ACTINOMYCOSIS OF BONE WITH SPECIAL REFERENCE TO INFECTION OF THE VERTEBRAL COLUMN

V. Zachary Cope, London, England

Three years ago a junior Fellow of the Royal College of Surgeons asked me if actinomycosis ever affected bone, for (said he) he had been taught that it never did gain a foothold in that structure. I was surprised at the question and still more disturbed at the erroneous teaching, because from the earliest years of our knowledge of actinomycosis it has been well known that bone is not exempt from its ravages. Certainly it is rare for the bones of the extremities to be affected, for less than a dozen such cases are on record, but the lower jaw is quite often a seat of the disease and the spinal column is sufficiently frequently affected to demand that it should be kept in mind in diagnosing any doubtful condition of the spinal column.

Mode of infection of the patient—In nineteen cases out of twenty, actinomycotic infection in human beings is due to a micro-aerophilic fungus which has never yet been found outside the body but has often been found lying latent in the crevices of carious teeth or in the tonsil.

From these sites the fungus can be swallowed and traverse the alimentary canal or it can occasionally be inhaled or aspirated into the lungs. It cannot penetrate epithelium without the aid of some local traumatic or pathological lesion, but given the opportunity it can grow and spread widely in the connective tissues.

Mode of infection of bone—Bony tissue reacts to the actinomycotic infection in a very interesting and characteristic way, differing in some respects from that in every other form of bony infection. Immediately round the focus of infection there is absorption of bone; beyond that the bone cells are stimulated to form new bone, sometimes of considerable density. This
combination of caries and sclerosis in differing proportion gives rise to many clinical types. Sequestration is very uncommon. The lower jaw presents examples of every type. Sometimes a large bony tumour may be formed as shown in the illustration of the mandible of the horse affected by actinomycosis (Fig. 1). I have on two occasions operated upon human mandibles similarly affected in which the bone was about an inch thick and was traversed by a series of channels or sinuses in which the fungus was found. Sometimes (rarely) rarefaction predominates over sclerosis as in the case of a girl who had an abscess in the lower jaw contained in a smooth-walled cavity which on external pressure gave the sensation of egg-shell crackling. In one case in which a small actinomycotic mandibular focus burst into the submaxillary region the track of the infection was shown in the radiograph by a small tube of newly formed bone (Fig. 2). These mandibular illustrations are worthy of study, for the bony reaction is everywhere similar, though in the case of the spine not so easily demonstrated.

With rare exceptions bone is affected by spread from neighbouring soft-tissue foci. The spinal column lies on the path of extension of several common foci of actinomycosis; a deep cervical phlegmon, an extending mediastinal infection, a retroperitoneal infiltration after perforative appendicitis or a perforated peptic ulcer may each or any of them provide the source of spinal infection.

VERTEBRAL ACTINOMYCOsis

Incidence—It is difficult to assess the incidence of actinomycotic infection of the spine. In 1935 Meyer and Gall were able to collect forty-seven cases which had occurred since the disease had been recognised in 1876. Since that date fifteen cases have been recorded in the literature and to these can be added four cases which have come within my personal knowledge. Sixty-six cases in just over seventy years would lead one to think the disease very rare but such a conclusion must be modified by the fact that often the disease has not been diagnosed until a post-mortem examination has revealed its presence. Many victims may—indeed must—have been buried with a false diagnosis.

Pathology—Actinomycosis of the spine is always secondary to an infection of contiguous tissues. It is true that Huchzermeier (1930) reported two cases in which he thought the lesion was primary in the spine, but a careful reading of his account leads one to think that in both cases the primary lesion was appendicular.

The pathological results of the attack of actinomyces upon the vertebral column vary in extent and intensity but follow the lines we have described above. The disease may be limited to one vertebral body but more usually affects several vertebrae—sometimes large extents of the column, for the suppuration may spread under the anterior common ligament. The intervertebral discs are exceptionally affected. Unlike tuberculosis, actinomycosis often involves the adjacent pedicles and transverse processes and also the heads of the neighbouring ribs.

Rarefaction and sclerosis are found in varying proportions. In the early stages and in
milder cases there may be merely absorption of the superficial part of the vertebral body and some deeper rarefaction limited by slight sclerosis. When the disease, either by continuous extension or by vascular embolism, involves the whole vertebral body the picture is characteristic. The vertebra is riddled by a network of suppurating channels which are bounded by bone of increased density—a sort of honeycomb effect which shows up like lattice-work on a radiograph. When the disease is progressing rarefaction is more prominent, but as improvement takes place sclerosis dominates the picture, so that repeated and regular radiographs will tell the surgeon the effect of his treatment. In the case recorded by Cseh (1936) interesting histological evidence was provided to show the simultaneous processes of bone formation and bone absorption. The same stimulus to bone formation may lead to the formation of osteophytic outgrowths on the transverse processes and heads of the ribs.

Because of the formation of the dense trabeculae it is uncommon for the vertebral body to collapse; but in severe cases this may happen, and in one case (Dixon 1939) led to a remarkable mobility of the spinal column.

**Symptoms**—As spinal actinomycosis is secondary to infection of a neighbouring part, the initial symptoms are those of the primary lesion—cervical, thoracic or abdominal. In the neck it may result from a retropharyngeal abscess or suppuration lower down, in the thorax from an empyema or mediastinal suppuration, in the abdomen from perforation of an inflamed appendix.

The symptoms referable to involvement of the spinal column are very varied and inconstant. There may be pain in and tenderness over the involved part of the spine, and sometimes the pain may radiate along the outgoing nerves and even simulate a gastric crisis of tabes dorsalis. There may be rigidity and limitation of movement of the affected part of the spine but this is not constant and occasionally there may be increased mobility. **Kyphosis is rare.**

The nervous system may be affected. In one case the disease was ushered in with symptoms simulating cerebro-spinal meningitis. In another case there was bilateral weakness of the arms, forearms and hands. In two cases convulsions occurred and in one of these autopsy showed no cerebral lesion to account for the convulsions.

The general symptoms are important. There are usually serious loss of weight, irregular fever, secondary anaemia and a moderate leucocytosis, all pointing to an active infective process. Frequently there are sinuses, from the operative or spontaneous opening of abscesses.

**Diagnosis**—The only certain method of diagnosis is to find the actinomycotic organism in the pus from the affected part. Till then diagnosis is a matter of conjecture, though, if the possibility be considered, earlier diagnosis can often be made with probability. The radiographic appearances may be very helpful though one can hardly go so far as Huchzermeier (1939) and say that they by themselves may be diagnostic. It is incumbent on all surgeons opening abscesses in the neck, back or loin to insist on having the pus examined carefully for the actinomyces.

**Differential diagnosis**—The conditions for which actinomycosis of the vertebrae has been mistaken are many and include tabes dorsalis, bilateral pulmonary tuberculosis, tuberculous caries of the spine, tuberculous glands in the mediastinum and carcinoma of the lung. It must also be distinguished from septic osteomyelitis of the spine and from chronic lesions such as osteitis deformans. From the orthopaedic point of view spinal actinomycosis must be considered when diagnosing any subacute or chronic spinal condition. Actinomycosis can generally be distinguished from tuberculosis of the spine by these facts: the intervertebral discs are usually spared; transverse processes and heads of the neighbouring ribs are often attacked; collapse of a vertebral body and kyphosis are uncommon; sclerosis is generally mingled with rarefaction and a radiograph may reveal the lattice pattern. In both actinomycosis and tuberculosis large abscesses may lie near the column, but, whereas the tuberculous abscess travels outward from the vertebra and follows definite routes along the
psoas or backwards along the ribs, the actinomycotic abscess which travels from the adjacent tissues to attack the vertebral column has no definite pointing place though it usually comes to the surface posteriorly.

Septic osteomyelitis of the spine has a more acute onset and may give rise to the formation of sequestra—an occurrence almost unknown in spinal actinomycosis. Rarefaction of the bodies is also seen in osteitis deformans and in fibrocystic disease but here there are no general manifestations (fever, wasting, anaemia) of chronic inflammation. Secondary growths in the vertebrae usually cause much greater pain, especially on movement, paraplegia is more common and the general symptoms of suppuration are absent.

**Prognosis**—Until ten years ago the outlook for actinomycosis of the spine was almost hopeless, except in cases with merely superficial irritation of the bone. Treatment was of no avail and death took place after a time varying from a few months to two years. The opening of abscesses, the trial of X-ray therapy and the administration of iodine compounds did little to avert the issue. During the past few years, however, the antibiotic group of drugs and the sulphanilamide preparations have altered the prognosis and, provided abscesses be drained and the general bodily state maintained, there is now no reason to despair even of the most desperate cases.

**Treatment**—It is very important to counter the depression of the bodily condition. The general treatment includes rest in bed, administration of haematinics, in some cases blood transfusion, and provision of a sufficient and easily assimilable diet. Extra milk is as important as in tuberculosis. It is unnecessary to give potassium iodide although the compounds of iodine do seem to have a slightly beneficial effect. Probably the best method of giving iodine is in the form of tinct. iodi. (minims 5 t. d. s. in milk).

The essential treatment is the administration of one of the antibiotics (preferably penicillin) and the sulphonamides. In most cases the organism is sensitive to penicillin, and this drug will usually cure the patient if given in large enough doses for a sufficient time—a million units a day continued for at least several weeks, usually several months, and in some cases for a year or two (with a few intermissions). If by evil chance the infecting organism is not sensitive to penicillin then one can have recourse to streptomycin, chloromycetin or aureomycin, but with these drugs there is more risk of toxic manifestations.

The absence of all symptoms must not be considered a signal to stop treatment. The fungus may lie latent and wake up again when given the opportunity. Treatment must therefore be continued long after the patient appears well. When, however, the radiographic appearances show that dense new bone has been formed over the affected part of the spine one may feel confident that the insidious infection has been overcome.

**PREVIOUS CASES**

The forty-seven cases published up to 1935 are summarised by Meyer and Gall (1935). The fifteen cases published since then are summarised here.

**Case I.** (Cseh 1936)—Male aged forty-three, in whom the clinical diagnosis was tabes dorsalis, chronic emphysema and caries of a rib. Post-mortem: actinomycotic changes in the tenth and eleventh thoracic vertebrae; lungs unaffected but pleura thickened; cause of death was intercurrent infection with pleuritis, anterior mediastinitis, pericarditis and endocarditis.

**Case II.** (Suga 1936)—Clinical diagnosis: bilateral pulmonary tuberculosis, peritonitis and vertebral caries. Post-mortem: actinomycosis of cervical and thoracic vertebrae, and of lungs and pleurae. Actinomycotic granules were found in the bodies of the vertebrae. Was considered to be a primary vertebral infection from perforation of the oesophagus.

**Case III.** (Namikawa, Inagaki and Tsukada 1937)—Affection of the right lung leading to empyema, suppuration along the ribs reaching to the breast and also involving the lumbar vertebrae. Death after two years' illness. Post-mortem: disease process had begun to destroy the lumbar vertebrae.

**Case IV.** (Derra 1938)—Man aged fifty-three, agricultural labourer. In June 1932 painful swelling developed on right side of the neck; broke down spontaneously. Admitted to hospital October 18, 1932, complaining of hoarseness and expectoration; secondary anaemia and wasting; fever. The
right side of the neck was swollen and actinomycotic mycelium was found in the sputum. October 22, 100 cubic centimetres sputum daily. Abscess over the clavicle opened. November 20, right facial paresis. This patient was treated by X-rays and by iodine. Death on November 23, 1932. Post-mortem: extensive actinomycotic inflammation right side of the neck; retropharyngeal phlegmon with numerous sinuses in posterior wall; actinomycotic caries of lower cervical and upper two thoracic vertebrae; recent opening in oesophagus three centimetres below larynx; actinomycotic thrombus right jugular vein; multiple lung abscesses.

Case v. (Derra 1938)—Boy aged eight years. Summer 1935, immobilisation of the neck for suspected caries of third, fourth, and seventh cervical vertebrae although radiographs were atypical; lungs normal. From early 1936 till January 1937 seemingly cured. February 1937, fever and bodily pains ascribed to some renal condition. April 1937, swelling of left side of chest; puncture negative. May 7, 1937, admitted to hospital: fever, leucocytosis and loss of weight; hard painless swelling over the sixth to ninth left ribs; radiographic involvement of left lower chest. May 13, 1937: exploration left subphrenic abscess; actinomycosis diagnosed. March 1938: death. Post-mortem: actinomycosis left lung and pleura with numerous abscesses; actinomycotic abscess extending from the left pleura along vertebral column with involvement of diaphragm spleen and left kidney; actinomycosis of lower cervical and lower thoracic vertebrae.

Case vi. (Huchzermeyer 1939)—Man aged thirty-three years, labourer. Town dweller. Two years’ pain in right renal region; three days before admission for appendicitis, rigors and colicky pain in bladder region; pain on pressure between right costal margin and navel; T. 38° C.; nothing to point to vertebral lesion; lesion of the urinary tract diagnosed. Fever and general resistance in right lower abdomen led to laparotomy. The appendix was retrocaecal with a thick retroperitoneal infiltration, although there was only chronic inflammation in the outer wall of the appendix. A few days after operation psaas contracture developed; exploration yielded suspicious looking pus but no actinomycotic granules. Later exploration revealed large abscess cavity leading up to caries in second lumbar vertebral body where there was an abscess the size of a cherry. "The clinically sure diagnosis of actinomycosis could not be confirmed bacteriologically."

Case vii. (Huchzermeyer 1939)—Woman aged thirty-three years, manageress. In the two years before observation had lost 20 lb. in weight. Two months previously on moving suddenly felt a tearing pain in the right groin. Examination: tenderness on pressure above the right anterior superior iliac spine; slight limitation of movement at right hip; leucocytosis 8,200; slight secondary anaemia. Radiograph suggested actinomycosis of first lumbar vertebral body; lattice appearance of the body; trabeculae diminished in number but hypertrophied; the anterior periosteal border was convex, not concave, and the lateral border was almost straight; the right transverse process was also affected but the cortical contour of the vertebrae was nowhere broken. Retroperitoneal exploration confirmed the diagnosis of actinomycosis in the first lumbar vertebral body. Treatment by X-ray therapy, potassium iodide and (locally) iodoform in ether led to improvement.

Comment—Huchzermeyer thinks that the radiological appearance of actinomycosis of the vertebral body is pathognomonic but his case reports are not altogether satisfactory.

Case viii. (Flynn and Gillies 1938)—Man aged thirty-two, ship’s fireman. June 1935: gangrenous retrocaecal appendix removed; five weeks in hospital. Two weeks later right lumbar abscess opened. November 1935: readmitted with sinuses in right loin, loss of weight, and pain in right testis. December 1935: pleuritic rub left chest; radiograph showed affection of base of right lung but no lesion in spine; r.b.c. 3,740,000; w.b.c. 20,000; haemoglobin 62 per cent; actinomycoses found in pus from sinus. January 1936: cough; extension of lung lesion. March 1936: pain in small of back; transfusion. April 1936: radiograph: compression fracture second lumbar vertebra with erosion of vertebral body suggestive that fracture was pathological and consistent with presence of actinomycosis. May 1936: lethargic; transfusion. May 23, 1936: death. Treatment was by X-ray therapy and by Lugol’s iodine in milk. The temperature was intermittent throughout. Post-mortem: third thoracic to fourth lumbar vertebrae involved in actinomycosis; they were black in colour, devoid of periostium though in places covered by ligaments, rarefied and friable so that the bone could be easily cut by a knife; body of the second lumbar vertebra particularly affected, and collapsed; intervertebral cartilages apparently not affected; arches and laminae of the vertebrae apparently not involved; sagittal section of the spine showed small abscesses in vertebral bodies from which the streptothrix actinomycosis was obtained in large numbers; both lungs were bound down to vertebral column and the left lung was adherent to the diaphragm.

Case ix. (Dixon 1939)—Man aged twenty-seven, electrician. September 1938: lower abdominal pain with vomiting; after a week went to bed and later to hospital; returned to work in November. February 6, 1939: pain in back and right hip; a week later, incision in right loin. March, severe
pain in loin, back and chest; lower thoracic and upper lumbar spine rigid; left pleural effusion and irregular fever. Radiographs showed collapse of twelfth thoracic vertebral body. Sulphur granules from sinus over right ilium. April 1939, pus aspirated three times from chest; pathological mobility of the spine. Death on May 1, 1939. Post-mortem: appendix and caecum bound down; tip of appendix adherent to fascia transversalis; extensive actinomycotic infiltration of thoracic vertebral bodies.

Case x. (Gamboa, Salvati and Moreno 1941)—Boy aged nine years. November 15, 1939: twenty-five days' history of pain in the neck and difficulty in moving the head. Pain worse at night; night sweats; T. 38.5° C. The patient was pale and ill-nourished. There was muscular rigidity in the cervical and upper dorsal region and pain on percussion of the lower cervical and upper thoracic spines. Suprascapular pain on elevation of right arm. Cervical plaster. February 1940, supraspinous region swollen. March, discharge of pus left side of neck, filaments of fungus and no tubercle bacilli found. Sulphanilamide. April, worse; more sinus; plaster removed; actinomycosis suspected; Lugol's solution of iodine, 80 drops a day. July 1940, very ill; irregular temperature; increased upper dorsal rigidity; actinomycotic granules obtained. Under treatment by sulphonamide, Lugol's solution and X-ray therapy the patient's condition improved so that by August 1941 all the fistulae were closed and the general condition was much better. Radiographs in November 1939 revealed no vertebral involvement, but enlargement of the heads of the second and third right ribs which contained rarefied areas with condensed borders. In June 1940 there were small shadows in the first and second thoracic vertebral bodies and the cervical menisci were invisible. In May 1941 there was definite evidence of bony repair, and in August 1941 the appearances were better still. Administration of sulphapyridine was continued—1 gramme daily for three months and 1 ½ grammes daily for another two months.

Comment—This is a case of apparent cure of vertebral actinomycosis but the follow-up should be longer for confirmation.

Case xi. (Lubert 1944)—Negro aged twenty years, inmate of prison farm. Admitted June 26, 1941, having lost 25 lb. in five months. T. 38.8° C., P. 130, R. 22. There was a mass 4 centimetres in diameter on the right side of the neck and another just to left of the sternum. Teeth good. Radiographs showed no pulmonary infiltration but an area of destruction of the fourth right rib posteriorly, and also areas of destruction in the left frontal bone. The diagnosis made was osteomyelitis and mediastinal lymphadenitis of tuberculous origin. Two months later, radiographs showed punched-out areas of destruction in the bodies, pedicles and sinus processes of the vertebrae in the thoracic, lumbar and sacral regions, but discs intact. X-ray treatment. December 1941, there was now infiltration of the base of the right lung. March 20, 1942, death. Post-mortem: there was a large actinomycotic paravertebral phlegmon in the thoracic and lumbar regions; the anterior aspects of the bodies of the vertebrae showed deep abscess pockets involving at least half of the depths of the bodies in most instances; the lungs were involved but not the ribs.

Case xii. (Lubert 1944)—Man aged twenty-one years, white. December 1931, eight months after appendicectomy, pain in the back and sinuses in the right lower abdomen; tenderness over the fifth lumbar vertebra; spinal radiograph normal; teeth bad; actinomycosis diagnosed. Deterioration in spite of treatment. In November 1932, emaciated and weak; legs flexed and tendon reflexes absent, but sensation normal; radiograph showed multiple round translucent areas with surrounding sclerosis in lumbar spine, sacrum and perhaps ilium; convulsions and death. Post-mortem: abdominal viscera matted together by grey fibrous tissue containing abscesses; surface of the lumbar vertebrae rough; many small abscesses surrounded by increased amount of bone with circumferentially arranged trabeculae; actinomycosis of left lung, liver, vertebrae, skin, subcutaneous and retroperitoneal tissues.

Case xiii. (Lubert 1944)—Man aged sixty-one years. April 10, 1941, two years' history of pain in the left lower chest and chronic cough; loss of weight; teeth were poor; rales posteriorly in left chest; left pupil was smaller than right; leucocytes 10,900. Radiographs showed a streaked infiltration extending outwards from the hilum of the lung, ascribed to bronchogenic carcinoma and treated by X-ray therapy. In November 1941, readmitted; emaciated, pain in the back, thick mucoid sputum; there was dorsal kyphosis and radiographs showed ninth dorsal vertebra almost completely collapsed; intervertebral discs not involved. Treatment was of little avail and he died on December 26, 1941. Post-mortem: mid-dorsal kyphosis; ninth thoracic vertebra almost completely replaced by a cavity filled with thick yellow fluid; microscopic examination showed typical actinomycoses; spinal cord at this level soft and compressed by the collapsed bone; lungs contained many soft-walled cavities filled with yellow creamy material; portions of the lungs were adherent to the chest wall, mediastinal and paravertebral tissues.

Case xiv. (Campbell and Bradford 1948)—Man aged twenty-six years. November 1937,
Case 1—Actinomycotic invasion of the lower cervical and upper thoracic dorsal vertebrae. (Reproduced by courtesy of Professor W. D. Newcomb, the Editors of *British Surgical Practice*, and Messrs Butterworth & Co. (Publishers) Ltd.)
appendicectomy, left lower abdominal abscess drained; actinomyces in pus. February 1939, right periappendicular abscess drained. March 1939, right subphrenic abscess drained; right nephrectomy. September 1939, right iliolumbar abscess drained; radiographs showed absence of right psoas shadow; began to have epileptiform convulsions, which recurred till death on November 9. Post-mortem: no evidence of peritonitis; sinuses led to abscesses adjacent to the vertebrae, eighth thoracic to sacrum; abscess in the body of tenth thoracic vertebra; no involvement of the meninges or central nervous system.

**Case xv.** (Chanton, Hollis and Hargrove 1948)—Woman aged thirty years. June 1946, fever and pain in the back. September 1946, left renal region explored with negative result. Two weeks later a fluctuant mass developed in the left posterior aspect of the chest; incision, but no pus obtained though later pus escaped. November, high fever and delirium; sinus in left paravertebral region draining pus (level of tenth and eleventh ribs); radiograph of thoracic vertebrae showed destruction of the left lateral border of the eighth thoracic vertebra and erosion of the vertebral ends of the eighth and ninth ribs; diagnosis of actinomycosis established; spine immobilised, and penicillin and sulphadiazine begun (over thirty-two million units of penicillin given). Fever subsided in six weeks, and in April 1947 radiographs showed advanced healing. The patient was well eight months later.

**NEW CASES**

Notes are given here of three previously unreported cases; Mr M. S. Brett reports a further case on page 215, bringing the total number now recorded to sixty-six.

**Case 1.** (Museum of St Mary’s Hospital)—W. B., aged forty-two years. Admitted on December 28, 1938, complaining of stabbing pain in the back of two weeks’ duration. There had also been vomiting. Radiography revealed a mass in the superior mediastinum which was thought to be of lymph-node origin. There were no clinical signs of tumour. A course of X-ray therapy was not completed because the radiologist considered that the mass was increasing. Later, signs of lung involvement developed and a hard enlarged gland appeared on the right side of the neck. A swelling also appeared on the back about the level of the mid-thoracic spine. Paraplegia developed on April 1, 1939, and death occurred five days later. At autopsy the right clavicle, the first rib, the lower cervical and upper thoracic vertebrae (Fig. 3) and the organs of the upper mediastinum were invaded by actinomycosis. A large abscess cavity over the lower cervical and upper thoracic vertebral bodies extended out on both sides and contained an enormous quantity of pus with sulphur granules.

**Case 2.** (Mr Nils Eckhoff)—L. B., a man, seen at Lewisham Hospital in 1941 with a pharyngeal swelling and complaint of pain in and limitation of movement of the cervical spine. The pain radiated down the arms. Both arms were weak and there was wasting of the scapular muscles, the triceps, the biceps and the muscles of the forearm and hand on both sides. The abscess burst in the neck and the actinomyces were found in the pus. The radiographs showed erosion of the anterior part of the bodies of the fifth and sixth cervical vertebrae. (Nothing more is known of this patient because all the records were destroyed during a London air-raid.)

**Case 3.** (Mr Gordon Ungley)—R. W. C., greengrocer, aged forty-four years. August 1948, multiple extraction of teeth, both jaws. October 1948, in hospital under physician for paraesthesia in legs, generalised weakness and depression. Radiograph of neck normal. Lumbar puncture: fluid normal except cell count with 90 per cent lymphocytes. Lymphocytic meningitis diagnosed. November 1948, acute abscess of left supraclavicular fossa. December 1948, abscess opened; thick yellow pus; the cavity extended towards front of lower cervical vertebrae, but no bare bone found. Culture: staphylococcus saprophyticus and diphtheroids; no tubercle bacilli. Radiograph (Fig. 4) showed slight changes in body of C.6 and very large prevertebral abscess. Diagnosis of osteitis of vertebra C.6. January 1949, subacute abscess, right side of back of neck. Opened; foul smelling pus; cavity towards spine, but not communicating with other cavity; no bare bone. Culture: a few colonies of staphylococcus saprophyticus; no tubercle bacilli or actinomyces. Guinea-pig inoculation negative. Radiograph (Fig. 5) showed prevertebral abscess smaller than a month before. White blood count: leucocytosis 15,400. March 1949, cervical pain worse and severe scapular pain passing.
Case 3—Actinomycotic involvement of the fifth and sixth cervical vertebrae. Figure 4—Retropharyngeal abscess with rarefaction of fifth and sixth vertebral bodies. Figure 5—Six weeks later: abscess much smaller. Figure 6—Eight months later still: bony repair.
through chest to sternum. Half a million units penicillin twice daily, without improvement. May 1949, shingles in T. and T.2 distribution. Drainage of foul pus from acute abscess of left side of base of neck. Cultures: aerobic and anaerobic, sterile; no actinomyces. White blood count 12,000 (83 per cent polymorphs). Haemoglobin: 24 per cent. Urine contained blood, granular casts and albumen. Treatment: multiple transfusions, penicillin and streptomycin. Very great improvement. August 1949, recurrence of pain and polymorphonuclear leucocytosis (w.b.c. 26,000) without further radiological changes in neck and none in thoracic spine. September 1949, left interscapular abscess drained; no communication with other abscesses; no bare bone. Penicillin 250,000 units six-hourly and streptomycin \( \frac{1}{2} \) gramme six-hourly. Actinomyces found in film and culture for the first time. Radiograph (Fig. 6) showed little or no prevertebral abscess. Treatment: penicillin half a million units twice daily (total 66 million units), sulphadiazine 2 grammes six-hourly (total 36 grammes), streptomycin \( \frac{1}{2} \) to 1 \( \frac{1}{4} \) grammes six-hourly (total 108 grammes), Lugol's iodine in milk, 10 mimims thrice daily (total 990 mimims). August 1950, completely recovered.

**SUMMARY**

1. The pathology of actinomycosis is briefly summarised, especially its method of invading bone by direct spread.
2. The manifestations, diagnosis and treatment of spinal involvement are considered.
3. The literature is brought up to date with a) a summary of fifteen cases published since the last collected series (forty-seven cases), and b) notes of three cases previously unreported, making, with the case reported on page 215 by Mr Brett, sixty-six cases in the literature.

**REFERENCES**