptococci are intensely virulent. Barriers of white corpuscles will not restrain them, and tissues break down before cellular multiplication is able to encompass the bacteria. The bacteria disseminate through the lymph-spaces and lymph-vessels. The disease in severe cases produces enormous swelling, areas which feel boggy, a dusky red discoloration, and great burning pain. Gangrene of superficial areas is not unusual, due to thrombosis of vessels or coagulation necrosis from toxins. The discharges of the wound, if a wound exists, are apt to dry up, and the wound becomes foul, dry, and brown. The

adjacent lymphatic glands are much enlarged. The disease is ushered in by a chill, which is followed by high oscillating temperature, due to suppurative fever, sapremia, or even septic infection or pyemia. Sweats are noted during falling temperature. Diffuse suppuration tends to arise in infected compound fractures, in extravasation of urine, and after the infliction of a wound upon a person broken down in health. It is not unusual after typhoid or scarlet fever, and is typical of phlegmonous erysipelas. The pus is sanious and offensive, and burrows widely in the subcutaneous tissue and intermuscular planes. This diffused suppuration may widely separate muscles, and even lay bare the bones. It is a very grave condition, and may cause death by exhaustion, septic intoxication, septic infection, pyemia, or hemorrhage from a large vessel which has been corroded. Cellulitis of a mild degree, due usually, but not always, to streptococci, may surround an infected wound or a stitch-abscess. Its spread is manifested by red lines of lymphangitis running up to the adjacent lymphatic glands. Light cases may not suppurate, the lymphatics carrying off the poison. Any case of cellulitis is, however, a menace, and any severe case is highly dangerous (see Erysipelas).

Acute Abscesses.—An abscess is a circumscribed cavity of new formation containing pus. We emphasize the fact that it is a *circumscribed cavity* —circumscribed by a mass of leukocytes and proliferating connective-tissue cells. A purulent infiltration is not circumscribed, hence it does not constitute an abscess. An essential part of the definition is the assertion that the pus is in a cavity of *new* formation, in an abnormal cavity; hence pus in a natural cavity (pleural, pericardial, synovial, or peritoneal) constitutes a purulent effusion, and not an abscess, unless it is encysted in these localities by walls formed of inflammatory tissue.

An acute abscess is due to the deposition and multiplication of pyogenic bacteria in the tissues or in inflammatory exudates. These bacteria attack exudates or tissues, form irritants which cause inflammation or intensify existing inflammation, and by exerting a peptonizing action on intercellular substance and the fibrin of the exudate liquefy tissue and the products of inflammation, and form pus. As a rule, within twenty-four hours after lodgment of the bacteria the exudation increases in amount, the migrated leukocytes gather in enormous numbers, the fibers of tissue swell, and the connective-tissue spaces distend with cells and fluid. The connective-tissue cells, acted on by pus cocci, multiply by karyokinesis, develop many nuclei, lose their stellate projections, degenerate, and constitute one form of pus-corpuscle, leukocytes forming the other. All the small vessels are choked with leukocytes, this blocking serving to cut off nourishment and tending to produce anemic necrosis. Liquefaction occurs at many foci of the inflammation, drops of pus being formed, the amount of each being progressively added to and many foci coalescing (Fig. 45). The pus-cavity is circumscribed, not by a secreting pyogenic membrane, but by a mass of fibroblasts, whose cells and intercellular material have not as yet broken down; such a mass of fibroblasts is often called embryonic tissue, and it is circumscribed by a zone of inflammation in which there are hordes of migrated leukocytes (Fig. 46). As an abscess increases in size, the embryonic tissue from within outward liquefies into pus, and the zone of inflammation beyond continually enlarges and forms more embryonic tissue. After a time the inflammation reaches

the surface, the embryonic tissue glues the superficial to the deeper parts, the superficial part inflames and becomes embryonic tissue, and the intercellular substance is liquefied. When pus has all but reached the surface, a thin layer of tissue only being undestroyed, an elevation or tit of thin tissue is formed, due to the fluid pressure. This process is known as *pointing*. The elevation or

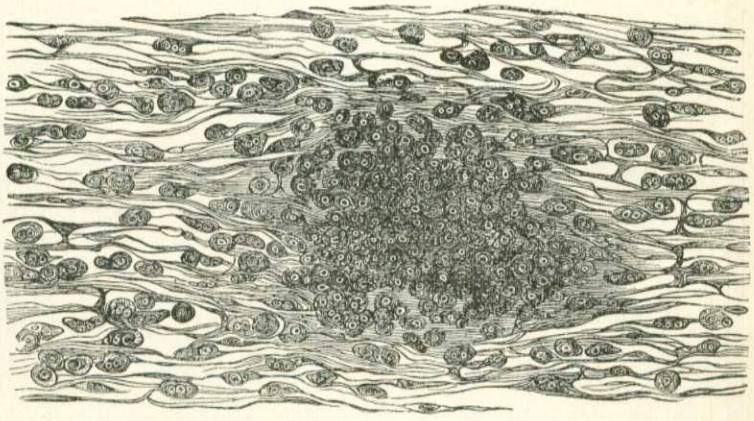

Fig. 45.—Infiltration of connective tissue of cutis (× 500) with beginning suppuration in the center (Senn).

point thins from tension and liquefaction, and finally gives way and *spontaneous evacuation* occurs. When an abscess forms in an internal organ or in some structure which is not loose, like connective tissue,—for instance, in a lymphatic gland,—a mass of pyogenic bacteria, floating in the blood or lymph, lodges, and these bacteria by means of irritant products cause coagulation necrosis of the adjacent tissue and inflammatory exudation around it. The area of coagulation necrosis becomes filled with white blood-cells, and the dry necrosed part is liquefied by the cocci. Suppuration in dense structures causes considerable masses of tissue to die and to be cast off, and these masses float in the pus. Death of a mass with dissolution of its elements is necrosis, or inflammatory gangrene. Pus travels in the line of least resistance. It may reach a free surface, or may break into a cavity or joint, may invade bone or destroy a vessel. When an abscess ceases to spread or is evacuated, the fibroblastic layer forming the walls becomes vascularized and is converted into *granulation tissue*. An abscess heals by the collapse of its walls and fusion of the granulations (union by third intention), or by granulation (union by second intention). In either case granulation tissue is ultimately converted into fibrous or scar tissue.

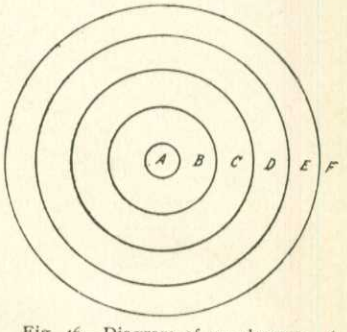

Fig. 46.—Diagram of an abscess: *A*, Pus; *B*, layer of fibroblasts; *C*, tissue infiltrated with leukocytes; *D*, zone of stasis; *E*, zone of active hyperemia; *F*, healthy tissue.

Forms of Abscesses.—The following are the various forms of abscesses: *Acute*, which follows an acute inflammation. *Strumous, cold, lymphatic, tuberculous*, or *chronic* abscess is due to tubercle, and does not contain true pus unless there is secondary infection. It presents no signs of inflammation. A lymphatic abscess may form in a week or two, and hence is not necessarily chronic, which term may also be used to mean a persistent non-tuberculous abscess. *Caseous* or *cheesy* abscess, a cavity containing thick cheesy masses, is due, perhaps, to the fatty degeneration of inflammatory exudate and pus-corpuscles, but most commonly results from the caseation of a tuberculous focus. *Circumscribed* abscess is one limited by a layer of fibroblasts. *Diffused* abscess is an unlimited collection of pus, in reality not an abscess, but either a purulent effusion or a purulent infiltration. *Congestive, gravitative, wandering*, or *hypostatic* abscess is a collection of pus or tuberculous matter which travels from its formation-point and appears at some distant spot (as a psoas abscess). *Critical* or *consecutive* abscess is one which arises during an acute disease. *Diathetic* abscess is due to a diathesis. *Embolic* abscess is due to an infected embolus. *Tympanitic* or *emphysematous* abscess is one which contains air or the gases of putrefaction. *Encysted* abscess, in which pus is circumscribed in a serous cavity. *Fecal* or *stercoraceous* abscess is one containing feces in consequence of a communication with the bowel. *Follicular* abscess is one arising in a follicle; *hematic* abscess, one arising around blood-clot, as a suppurating hematoma; *marginal* abscess, which appears upon the margin of the anus. *Pyemic* or *metastatic* abscess is the embolic abscess of pyemia. *Milk* abscess is an abscess of the breast in a nursing woman; *ossifluent* abscess, arising from diseased bone; *psoas* abscess, a tuberculous abscess arising from vertebral caries, the matter following the psoas muscle, and usually pointing in the groin. *Sympathetic* abscess, arising some distance from the exciting cause, such as a suppurating bubo from chancroid, is not in reality sympathetic, because infective material has been carried from the primary focus. *Thecal* abscess is a purulent effusion in a tendon-sheath. *Tropical* abscess is an abscess of the liver, so named because it occurs chiefly in tropical countries: it usually follows dysentery; *urinary* abscess, caused by extravasated urine; *verminous* abscess, one which contains intestinal worms and communicates with the bowel; *syphilitic* abscess, which occurs in the bones during tertiary syphilis, and which is gummatous and not pyogenic. *Brodie's* abscess is a chronic abscess of a bone, most common in the head of the tibia; *superficial* abscess, occurring above the deep fascia; *deep* abscess, occurring below the deep fascia; and *residual* or *Paget's* abscess, a recurrence of active changes, it may be after years, about the residue of a former tuberculous abscess.

Symptoms of Acute Abscess.—In an acute abscess, as before stated, a part becomes inflamed and a quantity of fibroblasts are formed; fibroblastic tissue is liquefied (as above noted) and pus is produced. If the abscess is in the brain, in the tonsil, or in the neighborhood of the rectum or vermiform appendix, the odor of the pus is apt to be offensive. An acute abscess can occur in a person of any constitution.

Local Symptoms.—Locally there is intensification of inflammatory signs and enormous increase of the swelling. At first the area is hard, but afterward becomes soft, and it finally fluctuates. The discoloration becomes

dusky. The pain becomes throbbing and the sense of tension increases. The pain is greater the more dense the implicated tissue is and the greater the number of nerves it contains. At every pulse-beat the tension in the abscess increases temporarily, and hence the pain momentarily increases. Pain is increased by a dependent position of the part. There is great tenderness. The pain may be felt at the seat of suppuration or may be referred to some distant point. Tenderness is located at the focus of disease. The cutaneous surface, if the abscess is adjacent, is seen to be polished and edematous, and after a time pointing is observed and fluctuation can be detected.

Constitutional Symptoms.—If there is a small collection of pus in an unimportant structure there may be no obvious constitutional disturbance. If the abscess contains much pus or affects an important part, disturbances generally appear, from slight rigors or moderate fever to chills, high temperature, and drenching sweats. The constitutional condition typical of an abscess is due to the absorption of retained toxins, and is known as "suppurative fever." When an abscess is open but ill-drained, or when it is unopened and deep-seated, long-continued suppuration causes a fever which is markedly periodic: the temperature rises in the evening, attaining its highest point usually between 4 and 8 P. M., and then sinks to normal or nearly normal in the early morning (from 4 to 8 A. M.). When the temperature begins to fall, profuse perspiration takes place. This fever is known as *hectic*. Prolonged suppuration causes albuminoid changes in various organs, notably in the liver, spleen, and kidneys. Albuminoid changes are especially common when there has been mixed infection of a tuberculous area and long-continued suppuration. It also occurs as a result of syphilis.

Dr. J. C. DaCosta, Jr., tells us ("Clinical Hematology") that "in both trivial and extensive pus foci the number of leukocytes may be normal or even subnormal; in the former instance because systemic reaction is not provoked, and in the latter because it is overpowered. Leukocytosis may also be absent in case toxic absorption is impossible, owing to the complete walling off of the abscess. In all other instances save these, a definite and usually well-marked leukocytosis occurs, amounting on the average to a count of about twice the mean normal standard, but frequently greatly exceeding this figure in the individual case."

The signs and symptoms of an abscess are somewhat modified by location, and it is wise to discuss acute abscesses in different situations.

Acute Abscesses in Various Regions.—*Abscess of the brain* in about 50 per cent. of cases results from suppurative disease of the middle ear. In *abscess* of a silent region of the *brain* symptoms may long be entirely absent. The usual symptoms are headache, vomiting, delirium, drowsiness, optic neuritis, and in about one-half of the cases a subnormal temperature. Localizing symptoms, spasmodic or paralytic, may be present. There is usually leukocytosis. In but few cases are there fever and sweats. In extradural abscess there is fever.

Appendiceal or *appendicular abscess* results from inflammation, usually with perforation of the vermiform appendix, plastic peritonitis leading to agglutination of the mesentery and omentum, adhesion of the bowels and mesentery, and the formation of a barrier of leukocytes and a mass of fibroblasts. This process circumscribes the pus. If the pus in appendicitis has

been formed by colon bacilli or staphylococci, it will probably be circumscribed and limited. If the pus has been formed by streptococci, it will probably not be limited, and the peritoneum will be attacked by diffuse septic peritonitis. The signs of appendicular abscess are pain, tenderness, muscular rigidity, the existence of a mass, which may be palpated through the abdominal wall or rectum and which is dull on percussion, occasionally fluctuation and skin edema in the right iliac fossa, vomiting, sometimes constipation, and sometimes diarrhea. The patient lies upon his back, usually with one or both thighs flexed. In appendicular abscess there is fever, usually higher at night than in the morning, profuse sweating occurring during the fall. In some cases the temperature is persistently high. In some the elevation is trivial. In some chills occur. A sudden fall of temperature with shock is produced by rupture of the abscess-wall. If this accident happens, general peritonitis quickly arises. In appendicular abscess there is marked leukocytosis unless the walls are very thick or unless the process has diffused and general peritonitis has taken place, in which conditions it may be absent. Appendiceal abscess may be assumed to exist when the symptoms of appendicitis persist after the fifth or sixth day, or when, after the symptoms have subsided, they reappear a day or two later (page 729).

Abscess of the liver may not be announced by symptoms until rupture. It may follow dysentery, may be a result of the lodgment of infected clots from the hemorrhoidal veins, may follow upon the infective phlebitis of appendicitis, may result from septic cholangitis or suppuration of a hydatid cyst. We usually find fever of an intermittent type, profuse sweats, pain in the back, the shoulder, or the right hypochondriac region, enlargement of the area of liver-dulness, also hepatic tenderness, and finally constitutional symptoms of the existence of pus. Sometimes there are fluctuation and skin edema over the liver, and the general cutaneous surface may be a little jaundiced. The symptoms vary as the pus invades adjacent organs. When there are pain on respiration and evidences of diaphragmatic pleuritis the pus is probably breaking into the pleural sac. There may or may not be leukocytosis (see page 749).

Acute retropharyngeal abscess is due to pyogenic infection of the retropharyngeal tissues. The abscess usually forms upon one of the lateral halves of the pharynx. It may be due to traumatism, to acute infectious diseases, to infective processes of the mucous membrane of the mouth, ear, and nasopharynx, or to pyogenic infection of a tuberculous abscess. In the great majority of cases the disease is due to suppuration of the deep cervical glands. There is pain, difficulty in swallowing, dyspnea, nasal voice, bulging into the pharnyx, which is detected by inspection and palpation, enlargement of the deep cervical glands, fever, sweats, and great weakness. Tuberculous retropharyngeal abscess is considered on page 124.

Subphrenic abscess is apt to begin beneath the diaphragm, though in some few instances the pus forms above this muscle, and subsequently gains access to the region beneath. Such an abscess may contain not only pus, but gas, and in some cases also fluid from the stomach or intestine. It may arise after perforation of the bowel or stomach, or it may result from Pott's disease, perinephric abscess, traumatism, abscess of liver, kidney, spleen, or pancreas, empyema or pneumonia (Greig Smith). The signs are pain, fever, sweats,

dyspnea, cough, and the physical signs of a collection of fluid beneath the diaphragm and of gas in the cavity of the abscess. As in any other abscess there may or may not be leukocytosis (page 109).

Abscess of the lung gives the physical signs of a cavity; the expectoration is offensive and contains fragments of lung-tissue. An abscess may occasionally be located by the use of the *x*-rays. Pyemic abscesses may exist and yet escape discovery. (See under Surgery of Respiratory Organs.)

Abscess of the mediastinum causes throbbing retrosternal pain, chills, fever, sweats, and often dyspnea. A tumor may appear which pulsates and fluctuates, but the pulsation is not expansile.

Perinephric abscess usually causes tenderness and pain in the lumbar region or about the hip-joint, which pain runs down the thigh and is accompanied by retraction of the testicle. Induration, fluctuation, or edema of the skin may be observed in the lumbar region. The constitutional symptoms of suppuration usually exist (page 115).

Abscess of the antrum of Highmore causes pain, edematous swelling of the overlying soft parts, and crepitation on pressure upon the superior maxillary bone. Pus may escape from the nostril of the diseased side when the head is bent in the direction of the healthy side. A rhinoscopic examination discloses the fluid passing into the nares. The antrum on the side of the abscess cannot be transilluminated by an electric light in the mouth (Garel's sign).

Alveolar abscess is suppurative dental periostitis due to diseased teeth. The simplest form is a *gum-boil*, a collection of pus between the gum and the bone "external to the root of the tooth which is the seat of inflammation" ("Dental Surgery," by Sewill). In more severe cases the cheek is involved and the abscess breaks into the mouth or through the cheek. In any case suppuration begins in the socket of a tooth. In mild cases the pus escapes around the neck of the tooth, a distinct and local abscess may be situated at the end of the root, absorption of bone having occurred, or a considerable cavity may form in the bone, the external maxillary plate being perforated. Alveolar abscess causes intense pulsatile pain, marked swelling of the gum and cheek, and sometimes very great edematous and dusky swelling of the face. A sinus may follow it.

Abscess of the larynx induces violent cough, pain, interference with the voice, swallowing, and breathing, and can be seen with a laryngoscope.

An *ischiorectal abscess* is situated in the areolar tissue of the ischiorectal fossa. The pyogenic organisms usually gain entrance to the lymphatics by way of an abrasion, fissure, or ulceration of the rectum or anus. A perforation made by a foreign body may inaugurate the condition. In rare cases bacteria reach the fossa in the blood-stream. The pain is severe and throbbing; there are great tenderness, redness and edema of skin, induration, and usually the constitutional symptoms of pus-formation. Fluctuation is a very late sign because of the density of the fascia.

Prostatic abscess is manifested by chills, fever, sweats, frequency of micturition, tenderness of the perineum and rectum, and agonizing pain, developing during an attack of acute prostitis.

Abscess of the breast can arise from absorption of pyogenic bacteria from a fissure or abrasion of the nipple. Some surgeons maintain that the bacteria enter along the milk-ducts, while others assert that they gain entrance by the

lymphatics. It is most common in nursing women. Its symptoms are pulsatile pain, dusky discoloration, skin edema, fluctuation, and usually constitutional disorder. (See Mastitis.)

Orbital abscess is a diffuse suppuration due to cellulitis or a collection of pus due to caries or necrosis of the orbital wall. In severe orbital cellulitis the movements of the eye are limited, the lids are very red and edematous, the conjunctiva is red and swollen (chemosis), and, if the case is not promptly relieved, optic neuritis may arise and sloughing of the cornea occur.

Suppurative thecitis or *felon* is a form of diffuse suppuration. (See Felon.)

Palmar abscess is a purulent effusion (page 559).

Furuncle and carbuncle are discussed on pages 896 and 897.

Empyema is a purulent effusion into the pleural sac (page 662). It is technically an abscess if it becomes encapsuled.

Diagnosis.—The diagnosis of an abscess rests upon—(1) its history; (2) fluctuation; (3) pointing; (4) surface edema; (5) the use of the tubular exploring needle; and (6) leukocytosis.

Fluctuation is the sensation imparted to a finger held against a sac containing fluid when a wave is started in the fluid by striking the mass with a finger of the other hand. Fluctuation cannot be obtained if the amount of fluid is small. It should never be sought for across a limb, but rather along it, because a false sense of fluctuation can always be obtained across the muscles of the limb. Pointing and surface edema have been discussed.

A suspected abscess in a part containing large blood-vessels under no circumstance should be opened by a bistoury without knowing that the diagnosis is certainly correct. This knowledge is obtained in some cases by inserting a small aspirating needle and observing the nature of the fluid which exudes. This operation must be performed with aseptic care; otherwise, if there is no abscess, infection may be inaugurated; if there is an abscess, mixed infection may occur. The older operators used a grooved exploring needle, but many able surgeons object to its use on the ground that when plunged into an infected area, pus bathes the track of penetration and may cause infection of other tissues and diffusion of the pyogenic process. The tubular exploring needle is the proper instrument.

An abscess which moves with the pulse because it rests upon an artery may be confounded with an aneurysm. The pulse movements of such an abscess are in one direction only; the abscess is lifted with each pulse-beat, but does not enlarge, and if a finger is laid upon either side of it the fingers will be lifted, but not separated. The pulse movements of an aneurysm are in all directions; they are expansile, the tumor grows larger, and the fingers will not only be lifted, but will also be separated. The tubular exploring needle can be used in doubtful cases; if aseptic, it will do no harm even to an aneurysm. A rapidly growing, small-cell sarcoma feels not unlike an abscess; but the exploring needle discovers blood, and not pus. A cystic tumor is separated from an abscess by the absence of inflammation, or, if it inflames, by the nature of the contained fluid. Ordinary caution will prevent one confounding an abscess with strangulated hernia. A tuberculous abscess is separated from an acute abscess by the absence of inflammatory signs in the former. The contents of the acute abscess differ from those of the chronic abscess. When an abscess exists in an important region (brain, appendix,

liver, etc.), cultures of the pus should be taken after incision. Such studies often give valuable information as to the probable course of the condition, and an accumulation of many accurate observations will add greatly to scientific information. Fig. 47 shows a convenient case for carrying culture-tubes.

Prognosis.—The prognosis varies according to the number of abscesses, their location and size, the strength of the patient, and the virulence of the causative bacteria.

Treatment.—In the treatment of an abscess there is one absolute rule which knows no exception, namely, that whenever and wherever pus is found the abscess should be evacuated at once, and, after evacuating it, thorough drainage must be provided for. It should be opened early, if possible even before pointing or fluctuation, to prevent tissue destruction, subfascial burrowing, and general contamination. Drainage is continued until the discharge becomes scanty, thin, and seropurulent.

Alveolar abscess requires prompt incision through the gum, extraction of the diseased tooth in most cases, and the rinsing of the mouth at frequent

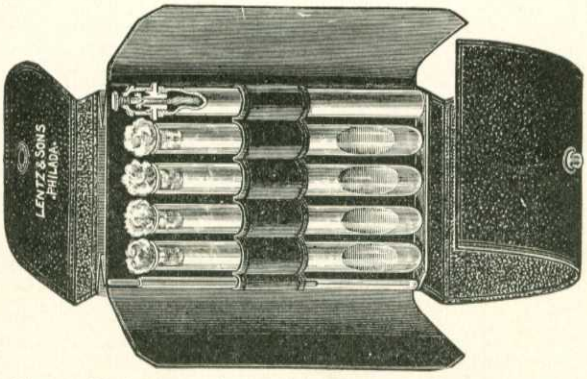

Fig. 47.—Vischer's case for carrying culture-tubes for inoculation.

intervals with hot fluid. Heat should not be applied externally, as it would favor external rupture. If spontaneous rupture externally is inevitable, then an incision must be made at the point where the abscess is nearest the surface. The cut will leave less scar than will spontaneous evacuation.

Abscess of the liver is often operated upon in two stages. An incision is made along the edge of the ribs down to the liver, which organ is then stitched to the edges of the wound. In a day or two after the first operation the two layers of peritoneum are firmly adherent and the abscess can be opened without danger of the passage of pus into the peritoneal cavity. The abscess, located by an aspirating needle, is opened by the Paquelin cautery, is washed out with salt solution, and a tube is inserted. If care is taken the operation can be safely completed at once. If this course is determined on, after the liver is exposed by incision, the exposed surface of the organ is surrounded with iodoform gauze, the abscess is located by an aspirating needle, is opened by the cautery, is irrigated and drained as directed above. Some physicians

try to locate an abscess by plunging an aspirating needle into the liver before making an incision. This procedure is uncertain and dangerous.

Abscess of the liver is occasionally reached by resecting a rib, opening the pleural sac, and incising the diaphragm (transthoracic hepatotomy).

Abscess of the *mediastinum*, like all other abscesses, requires incision and drainage. This is effected by cutting between the rib cartilages or by trephining the sternum.

In *abscess of the lung* an incision is made and the pleura is exposed. The incision is usually through an intercostal space; but if the spaces are narrow, it will be necessary to resect a rib. If the two layers of pleura are found adherent, the operation is proceeded with. If they are not adherent, they are stitched together with a catgut suture, and the surgeon waits forty-eight hours before continuing. The operation is completed by locating the pus by means of an aspirating needle, evacuating it by the cautery at a dull-red heat, and inserting a drainage-tube into the abscess-cavity.

In *abscess of the antrum of Highmore* bore a gimlet-hole through the superior maxillary bone, above the canine tooth, or perforate the bone by means of a trocar. Irrigate daily with boiled water or normal salt solution. Keep the opening from contracting by inserting a small tent of iodoform gauze. In persistent cases it may be necessary to draw a tooth, break through the socket of the first or second bicuspid into the antrum, and insert a silver or hard-rubber tube. In very persistent cases osteoplastic resection of a portion of the upper jaw will be demanded.

In *appendicular abscess* incise, support the abscess-walls with gauze, remove the appendix in most cases, but not in all, and insert a drainage-tube and strands of gauze (page 738).

An *ischiorectal abscess* must be opened early. The surgeon never waits for fluctuation. Fluctuation is a very late symptom. To wait for it entails great destruction of tissue and serves no useful purpose. Place the patient on his side, with the legs drawn up. Insert a finger in the rectum, lift the abscess toward the surface, and incise it from the surface. The incision runs from the anal margin like a spoke from the hub of a wheel. Irrigate with salt solution, inject iodoform emulsion, insert a drainage-tube, dress, and let the patient know he is in danger of developing a fistula.

A *retropharyngeal abscess* must be opened early, because if spontaneous evacuation occurs the patient may be suffocated. Some surgeons open it from within the mouth, but this exposes the patient to the development of septic bronchopneumonia and gastro-intestinal disorder. It is better to open it from the neck by Hilton's method, the incision being carried through the sternocleidomastoid muscle or posterior to it. Drainage is inserted and the abscess treated in the usual way.

In *abscess of the breast* make an incision radiating from the nipple, or, what is better, incise under the breast by means of a cut at the inferior thoracic mammary junction, and enter the abscess from beneath.

In *abscess of the brain* the skull should be trephined, the membranes incised, and the abscess sought for, opened, and drained (page 619).

In suppuration within the *orbit* due to cellulitis, incise from the conjunctiva and drain. In suppuration due to caries or necrosis of the upper orbital wall make a transverse incision through the upper lid, reach the pus by Hilton's method (page 121), remove carious or loose necrotic bone, and drain.

In an ordinary *superficial abscess*, after cleansing the parts, make the skin tense, locate the superficial vessels and nerves, and plan the incision to avoid them. Incise with a sharp-pointed curved bistoury at the most dependent part of the abscess or through the region of pointing. If the abscess is upon the face or neck, make the incision in the line of the skin creases so as to limit the scar. The incision must not be made suddenly and fiercely, neither should it be made with hesitation and uncertainty. As Bryant says: "It should be done, as ought every other act of surgery, with confidence and decision, boldness and rapidity of action being governed by caution and made subservient to safety" (Bryant's "Practice of Surgery"). Permit the pus to run out spontaneously; pressure, as a rule, is undesirable because it may damage the abscess-wall and cause diffusion of the infection. If tissue shreds block the opening, they must be picked out with forceps. If the atmospheric pressure will not cause the pus to flow out, make light pressure with warm, moist, aseptic gauze pads. After the pus has come away gently wash the cavity with normal salt solution or boiled water, and drain with a tube for two or three days, when the discharge becomes serous. It is not desirable to overdistend the abscess-cavity with fluid, because the hydrostatic pressure might break down the wall of young cells and infection be diffused. Do not irrigate with powerful disinfectants. They cannot be used strong enough to really disinfect, but may easily be used strong enough to cause necrosis of an abscess-wall. Peroxid of hydrogen is not to be used unless the incision is large, because the gas it generates may tear the abscess-wall and diffuse the infection. If an abscess contains putrid pus, after evacuation irrigate with hot salt solution or peroxid of hydrogen and inject iodoform emulsion. Pursue rigid antisepsis in dealing with purulent areas. It is true we already have infection with pyogenic bacteria, but infection can also take place with organisms of putrefaction, causing pus to become putrid, or with other bacteria, for instance those of tetanus. If a tube is not used and the cavity is packed with iodoform gauze, remember that gauze will not drain pus and requires to be changed once a day. An abscess should be dressed with hot, moist antiseptic dressings (antiseptic fomentation) and the part must be put at rest. When the discharge becomes thin and scanty, dry aseptic or antiseptic dressings are used.

In a *deep abscess* or an abscess situated near important vessels, do not boldly plunge in a knife. Hilton says to "plunge in a knife is not courageous, as it is without danger to the surgeon, but may be fatal to the patient." Remember also that a large amount of pus displaces normal anatomical relations. *Hilton's method* of opening a deep abscess (as in the axilla or neck) is to cut to the deep fascia, nick the fascia with a knife, and then push into the abscess a grooved director until pus shows in the groove; along the groove push a pair of closed dressing forceps; after they reach the depths open them and withdraw them while open, and so dilate the opening; then insert a tube and irrigate.

Always endeavor to open an abscess at its most dependent part, remembering that the situation of this part may depend upon whether the patient is erect or recumbent. If we do not make the opening at the lowest point, all the pus will not run out and the walls will not completely collapse. A deep abscess must be drained thoroughly until the discharge becomes seropurulent. When the tube is removed it is wise to insert a tent of iodoform gauze just

through the outlet of the abscess. This tent prevents the skin from closing over the channel. It is removed and a new one inserted every day until it is clear that there is no longer danger of fluid becoming blocked and retained. When an abscess contains diverticula or pouches they should be slit up or a counter-opening ought to be made. A counter-opening is made by entering the dressing forceps at the first incision, pushing them through the abscess to the point where we wish to make our counter-opening, opening the blades, and cutting between them from without inward. The blades are then closed and projected through the incision; they are opened to dilate the new door, and closed again upon a drainage-tube, which is pulled through from opening to opening as the instrument is withdrawn. When pus burrows, insert a grooved director in each channel and slit the sinus with a knife. An abscess may make an opening through dense fascia, the opening being small like the neck of an hour-glass (shirt-stud abscess). Always examine to see if such a condition exists, and if it is found, incise the fascia.

In a deep abscess containing putrid pus, frequent irrigation is desirable. In such a case two tubes may be employed (Fig. 48). The tubes are prevented from slipping in by the use of a safety-pin. The irrigating fluid is passed into the cavity (*d*) through the tube *b*, and it runs out through the tube *c*.

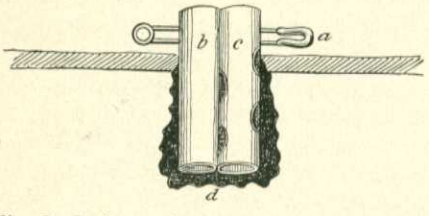

Fig. 48.—Drainage-tubes for abscess requiring irrigation.

Rest is of the first importance in the healing of an abscess, and we try to obtain it by bandages, splints, and pressure, which will immobilize adjacent muscles and approximate the abscess-walls. If an abscess is slow to heal, use as a daily injection a solution of corrosive sublimate of the strength of 1 : 1000, or three drops of nitric acid to ℥j of water, or 3 grains of zinc sulphate to ℥j of water, or a 5 per cent. solution of carbolic acid, or a 2 per cent. aqueous solution of pyoktanin, or 20 drops of tincture of iodin to ℥j of water, or a very dilute solution of bichlorid of palladium. Peroxid of hydrogen is a dangerous agent to inject into the cavity of a deep abscess of the neck, as the liberated gas may not escape from the opening, but may pass widely into the tissues and cause great distention. The author saw a child who narrowly escaped death after such an injection. In this patient the gas passed beneath the pharyngeal mucous membrane and the swelling almost occluded the air-passages. The constitutional treatment of an abscess depends upon the severity of the morbid process and the importance of the structures involved. In a serious case the patient should be put to bed, opiates should be given with a free hand, the bowels be kept active by calomel and salines, skin activity be maintained, the taking of nutritious food insisted on, and stimulants liberally employed.

Purulent Effusions.—(See Suppurative Thecitis, Palmar Abscess, Suppurative Synovitis, Purulent Peritonitis, Empyema, etc.)

Tuberculous abscess, called also chronic, cold, scrofulous, and lymphatic, is an area of disease produced by the action of the bacilli of tubercle and circumscribed by a distinct membrane. Ashhurst says that the term "chronic" is a bad one. "It refers etymologically only to time. A phlegmonous ab-

scess, if deeply seated, may be of slower development than a chronic or cold abscess which is superficial." A tuberculous abscess is most common in connection with tuberculous disease of the lymphatic glands, bones, joints, and subcutaneous connective tissues, but it can arise in the brain, in the viscera—in fact, in any tissue in which there is a tuberculous lesion. Tuberculous abscesses are most common before the twentieth year. Such an abscess may be small or may contain quarts of curdy pus. The contents of a true tuberculous abscess are not genuine pus, but are partly tuberculous material. True liquefied pus is present only when there is mixed infection. The bacilli of tubercle cause chronic inflammation. The cells of the tissue, especially the fixed cells, proliferate, and new tissue is produced by the proliferation. The new mass of cells, if examined by the microscope, is found to consist of numbers of those cell-clusters known as tubercles (page 177). Each tubercle enlarges, new tubercles form, and many old ones fuse together. The cells, however, do not become vascularized, new vessels are not projected from adjacent capillaries, and the cell-proliferation, which in an ordinary inflammation would lead to the formation of new vessels in a tuberculous lesion, eventuates in the formation of epithelioid cells (page 177). The tuberculous nodule is imperfectly nourished, and the nourishment becomes less as the nodule grows and is finally greatly diminished or cut off by closure of adjacent blood-vessels by proliferating endothelial cells.

The toxins acting on a cellular area of impaired nutrition produce coagulation necrosis and coagulation necrosis is followed by caseation (page 177). Caseation begins in many foci near the center of the tuberculous nodule and many caseated foci run together. In a caseated area the bacilli die for want of food. It is important to remember that a tuberculous lesion may spread at the periphery while it caseates at the center. When an area of caseated tubercle is partly liquefied, caseous, scrofulous, or curdy pus is formed; and the lesion is designated a tuberculous abscess. A true cold abscess, as before stated, does not contain genuine pus, but liquefied caseated tubercle, masses of coagulated fibrin, and bits of necrotic tissue. The wall of a cold abscess is composed of a membrane lined with yellowish tuberculous granulations. The layer of lining granulations is called Volkmann's layer. The membrane is due to compression of adjacent cells and in old cases is dense and fibrous. It was formerly the custom to refer to it as the *pyogenic membrane*, the supposition being that it secreted tuberculous pus. This view is completely abandoned; the membrane does not secrete the material contained in the abscess, but surrounds that material and prevents its diffusion. Roswell Park tells us it is a "*prophylactic membrane*." A tuberculous abscess may enlarge greatly and finally undergo spontaneous evacuation; it may be encapsuled by fibrous tissue while the tuberculous focus shrinks and remains caseous or becomes calcareous; or it may be converted into a fibrous nodule.

Symptoms.—The term *cold* abscess is employed for a tuberculous abscess because it presents no inflammatory signs. There is no local heat; no discoloration unless pointing occurs; the parts look paler than natural; pain is absent in the abscess, though it may exist at the point of origin of the fluid. The tuberculous material often wanders from its point of origin under the influence of gravity. Fluctuation is usually easily obtained because of the absence of surrounding exudation. Constitutional symptoms are trivial or absent

unless secondary infection occurs. The swelling may suddenly appear in some spot—the groin, for instance. When it appears suddenly it has traveled from a distant and older area of disease. The abscess may last for years without producing pain or annoyance. The introduction of an aseptic tubular exploring needle will settle the diagnosis. The constitution is invariably below normal because of the tuberculous infection, and the temperature may be a little above normal. A cold abscess which is infected with putrefactive or pyogenic organisms exhibits great inflammation, and sapremia or septicemia rapidly develops. In a pure tuberculous abscess there is no leukocytosis, but it develops when there is mixed infection with pyogenic bacteria. In tuberculous disease of the vertebræ the fluid may find its way to the lumbar region, to the iliac region, or to the immediate neighborhood of Poupart's ligament, above or below it. When an area of tuberculous disease undergoes mixed infection and prolonged suppuration occurs, *albuminoid degeneration* occasionally arises. If this form of degenerative disease begins, the patient is found to be weak, thin, and anemic. Occasionally capillary hemorrhage occurs under the skin or mucous membranes. The organ or part affected (liver, lymph-glands, kidney, or spleen) is enlarged and smooth, and diarrhea exists. In albuminoid disease of the kidneys there is albuminuria and the development of symptoms resembling those of Bright's disease. It is thought by some that this disease arises because the constant flow of pus drains the potash salts from the blood.

Tuberculous Abscesses in Various Regions.—**Tuberculous abscess** of the head of a bone (Brodie's abscess) arises in the cancellous structure of a long bone, most often in the head of the tibia. Pain is continued but not usually very severe, is of a boring character, and is worse when the patient is in bed. Attacks of synovitis arise from time to time in the adjacent joint. There is no such thing as an acute abscess of bone. A pyogenic inflammation of such severity that it would cause an acute abscess in soft parts, in bone causes acute necrosis. The tuberculous organisms obtain access to the bone by means of the blood, and find in the bone a point of least resistance.

Retropharyngeal or **postpharyngeal abscess** is often tuberculous. Such an abscess is usually due to caries of the cervical vertebræ, but can arise in the connective tissue of the parts or as a tuberculous adenitis. An abrasion of the mucous membrane may admit the bacilli to the connective tissue or the glands. A swelling projects from the posterior pharyngeal wall, and there is great interference with respiration and deglutition. Caseous matter from caries of the cervical vertebræ may reach the posterior mediastinum by following the esophagus, or may appear in front of or behind the sternomastoid muscle in the neck (Edmund Owen). A tuberculous abscess in this region is apt to undergo pyogenic infection, in which case the patient develops fever, sweats, pain, and prostration.

Dorsal Abscess.—The tuberculous matter in dorsal abscess arises from dorsal caries, flows into the posterior mediastinum, and reaches the surface by passing between the transverse processes. The tuberculous matter from dorsal caries may run forward between the intercostal muscles or between these muscles and the pleura, pointing in an intercostal space at the side of the sternum or by the rectus muscle. It may open into the gullet, windpipe, bronchus, pleural sac, or pericardium. It may descend to the diaphragm

and travel under the inner arcuate ligament to form a psoas abscess, or under the outer arcuate ligament to form a lumbar abscess. A psoas abscess points external to the femoral vessels, a characteristic which distinguishes it at once from a femoral hernia.

Iliac abscess arises from lumbar caries, the swelling lying in the iliac fossa and pointing above Poupart's ligament.

Psoas abscess is usually due to lumbar caries, but may arise from dorsal caries. The fluid usually points in Scarpa's triangle external to the femoral vessels, but may descend much lower (Fig. 49). A psoas or iliac abscess, by following the lumbosacral cord and great sciatic nerve, forms a gluteal abscess. These abscesses may open into the bowel, bladder, ureter, or peritoneal cavity.

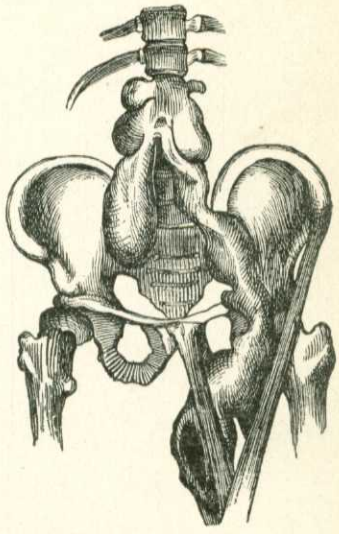

Fig. 49.—Psoas abscess (Albert).

Lumbar Abscess.—In a lumbar abscess the fluid produced by dorsal caries descends beneath the outer arcuate ligament, or the fluid from lumbar caries which collected anterior to or in the quadratus lumborum muscle passes between the last rib and iliac crest in the triangle of Petit, the small space bounded by the crest of the ilium, the posterior edge of the external oblique muscle, and the anterior edge of the latissimus dorsi muscle.*

Chronic abscess of the breast is a caseated area of tuberculosis of the breast. A lump is detected, which slowly enlarges and finally ruptures, sinuses being formed. The axillary glands are apt to be implicated. The patient belongs to a tuberculous stock, as a rule gives a history of previous tuberculous troubles of various sorts, and has usually borne children. Chronic abscess of the breast causes little or no pain.

Treatment of Tuberculous Abscess.—If a small cold abscess exists in a superficial structure, open it with aseptic care, rub its walls with bits of gauze to remove tuberculous masses, irrigate with 1 : 1000 mercurial solution, inject with iodoform emulsion, pack with iodoform gauze, and dress antiseptically. When the discharge becomes thin and scanty the packing can be dispensed with. If it be slow in healing, inject or swab out with a stimulating fluid as in acute abscess, or inject with iodoform emulsion.

Chronic Abscess of Bone.—Make an incision to bare the bone. Open the abscess with trephine, the gouge, or the chisel; curet with a sharp spoon and gouge; cut away the edges of the bone with rongeur forceps; irrigate the cavity with hot corrosive sublimate solution (1 : 1000), dry its walls with gauze, and paint the cavity with pure carbolic acid; pack with iodoform gauze and apply antiseptic dressings. It is better not to employ an Esmarch apparatus. Bleeding will not be severe, and when no apparatus is used one can be

* For a lucid description of these abscesses see Owen's "Manual of Anatomy," from which much of the above is condensed.

sure that all the diseased bone has been removed, because sound bone bleeds and dead bone does not.

Cold Abscess of Lymphatic Glands.—In non-exposed portions of the body the capsule of the gland should be incised and dissected or scraped away and the cavity swabbed out with pure carbolic acid and packed with iodoform gauze. If the abscess is allowed to burst, it will cause an ugly scar; therefore in exposed portions of the body an effort should be made to prevent a scar by incising early before the skin is involved. When only a little caseated matter exists and the skin is not discolored, prepare the parts antiseptically, incise, rub the interior with gauze, inject iodoform emulsion, use a small drainage-tube, and suture the wound. It used to be a custom in such cases to carry a silk thread by means of a needle through the skin, through the gland, and out at its lowest point, the part being then dressed with gauze. In three days the thread was removed and a firm compress was applied. The plan is not satisfactory and incision is to be preferred. When the gland is almost entirely broken down and the skin above it is purple and thin, insert a hypodermic needle through sound skin into the abscess, draw off the fluid tuberculous matter, and inject iodoform emulsion (10 per cent. of iodoform, 90 per cent. of sterile glycerin or olive oil). This procedure is to be repeated when the fluid again accumulates. By this means we can sometimes effect a cure in a week or so. When an abscess breaks or is at the point of breaking, cut away all purple skin, curet the abscess-walls (the abscess having become a tuberculous ulcer), remove the remains of gland and capsule, swab the cavity with pure carbolic acid, and dress with iodoform and antiseptic gauze.

Tuberculous glands ought to be extirpated before they caseate and form an abscess.

Cold Abscess of Mammary Gland.—Many operators simply incise, curet, pack with iodoform gauze, and dress antiseptically. It is wiser to remove the entire gland, and to clear out the axilla, as in an operation for cancer, in order to prevent both recurrence and dissemination.

Large Cold Abscesses (Psoas Abscess).—In view of the facts that these abscesses may cause no trouble for years and that an operation may be fatal, some eminent surgeons are opposed to an operation unless the abscess is moving toward inevitable rupture or is disturbing the functions of organs by pressure. Most practitioners believe, however, that this mass of tuberculous matter is a source of danger through being a depot of infective organisms which may overwhelm the system, and that death will rarely result from an operation performed by one who employs with intelligence strict antisepsis. In no other cases is attention to every detail more important, as a mixed infection can easily take place, and will probably mean death.

The elder Senn treats many cold abscesses by the following method: With the most scrupulous care, aspirate the abscess and draw off the fluid contents. Run a hot 3 per cent. solution of boracic acid into the abscess-cavity so as to overdistend it, allow it to flow out, and repeat this process until fibrinous shreds and necrotic particles cease to appear. An emulsion of iodoform (10 per cent. in glycerin) is injected, about four or five drams of the emulsion being used in an adult and half of this amount in a child. The abscess is rubbed and squeezed in order to bring the iodoform in contact with every portion of the wall, the puncture is sealed with collodion, and pressure is applied to approximate the walls. Secure rest by placing the patient in bed

or using splints. When the cavity partly refills, subject it to the same treatment. If the case is being improved the fluid is found to be thicker. If three or four tappings do not cure, the plan is abandoned ("Principles of Surgery").

A large abscess with uncollapsible walls should not be treated by this method. It is dangerous to inject large amounts of iodoform, as poisoning may be produced (page 27). If aspiration and injection fail or were not used, incise the most dependent portion of the abscess, scrape its wall with bits of gauze, and overdistend with a 1 : 1000 solution of warm corrosive sublimate. Let the mercurial solution run out and then irrigate the cavity with hot normal salt solution, which will remove the remains of the corrosive fluid. Inject emulsion of iodoform and sew up the wound. After suturing, apply dressings, approximate the walls of the abscess by pressure, and put the patient to bed. If the abscess fills again, the operation can be repeated. This operation often succeeds, but it may fail, and it is not a proper procedure if the abscess-walls are rigid and non-collapsible. It is the method of choice in cases unsuitable for aspiration and injection, because drainage in these cases is usually productive sooner or later of pyogenic infection. In large abscesses with thick and rigid walls an attempt may be made to remove the pyogenic membrane. A very large incision exposes the cavity, which after curetting and rubbing with gauze and washing is packed with iodoform gauze. Barker's spoon is most useful to scrape the walls. It is an irrigating curet, and while it is being used a stream of sterile hot water or salt solution flows from it. An operation occasionally performed for psoas abscess consists in an incision in the groin, an incision in the back, removal of carious vertebræ, thorough cleansing of the abscess-wall and through-and-through tubular drainage. It has been found, however, that this operation is uncertain and dangerous. It is not advisable to remove carious vertebræ, and through-and-through tubular drainage is rarely used unless mixed infection already exists. When a large abscess breaks spontaneously, it should be widely opened at once, scraped, rubbed with gauze, swabbed with pure carbolic acid, washed out with alcohol, and packed with iodoform gauze. In the treatment of a cold abscess give nutritious food, cod-liver oil, quinin, iron, and the mineral acids. Removal to the seaside is often indicated, and mechanical appliances may be needed for diseases of the bones and joints. If secondary pyogenic infection of a large tuberculous abscess does occur, the patient will develop septic fever and will almost certainly die (*q. v.*).

Dorsal abscess and **lumbar abscess** are treated after the same plan as psoas abscess, although one incision only is usually necessary unless the fluid has traveled to a distant point.

A **postpharyngeal abscess** must not be opened through the mouth. To open it in this manner puts the patient in danger of suffocation by fluid running into the larynx during or after the operation. Further, mixed infection of the abscess-area will be certain to ensue. Septic pneumonia will be apt to arise from inhaled infected particles, and profound gastro-intestinal disturbance will be liable to develop because of the inevitable swallowing of purulent, putrid, and tuberculous masses. Incise the neck and open into the abscess by Hilton's method, going through the sternocleidomastoid muscle or behind it. Rub the wall of the abscess with bits of gauze, remove any loose bone, irrigate with hot normal salt solution, inject iodoform emulsion, insert a tube or pack with iodoform gauze.