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THREE CASES OF SEPTIC OSTEOMYELITIS OF THE SPINE

The following is an account of three cases of septic osteomyelitis of the spine, each representing a separate type of that disease. The first belongs to the group of *acute, suppurative osteomyelitis*, the second is a typical case of *chronic spinal osteomyelitis*; the third shows how a severe osteomyelitis may arise *through perforation of the esophagus by a corpus alienum*. The two first both belong to the group of primary—genuine, hematogenous—osteomyelitis; the third, having arisen as the result of a perforating lesion, falls, of course, entirely outside of that group; but its unusual course justifies its discussion here, together with the others. To judge from the relatively small number of cases reported in the literature, both acute and chronic spinal osteomyelitis, but especially the latter, are very rare. Of acute and subacute cases, *Volkman*, for instance, could, in 1915, find only 87; a figure which was since added to by *Wohlgemut* (1923) and *Borchers* (1930), so that, in 1931, *Block* could give the number of known cases as 194. The clinical aspects of the acute form of the disease have been thoroughly dealt with by *Borchers*, *Lenner* and several others. The chronic form seems to be much rarer, even. It has been described in some detail by *Oehlecker*, who, in 1925, says that hardly a single case of it is to be found in the literature. According to *Hahn*, the ratio of osteomyelitis in the long tubular bones to the same disease in the short, flat bones is as 12 to 1; and of the latter, only 2 per cent. are spinal osteomyelitis. I now proceed to the description of my three cases.

CASE I. (Orthop. Journal 164/34).—Male, aged 18. Hereditation, none. As a child, morbilli, pertussia and varicellæ. Otherwise always in good health. On Jan. 7th, 1934, he took part in a wrestling match, but he doesn't remember having hurt either his head or his neck on that occasion. The next day he felt hot and tired, and got a pain in the lower part of the cervical spine. It became particularly strong whenever he moved his head, and compelled him to keep his neck stiff. On the 9th, he had got coryza, a stitch below his right shoulder-blade, and muscular pain across his loins. Fever, 39°. On the 10th, his condition was more or less the same; but he now felt a stronger, splitting pain in the lower cervical vertebræ. On the 12th, he was admitted to the Medical clinic. *Condition on admission*: General condition somewhat affected; patient is weak and tired. Temperature: 39.4. Pulse, 100. Internal organs, no remark. Wassermann and Kahn negative. Widal's reaction for typhoid, paratyphoid and undulant fever negative. Blood-sedimentation reaction (Fåhrens-Westergren), 48 mm./hour. White blood corpuscles, 10,800; on Jan. 17th, 13,500. Differential count: leucocytes, 83 per cent.; lymphocytes 9 per cent.; monocytes, 7.5 per cent. Lumbar puncture, everything normal. Roentgen examination of thorax, everything normal. Roentgen examination of thorax, everything normal. Pirquet positive. The patient lay with 39—40° fever and persistent pain in the lower part of the neck until Jan. 18th, when he was again *roentgen-examined*, with contrast fluid in the esophagus (Hellmer). The bodies of the cervical vertebræ, and the intervertebral discs, were of normal height; the contour and structure of the visible skeletal parts normal. Slight gibbus, with maximum at the level of the 4th intervertebral disc. The larynx and the upper part of the trachea, together with the esophagus, are pushed forward in an arch; the maximum of the dislocation lies at the level of the 7th cervical to 1st thoracic vertebræ. No sign of any process arising from the esophagus. *The roentgen examination shows the existence of an expansive process anteriorly to the spinal column, at the level of the seventh cervical to first thoracic vertebræ* (Fig. 1).

On Jan. 19th, the patient was transferred to the orthopedic clinic. On his arrival there, his general condition was rather considerably affected. His face was very flushed; temperature, 39°; pulse, 80. Internal organs, no remark. His neck was slightly, but visibly, swollen; perhaps with a somewhat greater bulge anteriorly on the left side. No circumscribed resistance could be felt, but he registered tenderness far down in the jugulum on palpation of the spinal column from in front. No noticeable tenderness to taps on the spinous processes of the cervical vertebræ. He carried his head and neck stiffly, and was very disinclined to move them. Forward flexion was entirely suspended, backward flexion and turning possible only to one fourth of normal extent. He had some difficulty in swallowing. As the roentgen findings, viewed in connexion with the

clinical course and his whole condition, seemed in every way to confirm the diagnosis of *septic osteomyelitis of the lower cervical spine, with prevertebral abscess*, operation was at once decided upon.

Operation (Frisings), Jan. 19th; *Exposure of the cervical spine and draining of abscess*. Full narcosis. Incision along the medial side of the sternocleidomastoideus. The soft parts between the thyroid gland and the ramus of the vasomotor nerve are divided, in part with knife, in part bluntly. After the deep has been reached, an abscess opens up, discharging a couple of soup-spoonfuls of thick, yellow, inodorous, apparently septic, pus, which is later found to contain a pure culture of *staphylococci*. The abscess is swabbed dry. It extends down along the cavity of the thorax for a distance of three or four centimeters more, rather sharply defined. Farther up, its limitation is more diffuse. At its bottom can be seen and felt the body of a vertebra, the anterior side of which is eroded; one feels the naked bone. Also the intervertebral disc below it seems to be distinctly eroded; when the body of the vertebra is lifted upwards by means of a scoop, an open gap is produced between the two. The abscess is drained with tube and tamponage. The head is afterwards immobilised by means of sandbags.

As far as could be judged, the process in the cervical spine gradually improved; but the patient now got into a pyemic condition, with the following metastases: Jan. 23rd, *septic gonitis* of the left side; Feb. 1st, *spontaneous pneumothorax* of the right side, due to septic metastasis; Feb. 5th, *purulent otitis media* of the left ear; Feb. 6th, *abscess* over the sacrum, with *staphylococci* in the pus; Feb. 10th, *abscess* on the right leg. On the latter and following day he got rapidly worse, and on Feb. 11th he died (i. e. 22 days after the operation). During this last period, the blood-sedimentation rate was high (80—96—113 mm./hour), and the fever likewise (38—39.7°).

Autopsy (Prof. Sjövall): Septic osteitis of the seventh cervical and first thoracic vertebræ + abscess of the neck and mediastinum + suppurative thrombophlebitis of the left anonymous vein + metastatic abscess of the lung, with perforation to the right pleura + fibrinous inflammation of the right knee. Several abscesses in the lungs. The pyemia was due to a thrombosis at the junction of the left external and internal jugular veins, through the walls of the latter becoming eroded by an abscess. The bodies of the seventh cervical and first thoracic vertebræ were superficially eroded on the anterior side; the intervertebral disc between them completely broken down.

CASE II. (Orthop. Journal 72/33).—Male, aged 36. Hereditation, none. As a child and youth in good health. When 15 years old, appendicitis. Has never, so far as known, suffered from septic infection. In 1919, gonorrhea twice, but denies syphilis. In 1918, he suffered for about six months with rheumatic pains in his back. They began little by little,

but at no time set in acutely, nor became very intense. During the following eight years, these pains returned occasionally, but in a fairly mild degree. In 1927 they became worse, and especially during the last six months before he was admitted to the hospital here for the first time (March, 1928) they were very intense, and radiated downwards towards the groin, and forwards, to the abdomen. He was first hospitalised here from March 30th to May 11th, 1928. *On admission*, then, his general condition was good. Internal organs, no remark. The normal curves of the lumbar and lower thoracic spine were straightened out. He held his back stiffly. There was no direct or indirect tenderness to taps on the spine. Wassermann, negative. Pirquet, positive.

Roentgenography of the back (Figs. 2—3) shows considerable changes in the tenth to twelfth thoracic and first lumbar, vertebræ. The intervertebral discs between them are visibly flattened, and the margins of the vertebræ opposed to them rough. On the right side there are strong bridges, of osseous density, between the eleventh and twelfth thoracic, and the twelfth thoracic and first lumbar vertebræ. There is thus, in these, a condition of very chronic irritation of the periosteum and bone, with pronounced reactive changes. From the roentgen examination it is impossible to say with any certainty whether it is a case of an old, moderate, tuberculous process or a chronic, septic, one.

The patient now lay for about six weeks with slightly subfebrile temperature, but during that time got so much better that on May 5th he could be sent home, wearing a plaster-jacket. The diagnosis was doubtful, but tuberculous spondylitis was considered to be the most likely. *On June 18th he returned*. The plaster-jacket was removed. His condition was now different from when he was last seen, in so far as there was distinct tenderness to pressure over the lower part of the thoracic and upper part of the lumbar spine, and that in the left iliac fossa and the left side of the abdomen there was a large resistance, extending up under the costal margin. Its limits were not clearly definable, and there was some tenderness to palpation. As there was a troublesome obstipation, an irrigoscopy of the colon was done, whereby it was found that the resistance lay back of the intestine, and free of the latter. Incidentally, calcified tuberculous nodules were found. Also roentgen examination of the kidneys showed normal conditions. He remained in the hospital for a month, during which time the resistance grew less, and became less tender. Afterwards, he was for some time under care at our coastal sanatorium, but *returned to the hospital on Sept. 17th*.

On his return this time, his condition was as before. Roentgen examination of the back showed the same picture, and also the resistance was the same as before. A number of Wassermann tests with varying results, together with positive sedimentation reaction (Kahn), awakened suspicion of lues, wherefore he was given salvarsan and potassium iodide, but

without any noticeable effect. He now lay for a month with rather severe pain in his back, remittent temperature of 37—39°, and the general condition poor. The resistance seemed to get less hard, with a suspicion of fluctuation. On the last named ground, an *exploratory incision was made, on Okt. 17th*, over the suspected abscess. A tumor, almost solid to the touch, was found; with seemingly adhesive inflammation of the surroundings. The excision of a specimen from the wall of this »tumor«, for the purposes of bioscopy, started a troublesome hemorrhage, which was only checked by tamponage; whereupon the operation had to be discontinued. Histological examination of the excised specimen showed »chronic inflammation, of unknown etiology«. The wound healed well; on Okt. 29th the tampon was withdrawn. No bleeding or suppuration. The patient's temperature had now again become lower and more even. On Nov. 6th, the wound was completely healed, but the skin with the cicatrix was bulging outward. The wound was therefore opened again, whereby about 400 c.c. of pus were evacuated; and as a result of this the resistance disappeared. Cultivation of the pus gave a pure culture of *staphylococci*. *Inoculation on guinea-pigs proved negative as regards tuberculosis.*

On Nov. 20th, palpation showed that the resistance had again increased. The fistula was divided, and let out *about 1000 c.c. of pus*. Palpation revealed the existence of a multilocular abscess-cavity with stiff, unyielding walls. A drain was inserted.

During the following six or seven weeks, the patient's condition got rapidly better. The improvement was very noticeable. He became like another man, his spirits rose, and his weight increased. The suppuration rapidly got less, and when he was discharged, on *Jan. 7th, 1929*, the fistula had completely healed. During all this time his temperature was normal. He remained thus on the whole fairly well until toward the end of *May, 1929*, when he again began to get a pain in the left groin, and himself, on palpation, felt *an abscess in his left iliac fossa*. He then entered the hospital again, on May 27th, and remained here until June 25th, same year. The abscess was opened, and healed again in about two weeks. Wassermann, negative.

After this he was again fairly well; and by August, 1929, he was able to take up his old occupation as a chauffeur. Only after any unusually heavy effort would he sometimes feel a pain in the small of his back, but this always passed away again when he rested a few days. His condition remained thus, without any change, until the end of *November, 1931*, when he began to fall of generally, got a pain in his back, little by little also in the left groin, and difficulty in straightening his left hip-joint. As on the former occasions when an abscess developed, he also began to suffer from obstipation. The result was that on *Dec. 28th, 1931*, he again entered the hospital. On admission, he was pale and thin. Heart and lungs, no remark. Blood-sedimentation rate, 120 mm./hour. Roentgen examination showed the

spondylitis unchanged, as before. In the left iliac fossa, palpation revealed a strongly distended, fluctuating abscess, the size of a closed fist. Temperature, 37—38°. An incision was made into the abscess, letting out 200 c.c. of thick, greenish-yellow pus. On Jan. 25th, 1932, the fistula had healed. During the whole time, there was from 0.2 to 0.4 per cent. albumin in the urine. The blood-sedimentation rate remained around 130 mm./hour. His temperature, which had been slightly febrile before, became normal after the operation. In the sediment there were a varying number of white blood corpuscles, but no tubercle bacilli. On *Feb. 23rd, 1932*, he was discharged; but he did not afterwards feel really well, was unable to work, and felt tired.

Toward the end of September, same year, he felt that an abscess was again beginning to form in his left iliac fossa, and on *Sept. 29th, 1932*, he was once more admitted to the hospital. He was then pale and thin. There was positive albumin in the urine (14 pro mille). In the blood-sediment varying quantities of white corpuscles. Tubercle bacilli, none. *In the left iliac fossa, an abscess the size of a closed fist*, which was incised and drained. It contained a large quantity of thick, yellow pus, in which *staphylococci* were found. The patient's temperature soon went down to normal, but the blood-sedimentation rate was all the time high,—from 100 to 149 mm./hour. Also the amount of albumin in the urine was great all the time—up to as much as 0.2 per cent.—which was ascribed to amyloidosis of the kidneys. His condition now got markedly better. He put on 9 kg. in weight; and by the time when he was discharged, on *Feb. 23rd, 1933*, the large incision wounds had healed almost completely. The treatment was afterwards continued at the polyclinic. He is now in fairly good health; his back troubles him only slightly, but the rate of albumin in his urine is still high. He is able to do light work. The spondylitis is, according to the radiograms, unchanged, as it has been all the time.

CASE III. (Orthop. Journal 56/34).—Male, aged 40. Except for an otitis media, his health had always been perfectly good. On March 20th, 1933, he swallowed a fishbone, which stuck in his throat; but he didn't pay much attention to the incident. He got hoarse, but felt no trouble in swallowing. The hoarseness persisted without change until the beginning of July. He then consulted a doctor, who suspected a tumor of the larynx and sent him to the ear-hospital in Lund, where he was admitted on July 6th. He was then very hoarse, which he ascribed to the swallowed bone. Indirect laryngoscopy showed a complete edematous filling of the piriform sinus, together with tumefaction of the aryal region and both vocal cords. On the anterior side of the neck, in the median line, right below the larynx, there was a non-fluctuating swelling, the size of a walnut. Roentgenography of the mediastinum and esophagus showed nothing in the way of either foreign bodies or tumor. Incision was made over

the swelling on the neck, and a lymph node extirpated. Histological diagnosis: suppurative degeneration of lymph node. On July 20th, an excision for the purpose of biopsy was made from the mucosa of the tumefied piriform sinus. Histological diagnosis: *fibroepithelioma*. On this indication he was given roentgen treatment for about a month, but got rather worse. He became stiff-necked, and his temperature, which had hitherto been subfebrile, rose to around 38°, with occasional extreme rises. A second roentgen examination, on Aug. 4th, still showed nothing positive (later scrutiny of these roentgenograms—see the following—resulted in the discovery of the fishbone; cf. Fig. 4). On Oct. 12th, repeated roentgen examination, at which a shadow, 4 cm. long and 3 mm. broad, probably representing a foreign body, was found at the level of the fourth to fifth cervical vertebræ (Fig. 5). Laryngoscopy *ad modum* Schwebel was immediately done, and a couple of centimeters down in the hypopharynx there was found, in the out-bulging posterior wall, an opening from which pus exuded. From side to side in this opening lay a bone, about 3.5 cm. long, which was removed. The patient got no better, however. On the contrary, symptoms now began to develop from the cervical spine, in the form of pain in the neck, and radiating out into the arms. A roentgen examination on Oct. 25th (*Hellmer*) showed that the foreign body had disappeared, but there was an indubitable, though slight, reduction of the fifth intervertebral disc, and an intensification of the gibbus which had been found faintly indicated already on Oct. 12th, when also a diminution in the lime-salt contents of the fifth cervical vertebra had already been noticed. The diagnosis was now: *incipient spondylitis*. The patient was fitted with a back-shield of plaster-of-Paris, in order to immobilise his spine.

Roentgen examination Nov. 10th (Hellmer): The destructive spondylitis considerably further advanced. The interarticular space between the fifth and sixth cervical vertebræ now almost entirely suppressed. Considerable destruction of the anterior part of the fifth. and upper anterior part of the sixth, cervical vertebræ. The height of the intervertebral disc somewhat diminished since last examination. The gibbus position further accentuated.

On account of the spondylitis, the patient was, on Nov. 10th, transferred to the Orthopedic hospital. His general condition was at that time rather severely affected. Temperature, 37.7. Blood-sedimentation rate, 52 mm./hour. He was absolutely deaf, and made an imbecile impression. Internal organs, no remark. Owing to the pronounced roentgenological changes, no closer examination was made of his spine. Of the muscular strength and sensibility of his arms there was nothing to remark. During the next few months he got better, in so far as the pain in the neck and arms became less, and finally disappeared altogether; but nevertheless his general condition gradually declined. His temperature, which, during

the first month of his stay in the Orthopedic hospital, had oscillated between 37 and 38°, lay, during the second month, around 38°, and during the third month for the most part between 38 and 39°. The blood-sedimentation rate rose to 79 mm./hour. There was during the whole time a very strong outflow of pus from the fistula in his hypopharynx; the getting rid of which was made all the more difficult by the fact that the condition of his cervical spine made it necessary for him to lie always on his back. In spite of this, he never had any demonstrable attack of aspiration pneumonia. On Dec. 8th, a renewed roentgen examination showed still further progress of the destructive process in the spine. He went slowly downhill, and during the first days of February, 1934,—about three months after his admission to the Orthopedic hospital—there came a rapid turn for the worse; and on Feb. 6th he died.

Autopsy (Prof. *Sjövall*): Suppurative gangrene of the retropharynx and mediastinum + spondylitis with necrosis of the fifth and sixth cervical vertebræ. The bodies of these two vertebræ entirely disintegrated, with sequestræ. The process had spread epidurally, and had, from behind, given rise to gangrenous disintegration not only of the fourth and third cervical, but also, especially, of the first and second thoracic, vertebræ. The third thoracic vertebra was intact. The dura mater had everywhere resisted the process. The soft membranes normal. In the lungs, nothing to remark.

As the clinical aspects of the acute and chronic spinal osteomyelitis have already been thoroughly dealt with by other authors (*Borchers, Lenner, Oehlecker* et al.), I shall not go into detail, but will confine myself to pointing out certain features of these three cases which are particularly characteristic of osteomyelitis in the spine, and important for the diagnosis of the disease in that location. First, however, I must briefly explain how the condition known as *infectious spondylitis* came to be recognised by the clinicians, and its relation to acute and chronic osteomyelitis of the spine.

About 1902, *Eugen Fraenkel* found that, in a number of *infectious conditions*, the bacteria corresponding to these could be demonstrated in the bone marrow of the vertebræ, while yet, during the patient's life, there had been no positive clinical symptoms from the spine. Fraenkel first made that observation with typhoid, where he was able, in *all* the cases he examined post mortem, to demonstrate the presence of typhoid bacilli in the marrow of the vertebræ. Afterwards he made the same ob-

servation with regard to pneumonia, phlegmon, erysipelas, panaritium, carbuncle of the neck, peritonitis, parametritis, phlebitis, and other affections; in which he found respectively pneumococci, staphylococci and streptococci, sometimes as miliary foci of pus, sometimes as smaller or larger necroses occupying up to as much as two-thirds of a marrow cavity. The bacteria were in most cases demonstrated by culture test, but could sometimes be demonstrated even directly. As a rule, he found them in the lower thoracic and upper lumbar spine; much more rarely in other parts of the spine, or in the ribs. On the basis of *Fraenkel's* observations, and of similar ones of his own, *Quincke* coined the clinical term: *infectious spondylitis*, as a designation for the cases in which those changes, during the patient's life, produced symptoms, oftenest in the form of a spondylitis mild in character and with good tendency to healing. Such is especially the spondylitis caused by pneumococci, and the one caused by *bacillus typhosus* (which may rightly be considered as a specific spondylitis); but also, in certain cases, the spondylitis caused by pyogenic bacteria. In contrast to these benign forms of spondylitis we have the acutely onsetting osteomyelitis, with its often fulminant course. This disease, as already remarked, is extremely rare. It is caused almost exclusively by pyogenic bacteria, in most cases by staphylococci, and differs from infectious spondylitis not only by the extreme rapidity of its course, but also by the great, soon occurring, disintegration of the bones, the tendency to abscess formation, and the frequency of its lethal issue. The findings in the 30 cases given by *Borchers* were: staphylococci in 27, streptococci in 2, pneumococci in 1, paratyphoid A in 1. *Laborde* (cit. from *Leibovici*) found staphylococci in all of 20 cases.

The mortality rate in acute osteomyelitis has become somewhat lower in recent years, but is still terribly high. I give here the total figures from the largest statistics since 1896:

1896.	<i>Makins and Abbot</i>	71.4	per cent.
1900.	<i>Hahn</i>	58.0	» »
1905.	<i>Joachimsthal</i>	56.6	» »
1906.	<i>Donati</i>	45.5	» »

1911.	<i>Grisel</i>	51.0	»	»
1913.	<i>T'serniak</i>	41.6	»	»
1915.	<i>Volkman</i>	41.8	»	»
1930.	<i>Borchers</i>	56.3	»	»

Borchers' figures are questioned by *Block* (1931), who, of his 81 cases, has a mortality of 34.5 per cent. This figure is for cases of the vertebral body and of the vertebral arch together. The mortality is greater for cases involving the former, than for those involving the latter part of the bone. For the various regions of the spinal column, the mortality figures, according to *Block*, are as follows: cervical spine, 33.3 per cent.; thoracic spine, 53.8 per cent.; lumbar spine, 19 per cent.

Of course, one sometimes finds cases representing a transition between the infectious spondylitis and the acute, suppurative osteomyelitis; but there is nevertheless every reason for recognising the two as separate types of disease, each with its own characteristics, and different both from each other and from the various specific forms of spondylitis (*Puhl*).

More difficult is the distinction between *chronic* osteomyelitis and infectious spondylitis. Many authors—*Radt*, for instance,—would regard the former rather as a variety of the latter; conceiving infectious spondylitis as the more comprehensive term. *Fraenkel*, on the other hand, says, in 1923, that in all his experience he has seen only one case of infectious spondylitis which eventually became chronic. Quite apart from the clinical and roentgenological differences, to which I shall return farther on, it would seem reasonable to class separately, as chronic osteomyelitis, those cases which are due to staphylococci; and to reserve the term: infectious spondylitis for those which, as *Fraenkel*, *Schmorl* and others have shown, occur in connexion with other infectious conditions (pneumonia, variola, influenza malleus, angina, undulant fever, etc.). Whether spondylitis typhosa (typhoid spine) should be reckoned as belonging to this group, or should be considered as a specific spondylitis, is a matter for discussion.

In view of the observations made by *Fraenkel* it is surprising that both suppurative osteomyelitis and infectious spondyli-

tis should be of such rare occurrence. Why this is so, no-one has as yet been able fully to explain. It has been supposed that the red bone marrow of the vertebræ, like the milt, might possess a destructive action on the bacteria; an idea which is to a certain extent supported by Wassermann's discovery that it is capable of forming antibodies against typhoid.

Critical Comment on the three Cases.

Case I is that of a young man, aged 18, previously always perfectly sound and healthy. Without any preceding trauma he becomes acutely ill, with symptoms which to the consulted physician rather suggest influenza. On the third day he is taken into the hospital, where his case is at first judged to be some sort of fever, of character as yet undetermined. Against the suspicion of typhoid spoke the white blood-picture: 13,500, of which 83 per cent. leucocytes; which pointed to an acute infectious condition of some other kind. The blood-sedimentation reaction: 48 mm./hour, further supported this view. Lumbar puncture showed normal conditions. Here it must be remarked that, according to *Volkman*, one-third of all the cases of suppurative osteomyelitis that come to autopsy do so under the following mistaken diagnoses (in order of frequency): abdominal typhus, tuberculous spondylitis, epidemic cerebrospinal meningitis, pneumonia, rheumatism, influenza, sepsis, lymphadenitis, acute myelitis, Landry's paralysis; subphrenic, paraphrenic and lumbar abscess; renal colic, appendicitis and peritonitis.

During the week that he lay in the Med. dep't, with high fever, the symptoms became more localised to the cervical spine, and a renewed roentgen examination of the latter, and of the esophagus, gave the following result (Fig. 1): *a*) cervical vertebræ and intervertebral discs, normal; *b*) in front of the seventh cervical to first thoracic vertebræ an expansive process which did not arise from the esophagus, but which, roentgenologically, answered the indications for an abscess arising from the vertebræ. The existence of this abscess could thus be demonstrated *ten days* after the patient was first taken ill, and was verified by the operation done the following day, when the cervical spine

was exposed and the cavity opened. According to *Rosenburg*, roentgenological changes in the vertebræ and intervertebral discs, in acute osteomyelitis, occur at the earliest after two weeks; according to *Radt* and others not until after three weeks.



Fig. 1.

Man, aged 18. Skeletal parts normal. Arcuate forward displacement of the larynx, the upper part of the trachea and the esophagus. Maximum of displacement at the level of seventh cervical to first thoracic vertebræ, showing the location, at that point, of an expansive process,—in this case a septic abscess.

This is a nice example of the value of roentgen examination as the means to an early diagnosis of spinal osteomyelitis through demonstration of the abscess. Considering the size of the latter in the present case, where it was found on the tenth day, it is

not improbable that a positive radiologic picture of it might have been obtained even earlier, as was the case in two instances cited by *Esau*. In one of these, a distinct abscess shadow close to the spine could be demonstrated already on the seventh, in the other on the tenth day. In the last case, *Esau* also found foci of rarefaction in several vertebræ. *Lenner* has been able to detect the presence of a similar abscess on the ninth day.

As interesting with regard to the differential diagnosis it should be noted that *v. Eiselsberg* and *Gold*, in cases of vertebral fracture, were able roentgenologically to demonstrate the presence of fracture-hematomata, as paravertebral or mediastinal shadows. The confusion of such with an abscess might lead to very grave consequences.

The pathoanatomical changes disclosed by the operation consisted in erosion of the marginal portion of the seventh cervical vertebra and of the intervertebral disc below it, with a gap between the two when it was tried to lift the vertebra upward by means of a scoop. This would seem to support the opinion of those who maintain that the infectious process in cases of acute osteomyelitis, just as in infectious spondylitis (*Puhl*), can have its first beginning in the epiphyseal plates of the vertebræ or in the intervertebral discs. So far as the latter are concerned, this is possible so long as the discs remain vascular; which, according to *Boemig*, is the case until the age of from twenty-five to thirty. Further support of the said opinion is to be found in the result of the autopsy, which took place twenty-two days after the operation; when it was found that the bodies of the seventh cervical and first thoracic vertebræ were only eroded superficially, while the intervertebral disc was completely broken down. *Schmorl* takes the opposite view: that the infectious process begins in the spongiosa of the vertebral bodies; and that in infectious spondylitis it does *not* extend to, and involve, either the epiphyseal plates or the intervertebral discs, as he has, on the other hand, observed it to do in acute osteomyelitis. He sees in the epiphyseal plates a barrier which is seldom passed by the infection. This must be interpreted as equivalent to saying that if the process begins in the vertebral body it will not encroach

upon the disc, and—vice versa—if it begins in the disc it will not encroach upon the vertebral body, until a very advanced state of deterioration has been reached. The latter part of this thesis is supported by the present case (Case I); the first may possibly explain the pathoanatomical finding in Case III, to which I shall revert later on. Of the symptoms noted at the time of the patient's admission, I would call attention specially to the very slight tenderness to pressure, both direct and indirect, in the lower part of the cervical spine. This is by most of the authors considered as characteristic for osteomyelitis; in contrast to tuberculosis, where those symptoms are more pronounced.

The blood picture was the typical one of high leucocyte values and high sedimentation rate. In some cases, leucocyte values as high as 30—40,000 have been noted.

The prognosis in cases of acute spinal osteomyelitis is always uncertain, and depends partly on an early diagnosis, partly on the early adoption of active surgical measures, even if the latter must be considered as totally ineffectual in those cases which become septicopyemic at an early stage. It is the unanimous opinion that the abscesses should be opened radically, and drained, as early as possible; the diseased vertebra exposed as thoroughly as possible, and any deteriorated sections of the bone removed. This last can be rather difficult when the osteomyelitis is in the body of the vertebra; if it is in the arch, the matter is more easy.

Block ascribes the recent decline in the mortality rate from the disease chiefly to this adoption of early surgical intervention. When the first fulminant stage has been luckily passed, the treatment should be continued with fixation in plaster-bed, later in plaster-jacket or bandage, until the process may safely be considered as thoroughly healed.

Case II belongs to an entirely different type. The patient is a man, aged 36, whose illness can be traced back for ten years prior to March, 1928, when increasingly troublesome, radiating pains forced him to consult a physician. By that time, the meager clinical picture shows, beside the subjective symptoms, only the

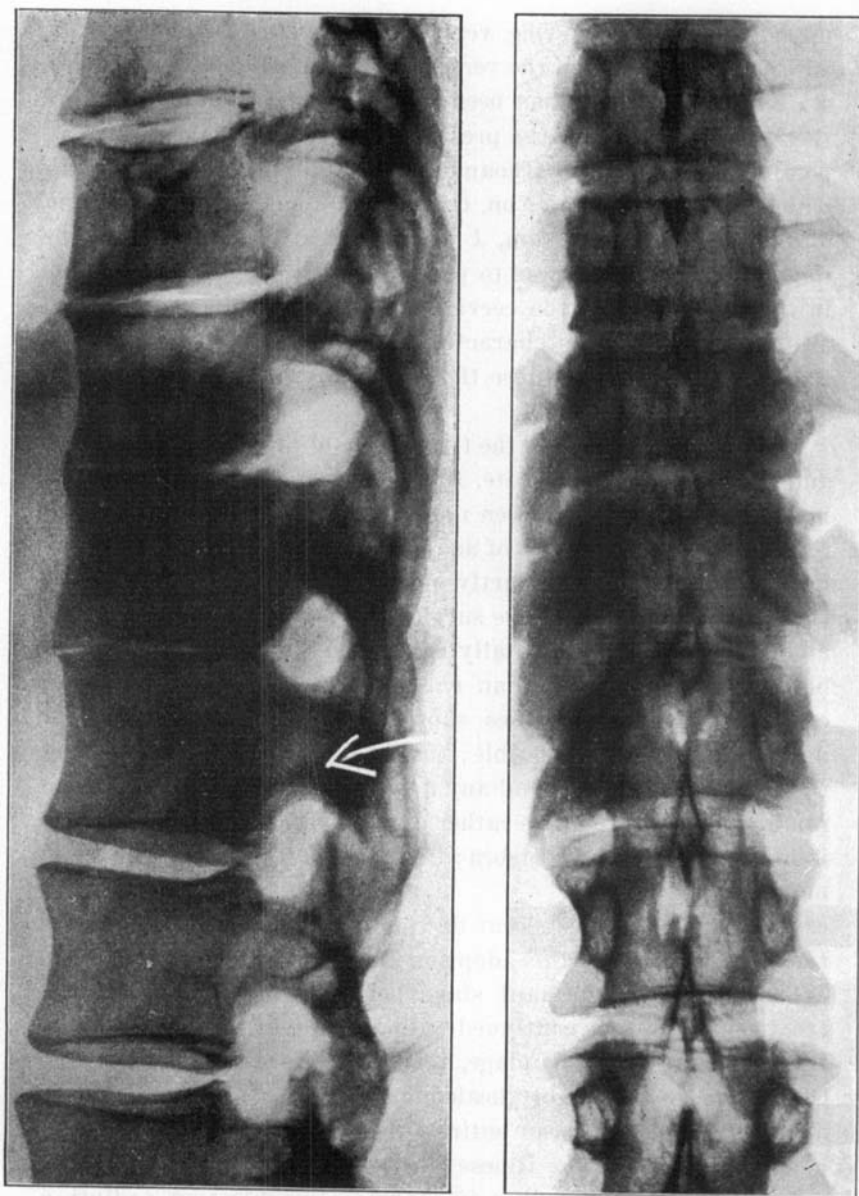


Fig. 2.

Man, aged 36. Flattened, almost effaced, intervertebral discs between the tenth thoracic to first lumbar vertebrae. No destruction of the vertebral bodies. Good calcareous density in spite of the progredient process.

Fig. 3.

Same as Fig. 2. Frontal view. Enormous bridges, of osseous density, on right side, between the eleventh and twelfth thoracic, and twelfth thoracic and first lumbar, vertebrae.

fact that he carried his back stiffly. The radiograms, however, (Figs. 2 and 3) reveal a highly pathologic condition of his spine, with three very much flattened intervertebral discs,—between the tenth to twelfth thoracic and twelfth thoracic to first lumbar vertebræ; beside enormous bridges, of osseous density, between the eleventh and twelfth thoracic, and the twelfth thoracic and first lumbar. This makes the roentgenologist suspect a chronic, septic spondylitis; but as that diagnosis is so immensely much rarer than tuberculosis the clinical opinion concludes in a verdict of mild, probably healed, tuberculous spondylitis with dorsal insufficiency, and on that basis conservative treatment is prescribed, with rest in bed and plaster-of-Paris jacket. Three months later there is found (June 1928), in addition to distinct tenderness to taps over the lower thoracic and upper lumbar spine, a large resistance in the left half of the abdomen. As the case is still held to be one of tuberculosis,—the diagnosis to that effect being supported by a positive Pirquet reaction and the finding of some calcified tuberculous nodules in the abdomen,—this resistance is at first interpreted as symptom of a, possibly circumscribed, tuberculous peritonitis. By this time the diagnosis is however getting unsettled by some positive Wassermann- and Kahn reactions, which arouse a suspicion of syphilis—the patient having had gonorrhea twice, in 1919; and an antiluetic treatment is instituted, but gives no result. The diagnosis of syphilis is eventually abandoned altogether, as the serologic finding proved uncertain, and in all probability negative. As the patient's general condition is getting worse, his temperature remittent, and the resistance seems to be fluctuating, it is decided, four months after,—in October, 1928,—to make an explorative incision over the suspected abscess; but the operation has to be interrupted on account of hemorrhage. About three weeks later, about 400 c.c. pus are evacuated through the cicatrix of the now completely healed incision wound, and after another couple of weeks 1000 c.c. more. In this pus, a pure culture of staphylococci is found, but inoculation on guinea-pigs gives a negative result. The patient gets better almost immediately, feels as a different being, and in January, 1929, three

months after, the fistula from the abscess is completely healed. The roentgenological picture is unchanged. In May, 1929, a fresh abscess in the same place is incised, and heals in two weeks. He now remains fairly well for about three years, until January, 1932, when he is again admitted to the hospital; an abscess, the size of a closed fist, in the same place as before, is incised, and heals in seventeen days. In the fall of the same year fresh abscess, incision, and rapid healing as before. At the present writing he is in fairly good health except for a nephropathy (amyloidosis). The roentgenologic picture is unchanged, as before.

What in this case speaks especially for the diagnosis of osteomyelitis, and against that of tuberculous spondylitis, are the following three points:

1) *The protracted course*,—the fact that he has now had symptoms from his back for seventeen years; something which is unusual in tuberculosis, but consists well with the essential nature of osteomyelitis.

2) *The roentgenologic picture*,—in which, in spite of an active process resulting in four large abscesses in the course of four years, only relatively small changes are found, consisting chiefly in a flattening of intervertebral discs. The enormous bony bridges between the eleventh and twelfth thoracic and between the twelfth thoracic and first lumbar vertebræ are not found in tuberculosis. They, too, speak against that diagnosis, and for osteomyelitis. So does the fact that the calcareous density of the vertebræ has remained the same in spite of the active fistulous process. *Oehlecker*, especially, has shown that such slight disturbances, together with early, strong, outgrowth of bone, is typical for the last named disease, and is the reason why it so seldom leads to deformities. One might say that nature does its own Albee operation, preventing any deformation. *Oehlecker* has seen bony outgrowths, more or less similar to those in the present case, develop in the course of only two months. How early they developed in the case of our patient we are unable to say, as they were present already when he was first admitted to the hospital.

3) *The character of the abscesses.* The four abscesses which developed in the course of four years did so insidiously, and clinically presented themselves as cold abscesses; but here the bacteriological examination proved of the utmost importance. In two instances the pus was found to contain pure cultures of staphylococci; and, what was still more important, inoculation on guinea-pigs gave a negative result. This is by *Oehlecker* considered as conclusive ground for excluding tuberculosis, despite the healthy scepticism with which negative examination results should otherwise be regarded. »Wird Eiter aus einer tuberkulösen Fistel, und mag diese Fistel noch so lange bestehen, auf Meerschweinchen verimpft, so wird das Meerschweinchen immer krank.« (Chirurg. 1932). Whether one will agree with *Oehlecker* or not, in his taking the negative guinea-pig test as conclusive proof with regard to the diagnosis, there is yet another circumstance, however, which further supports the latter; namely, *the patient's reaction to the abscesses*. We have seen that the development of these was in every instance followed by a distinct worsening of his general condition, but that this gave way to an equally noticeable, rapid, improvement as soon as the abscess had been incised and drained; a result which one would not expect in the case of a tuberculous abscess. Nor does the fistula from a tuberculous abscess heal as rapidly as was the case here: two of them respectively fourteen and seventeen days, the two others within a couple of months, after the incision. Neither is it probable that these recurrent abscesses, if the case had been one of tuberculous spondylitis, would have gone on developing without provoking clinical symptoms from the back far more pronounced than the quite insignificant ones observed in the present case. As a matter of fact, the patient's general health, in the intervals between these recurrences, was fairly good, and he was able to keep on with his rather exacting work as a motor driver, with relatively little trouble from his back. *Oehlecker* also says that if the course of a tuberculous spondylitis with fistula formation is unusually benign, one should suspect chronic osteomyelitis.

The age at which spinal osteomyelitis occurs is different for

acute and chronic cases. Of *Borchers'* 48 *acute* cases, 31 were subjects in the first and second decades of life. Of the 10 cases of *chronic* osteomyelitis described by *Oehlecker*, the first 7 were patients between the ages of twenty-eight and fifty,—or rather, who came in for hospital treatment at those ages, while in some instances their symptoms could be traced farther back. In many cases one will find in the anamnesis an earlier, more or less acute, beginning of the disease; or else an—often commonplace—septic infection, which can be causatively connected with the later occurring spinal osteomyelitis. In the case which I have been discussing here, where the patient was thirty years old at his first entrance into the hospital, neither the one nor the other of these features could be demonstrated in the anamnesis, in spite of careful scrutiny.

With regard to the blood-sedimentation rate, it is said that it is always high in acute cases, uncertain in the chronic. In the present case it was remarkably high during the two last recurrences (for the earlier ones observations are lacking); in one instance it reached the enormous height of 181 mm./hour before the incision was made. Simultaneously with this the patient was suffering from a disorder of the kidney (amyloidosis?), which may perhaps in part account for the fact.

On final diagnosis, the case is one of *chronic osteomyelitis due to staphylococci*.

Case III is not, as the two foregoing ones, a primary osteomyelitis, but was caused by a foreign body—a rather large fishbone. The patient swallowed this in the month of March, but only in July did the resulting symptoms, in the form of a persistent hoarseness, cause him to come to us for medical consultation. There is at that time an edematous filling of his piriform sinus, but repeated laryngoscopic and roentgenologic examinations fail to locate the fishbone of which he is speaking. An excision, for biopsy, from the piriform sinus leads to the histological diagnosis of fibroepithelioma, and on that basis he is given roentgen treatment. His condition gets worse, his temperature rises, and he develops a stiffness in the neck. On October 12th, a second roentgen examination results in the finding of the fish-

bone, which is located at the level of the fourth to fifth cervical vertebræ; and at the same time the roentgenograms show a reduction in the lime-salt contents of the body of the fifth cervical vertebra, together with a slight indication of gibbus. The fish-



Fig. 4.

Man, aged 40. The arrow indicates the point, at the level of the larynx, where the fishbone was situated on Aug. 4th.

bone is immediately removed. Renewed scrutiny of the roentgenograms from August 4th now results in its being located also in these, close to the larynx, but hidden by the latter, which, of course, explains its having been overlooked (Figs. 4 and 5). The bone has thus been wandering out, through the parapharyngeal and prevertebral tissues, toward the spine, and has there, *per continuum*, given rise to spondylitis. On October 12th, the latter

manifests itself only in the decalcification of the fifth cervical vertebra and the incipient gibbus; but already on October 25th, three weeks later, repeated roentgen examination shows a distinct reduction of the fifth intervertebral disc, and marked ac-



Fig. 5.

Same as Fig. 4. Oct. 12th. The fishbone is seen at the level of the fourth to fifth cervical vertebrae. Lime salt contents of the fifth cervical vertebrae diminished. Slight gibbus.

centuation of the gibbus. The patient now lies with an open, actively suppurating fistula in the pharynx, and with his head and neck immobilised in a back-shield of plaster-of-Paris. The spondylitis is in rapid development, and on Nov. 10th a roentgen

examination shows considerable destructions of the fifth and sixth cervical vertebræ, with complete flattening out of the intervertebral disc and the gibbus still further accentuated. He is now transferred from the otologic to the orthopedic dep't, and

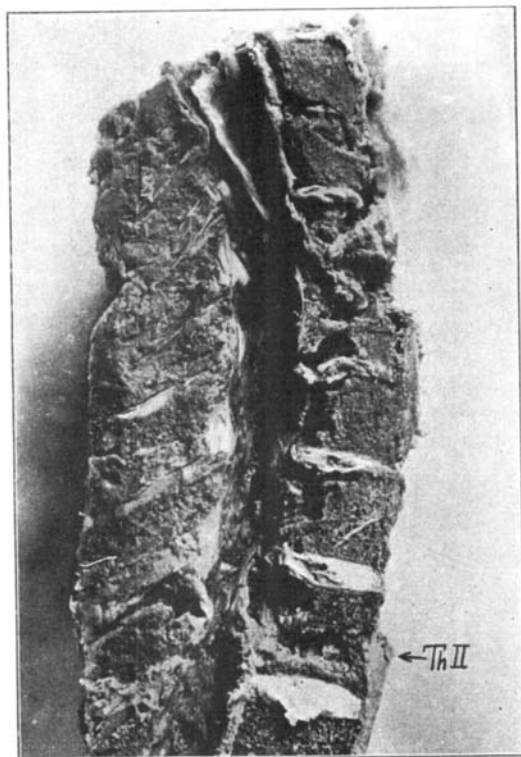


Fig. 6.

Same as Figs. 4—5. Sagittal section of post-mortem preparation. Extensive destructions throughout the cervical spine. The body of the second thoracic vertebra, from back to front and right down to the epiphyseal plate, very largely disintegrated; but, as far as can be judged macroscopically, the destruction has not gone beyond the epiphyseal plate. The underlying intervertebral disc apparently intact.

is still given conservative treatment in plaster-bed. A month later, the destructive process in the spine has gone considerably

further; there is continuous abundant suppuration from the fistula in the pharynx, the off-flow of which is made difficult through the necessity of the patient's being kept strictly lying on his back owing to the condition of his spine. His temperature continues to rise, the blood-sedimentation rate remains high, his general condition rapidly declines, and finally he dies.

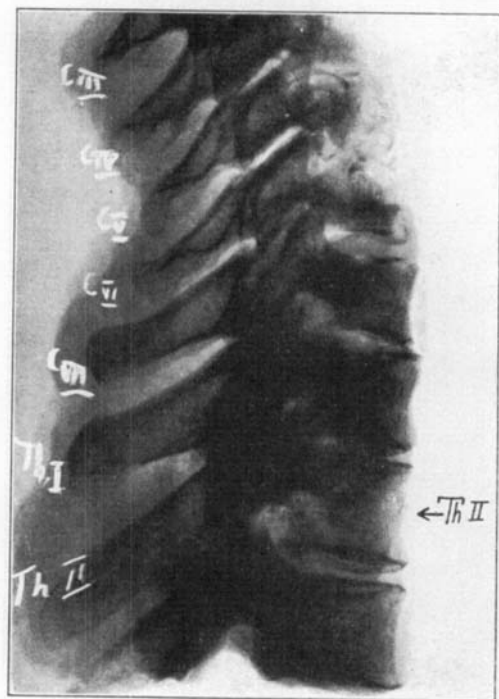


Fig. 7.

Same as Figs. 4—5—6. Radiogram corresponding to Fig. 6. No indication of the large destruction in the second thoracic vertebra. The epiphyseal plates apparently intact.

This case shows how a suppurative process, when it spreads to the spine, can cause rapid destruction both of the intervertebral discs and of the bodies of the vertebrae. The autopsy, four months after the spondylitis had first been roentgenologically ascertained, showed not only complete breakdown, with seques-

tration, of the fifth and sixth cervical vertebræ, but extensive destructions also of the third and fourth cervical, and first and second thoracic. The second thoracic vertebra presents, in the anatomical preparation, an interesting picture. In the first place, the vertebral body (see Fig. 6), from the posterior to the anterior surface and all the way down to the epiphyseal plate, is very largely disintegrated; but, as far as can be judged macroscopically, this process of disintegration has not gone beyond the epiphyseal plate, and also the adjoining intervertebral disc appears to be intact. I mention this because it would seem to support the opinion emitted by *Schmorl*, that the epiphyseal plates form a barrier against the infectious process. In the second place, the roentgen examination shows that the roentgenogram gives no indication of the presence of this large focus in the second thoracic vertebra; which should remind one of the necessity of being duly sceptical in regard to negative roentgen findings, especially where the skeleton is concerned (Fig. 7). It is interesting to notice that the process could extend itself epidurally on the posterior aspect of the vertebræ without giving rise to symptoms from the leptomeninges, which are completely intact; and also that the patient could lie for month after month with a continual, abundant outflow of pus in his throat, and yet not get aspiration pneumonia, in spite of increasing weakness and general decline.

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