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OF THE INVALID FOUNDATION, HELSINGFORS
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RETROPOSITION OF VERTEBRAE AS AN EARLY SIGN OF TUBERCULOUS SPONDYLITIS OF THE LUMBAR SPINE

BY

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It is a well-known fact that tuberculous spondylitis is able to develop, just as other kinds of tuberculosis of the bones do, without any changes that can be proved by roentgenograms. Rather large tuberculous vertebral foci have been found through autopsy, although the roentgenograms were negative. *H. R. Schinz* (1939) points out that "Von einer röntgenologischen Frühdiagnose der Spondylitis tuberculosa kann keine Rede sein." Although it is impossible to make an early diagnosis in a pathologico-anatomic sense, it has become much easier to make an early diagnosis in a clinical sense after it became known that a narrowed intervertebral space is often the first sign, proved by roentgenograms, of tuberculous spondylitis.

It is often necessary, for technical reasons, to roentgenograph the vertebral column when the patient lies down, making the distance between the focus and the object less than one metre. It may be difficult to compare, on the roentgenograms, the height of the different intervertebral spaces because of the oblique projection of those intervertebral spaces that are near the border of the picture. The scoliosis arising in the lumbar spine when the patient is lying on his side makes the intervertebral disks thinner on the concave than on the convex side. On account of these circumstances the value of the sign narrowed intervertebral space decreases.

A retroposition or backwards displacement of vertebrae has

been observed only in the lumbar spine. In 1929 the first observations of a retroposition were published in the U.S.A. by *R. A. Hibbs* and *W. E. Swift* and by *A. Def. Smith.* In 1934 *Smith* presented an analysis of fifty-six patients with a retroposition of the fifth lumbar vertebra. He found that "The most important single factor in determining a posterior displacement" was "the structure of the lateral articulations between the fifth lumbar and first sacral vertebrae." Smith maintains that if the plane of these joints is more frontal than usual a backwards displacement of the fifth lumbar vertebra is possible.

In 1930 *H. Junghanns* observed a retroposition of the first and the second lumbar vertebra respectively. He incidentally discovered this in the roentgenograms of four vertebral columns preserved after autopsy and sagittally sawn through. He, too, explained the phenomenon like this: if a traumatic or degenerative derangement of the disk causes a narrowing of the intervertebral space, the above vertebra is forced to glide backwards on account of the somewhat caudal-dorsal inclination of the joints between the articular processes. *E. Güntz* (1937) agreed, among others, with this. *Junghanns* points out that "Dass infektiöse Prozesse die Ursache solcher Veränderungen sind, ist sehr unwahrscheinlich."

Retroposition has proved to be a usual sign of degenerative changes of the intervertebral disks in the lumbar spine. In 1943 *Erik Severin* found retroposition with about half the number of 266 patients showing signs of degeneration of the intervertebral disks. This retroposition occurs in the cranial as well as in the caudal part of the lumbar spine.

Folke Knutsson was able to show, in 1944, that signs of instability of the lumbar spine in form of "parallel displacement and abnormal tilting movements" between the vertebrae often occur in case of degeneration of the intervertebral disks. The retroposition is not permanent; it is a phase of the abnormal movement. *Knutsson* points out that other kinds of changes of the disk, too, such as tuberculous or pyogenic spondylitis or trauma ought to cause abnormal mobility. There are, however, no such cases among his patients.

OWN RESEARCHES

Having methodically examined the roentgenograms of the fifty-nine patients suffering from tuberculous spondylitis that were treated in the Orthopedic Hospital of the Invalid Foundation, Military Ward, (1. Sotav S Jaosto 10), from March 1943 to March 1946 I observed, in five cases, a backwards displacement of one or more vertebrae already before the tuberculous vertebra had collapsed, the process having been localized to the lumbar spine. I found a retroposition of the same kind in a case of pyogenic spondylitis seu osteomyelitis columnae lumbalis.

CASE REPORTS

Case 1. Male, aged 35. No. 360/VIII/1945.

Diagnosis: Tub. vertebrae lumbalis II.

Fig. 1. Eight months after the first signs we see an incipient destruction of the anterior caudal corner of the second lumbar vertebra. The second lumbar intervertebral space[1] has diminished and a retroposition (of 4 mm) of the second lumbar vertebra is visible.

Case 2. Male, aged 23. No. 336/I/1943 and 12/V/1944.

Diagnosis: Tub. vertebrae lumbalis II-VI, (and one supernumerary lumbo-sacral vertebra).

Fig. 2 shows destruction of the pre-sacral vertebra eight months after the symptoms have begun. This picture shows no retroposition.

Fig. 3 shows the state eight months later. A destruction of those parts of the second, third, and fourth vertebra that are adjacent to the disks is visible. The second disk is almost entirely destroyed, the third disk is thinner than the fourth one. It is not evident whether the second lumbar vertebra is displaced. The third one is clearly displaced (5 mm.). —The pre-sacral vertebra is destroyed to a great extent.

Fig. 4. Two years later no retroposition of the second and third lumbar vertebra is visible any more. The disks are almost entirely destroyed. The process has now spread to the fifth lumbar vertebra. The fourth intervertebral space is narrower than before. The fourth and fifth lumbar vertebra are, both of them, displaced, 4 mm. and 3 mm. respectively. The density of the pre-sacral vertebra has increased.

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[1] The disks have, in this paper, the same numbers as the vertebrae next to them in cranial direction.

Case 3. Male, aged 27. No. 214/X/1945.

Diagnosis: Tub. vertebrae lumbalis III-IV.

Fig. 5 shows the state one year after the patient took ill. The anterior cranial corner of the fourth lumbar vertebra is destroyed, but the

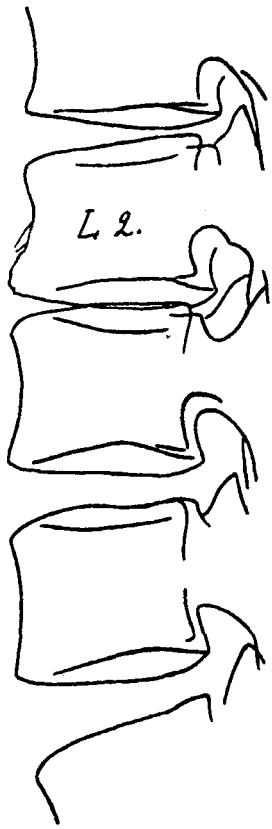

Fig. 1.

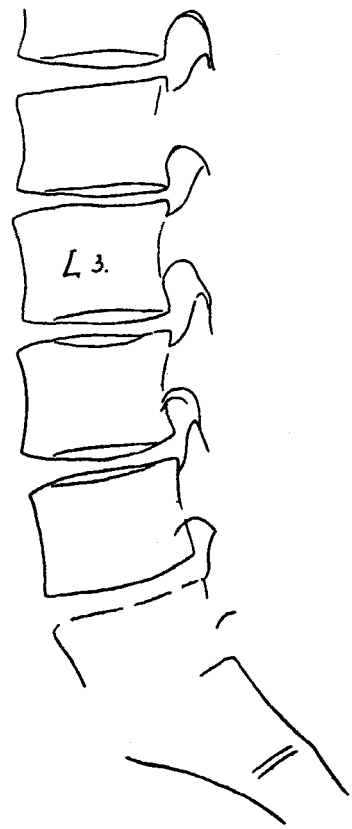

Fig. 2.

vertebra has not collapsed. A dim focus is visible in the anterior caudal part of the third vertebra. The third lumbar intervertebral space is narrow and the third lumbar vertebra is displaced 3 mm. A considerable retroposition of the second lumbar vertebra (6 mm.) is also visible. There are no other signs of the process having spread.

Case 4. Male, aged 23. No. 301/III/1943 and 91/V/1944.

Diagnosis: Tub. vertebrae lumbalis IV.

Fig. 6. Eight months after the day the pains began the disease is believed to be tuberculous spondylitis. The third lumbar disk is thinner than the other disks, but no retroposition is noticeable.

Fig. 7. Four months later a focus in the fourth lumbar vertebra is

Fig. 3.

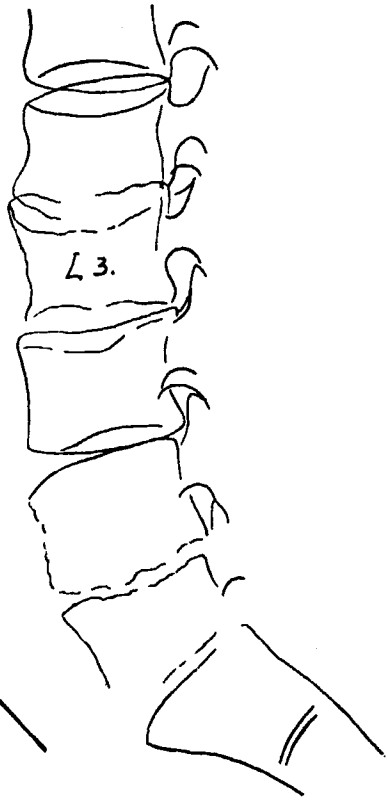

Fig. 4.

visible but is very dim. The focus is below the third disk. The latter is still narrower than before, and the third vertebra is displaced backwards 6 mm.

Fig. 8. Seven months later the focus in the fourth lumbar vertebra has grown larger. The third intervertebral space is very narrow and the third vertebra is displaced backwards.

Fig. 9. Four months later the cranial half of the fourth lumbar verte-

bra is almost entirely destroyed. The retroposition of the third vertebra has decreased to 2 mm.

Case 5. Male, aged 21. No. 88/IX/1945.

Diagnosis: Tub. et osteoporosis columnae lumbalis. Abscessus congestionis dorsi. Tub. pulmonum.

Fig. 5.

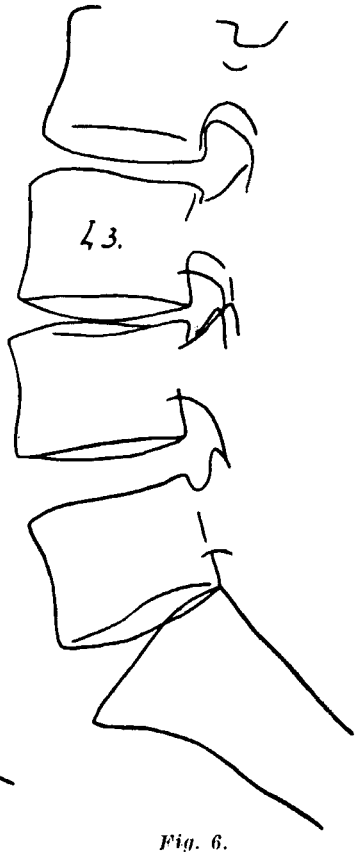

Fig. 6.

Fig. 10 shows osteoporosis with typical "fish vertebrae". Two years before the young man got acute tuberculous pneumonia. Seven months before the roentgenogram was made he got backache and it was stated that he had a congestive abscess. The second lumbar vertebra is displaced backwards 5 mm. and the third one 6 mm. Later on I shall discuss this case more in detail.

Case 6. Male, aged 21. No. 383/X/1946 and 105/XI/1946.

Diagnosis: Osteomyelitis columnae lumbalis.

Fig. 11. The patient fell ill nineteen months before this roentgenogram was made. He had backache and he showed signs of meningitis. The cerebrospinal fluid contained 210 cells per mm^3, Pandy's and Nonne's tests were positive. The leukocytosis reached the number 18500 per mm^3.

Fig. 7.

Fig. 8.

A contracture of the right psoas muscle was stated. When the roentgenogram was made he had a fistula after an incision of an inguinal abscess made one year before. An abscess in the back was incised on the day before this picture was taken. Staphylococci were found in the

pus. The possibility of a secondary infection through the inguinal fistula cannot be precluded, but the diagnosis osteomyelitis of the vertebral column seems to be certain.—The second lumbar intervertebral disk seems to be thinner than the other disks and a slight retroposition of

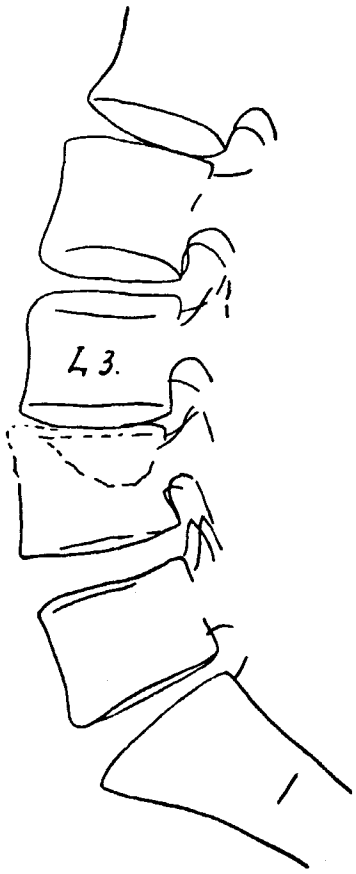

Fig. 9.

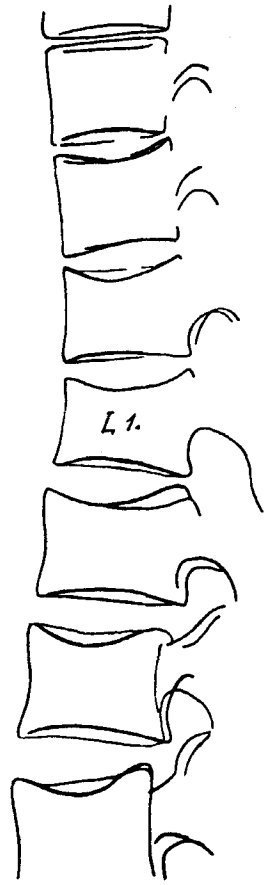

Fig. 10.

the second lumbar vertebra (2 mm.) is noticeable. No change of the structure of the vertebrae is visible.

Fig. 12. Five months later the incision wound in the back has healed up, but the fistula in the groin is still open. The spine shows a slight scoliosis. The patient feels pain both when he moves and when he is at rest. A considerable retroposition of the second lumbar vertebra (5 mm.)

is visible, and the second lumbar disk is thinner than the other disks. No change of the bone structure of the vertebrae is visible.

Fig. 13. When the fistula canals are filled, via the inguinal fistula, with roentgenopaque liquid, it becomes evident that the canals come

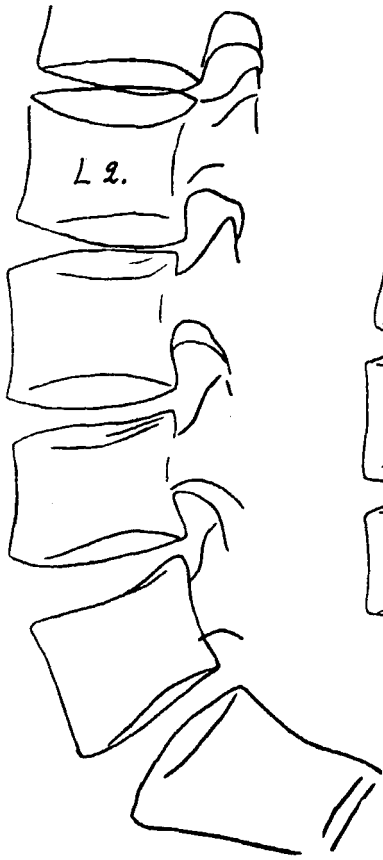

Fig. 11.

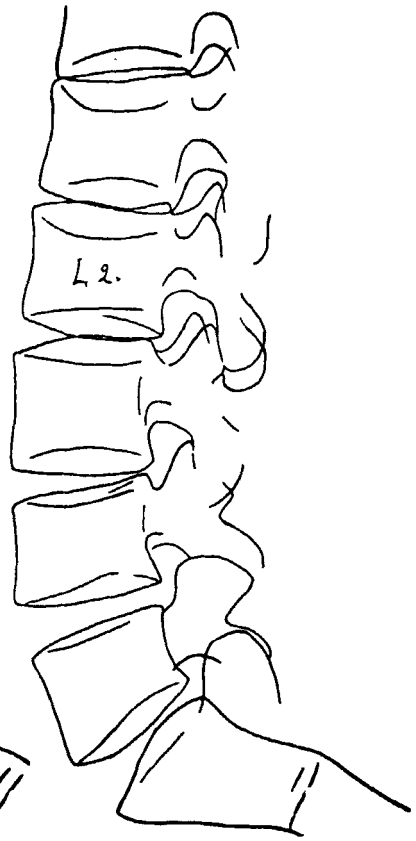

Fig. 12.

from some point near the second lumbar vertebra or from the vertebra itself.

On March 30th, 1946, I laid these observations before the Society of Finnish Surgeons and on April 17th before the Finnish Medical Society (Finska Läkaresällskapet). I found that

it was impossible to demonstrate, by means of my pictures from the archives, the instability i.e. the "parallel displacement and abnormal tilting movements" between the vertebrae observed by *Folke Knutsson* (1944). I hoped that further researches would

Fig. 13.

show that such an instability is also the reason for the retroposition stated in connection with tuberculous spondylitis. I am now able to present such a case.

Case 7. Female, aged 21. The Orthopedic Hospital of the Invalid Foundation No. 872/46.

Diagnosis: Tub. vertebrae lumbalis II.

Past history: Eighteen months ago the patient began to feel pain in

the lumbo-sacral region. Ever since then permanent backache, especially after exertion, but at times also when the patient is at rest. The ache is localized to the lumbo-sacral region in the middle line spreading to left in the region of the gluteus medius muscle and down the left hip,

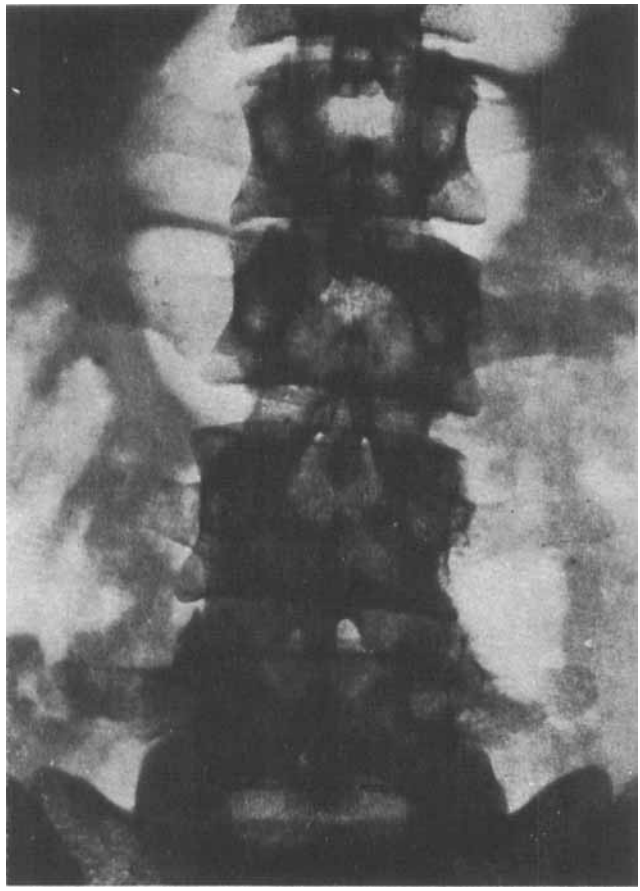

Fig. 14.

sometimes to right, too. Three months ago she felt pain in the lateral anterior part of the left thigh and has been feeling it since. The ache is felt down the thigh to the medial part of the knee. No pain when she coughs or sneezes. No feeling of paresthesia. The patient's power of work or motion has not decreased. None of the patient's relatives has had tuberculosis, neither is she cognizant of any origin of infection. She

has not suffered from pleurisy or erythema nodosum. A tuberculin test through injection into the skin (Mantoux) six months ago caused a reddening infiltration on the spot where the injection was made.

Status praesens: Height 168 cm., weight 60 kgs. Pallid, general condition good. Heart and lungs show no symptoms; this has also been stated

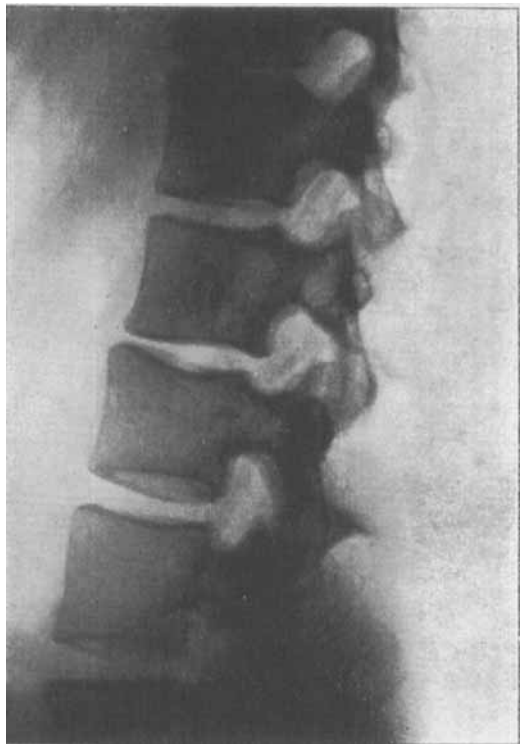

Fig. 15 a.

through a roentgenogram. Abdominal organs, genitals (virgin, examination per rectum), and urine test taken by catheterization are faultless. Blood: sedimentation rate 37 mm./1st hour. Hemoglobin 76/82 (Sahli), erytrocytes 4,980,000, colour index 0.82, leukocytes 5100, diff. faultless. Pirquet's reaction highly positive.

Local signs: The lumbar spine is quite straight and the upper lumbar part shows a slight kyphosis as a continuation of the thoracic kyphosis. A slight dorso-lumbar scoliosis with convexity to left. No gibbosity. No contracture. The patient bends forward until her finger-tips reach the floor but in doing so keeps the lumbar spine quite stiff. The bow causes

no pain. When the patient bends backward the kyphosis in the upper lumbar spine does not disappear. This movement causes pain deeply laterally in the anterior part of the left thigh. The slightest bending to right causes the same pain. A bending to left causes pain deeply in the

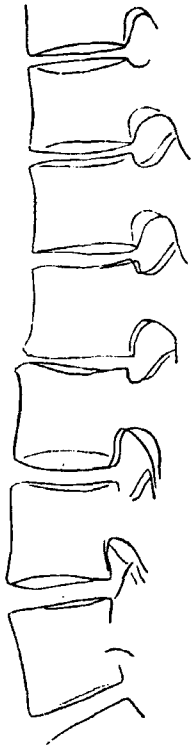

Fig. 15 b.

Fig. 16 b.

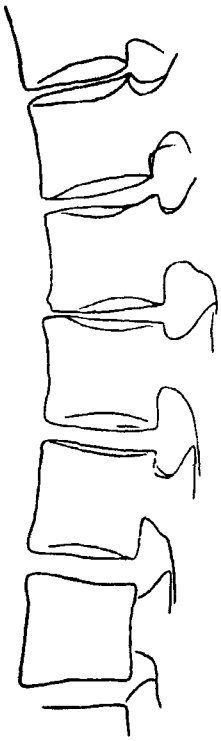

Fig. 17 b.

Fig. 15 b: Normal position. The second lumbar vertebra is visibly in retroposition and the intervertebral disk is thinner than the other disks. *Fig. 16 b:* Bending backward. The second lumbar vertebra is displaced backward in relation to the third vertebra. *Fig. 17 b:* Bending forward: The second lumbar vertebra is displaced forward to such a degree that the retroposition completely disappears.

left gluteal region. A deeper bending causes pain in the lateral anterior part of the left thigh.–Walks with stiff back without limping.—When she is sitting she feels pain in her left thigh as described above when lifting her left leg over her right one. The twisting movements turn out well, without pain.—In prone position the kyphosis in the upper lumbar spine does not disappear. Tenderness of the third lumbar vertebra, the

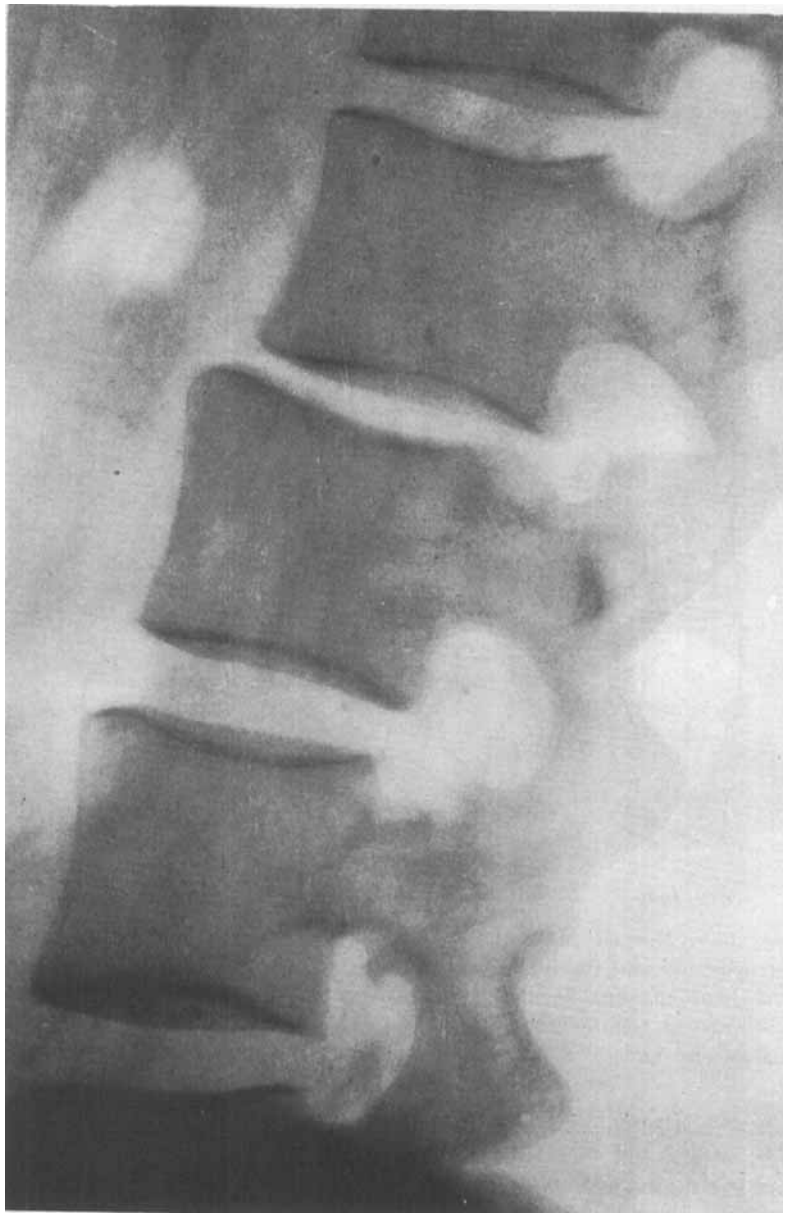

Fig. 16 a.

spinous process of the second lumbar vertebra slightly prominent.—No psoas abscesses are palpated. When the patient lifts both her legs stretched she feels the above mentioned pain in her left thigh. The hip-joints faultless. Lasègue's sign negative. Reflexes and sensibility faultless, no spasticity.

Roentgenogram of the lumbar spine:

Fig. 14. On May 27th, 1946, an antero-posterior roentgenogram shows that the second lumbar intervertebral disk is much thinner than the other disks. This disk is thinner to right than to left, and the spine, on this point, is curved to left. No changes in the outlines and structure of the vertebrae are found.

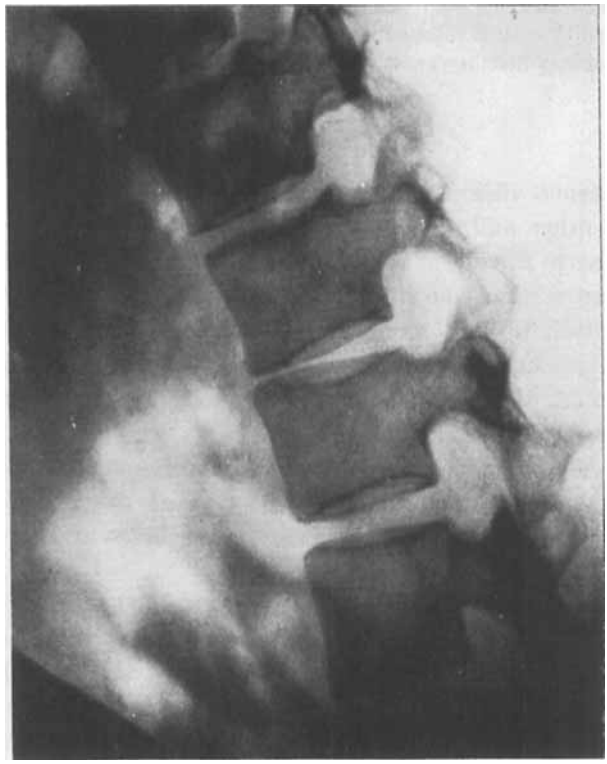

Fig. 17 a.

Fig. 15 a and 15 b. The lateral roentgenogram shows that the lumbar spine forms a slight kyphosis as a continuation of the thoracic kyphosis. The second lumbar intervertebral disk is much thinner than the other

disks. Small marginal spurs are seen on the corners of the adjacent vertebrae. The second lumbar vertebra is displaced backwards 4 mm. in relation to the third vertebra. The density of the vertebrae has not changed. No foci are noticeable.

On May 29th and June 4th, 1946, roentgenograms of the patient bending backward and forward in accordance with *Knutsson* were made.

Fig. 16 a and 16 b. Bending backward. A parallel displacement of the second lumbar vertebra has taken place and the vertebra is now displaced backwards 8 mm. in relation to the third vertebra. The anterior outline of the vertebrae clearly shows that the displacement is considerable.

Fig. 17 a and 17 b. Bending forward. The retroposition of the second lumbar vertebra is suspended, the vertebra having thus moved forward 8 mm. The anterior part of the second lumbar disk has thinned whilst the other disks seem to be of uniform thickness.—A focus adjacent to the second lumbar disk in the second lumbar vertebra is dimly seen.

DISCUSSION

A normal disk fastens the adjacent vertebrae very fixedly to each other and parallel displacements between the vertebrae do not arise in such cases. It is a well-known fact that instability occurs when the disks are degenerated. Whether the disk is destroyed through a spontoneous degeneration or through a tuberculous or other inflammatory process, the result as to the function of the disk should theoretically be the same. *Folke Knutsson* has already pointed out this.

My cases 1, 2, 3, and 4 show that retroposition occurs in connection with tuberculous destruction of the vertebrae and the disks of the lumbar spine before the body of the vertebra has collapsed.

Cased 2 and 4 elucidate the question of the connection between the degree of the destruction of the disk and the degree of the retroposition. In these cases we are able to follow the development of the process during three years and four months and during twenty-three months respectively. Even if these roentgenograms show the state at a certain moment arbitrarily chosen they favour the belief that the effect of the changes of the disks on the stability of the lumbar spine is, to a great extent, the same with tuberculosis as with disk degeneration.

A retroposition arises before the injured disk is entirely destroyed. After the disk substance is entirely destroyed and has perhaps been replaced by unspecific connective tissue and the surfaces of the vertebrae almost seem to touch each other, no retroposition is visible any longer, or, if a retroposition is visible, it is very slight.

My case 7 shows that retroposition with tuberculosis is really a sign of the instability between the vertebrae in the same sense as with disk degeneration.

Case 6 shows that retroposition occurs likewise with osteomyelitis in the lumbar spine. This discovery is not to be wondered at, as it is a well-known fact that the disk is destroyed in such cases, too.

Case 5 is of special interest. The roentgenogram shows osteoporosis and retroposition but no destruction of any vertebrae or disks. Only in case the disks are elastic and expansile they are able to make the vertebrae biconcave. It seems improbable that the juncture between the disk and the vertebra should have unfastened in any way. As the disk, however, has had an opportunity of expanding, it seems thinkable that the tension in the outer parts of the annulus fibrosus has lessened. This might be the reason for the instability that presents itself as a retroposition in the roentgenogram.

The practical importance of these observations is this: it may sometimes be easier to discern a retroposition on the roentgenogram than to discern whether the intervertebral disk has thinned. If one pays attention to the retroposition, it will be easy to discern the step in the curve formed by the posterior outlines of the vertebrae in the roentgenogram.

CONCLUSIONS AND SUMMARY

An instability between the vertebrae in the lumbar spine arises at an early stage—early in a clinical sense—with tuberculous spondylitis as well as with disk degeneration. In the roentgenogram this instability might show itself as a retroposition and might occur before any tuberculous changes in the vertebra itself are visible.

When tuberculous spondylitis in the lumbar spine is suspected it is a positive discovery to have found the retroposition of a vertebra. Such a discovery favours the belief that the process is to be found in either vertebra adjacent to the injured disk.

CONCLUSIONS ET RESUME

Une instabilité des vertèbres de la partie lombaire de la colonne vertébrale naît dans un stade relativement jeune—au point de vue clinique—de la spondylite tuberculeuse ainsi qu'elle le fait en cas de dégénération du disque. Une telle instabilité peut, dans la radiographie, se montrer comme une rétroposition et peut se produire avant l'apparition de modifications tuberculeuses dans la vertèbre elle-même.

Si l'on coupçonne une spondylite tuberculeuse dans la partie lombaire de la colonne vertébrale, une rétroposition d'une vertèbre est une constatation positive. Une telle observation indiquerait que le processus se produit dans une des vertèbres voisines du disque attaqué.

SCHLUSSFOLGERUNGEN UND ZUSAMMENFASSUNG

Genau wie bei Zwischenwirbelscheibendegeneration entsteht Instabilität der Lage der Lendenwirbelkörper in einem klinisch betrachtet frühen Stadium tuberkulöser Spondylitis. Diese Instabilität kann im Röntgenbild als eine Verschiebung nach hinten erscheinen und kann zwar vorkommen schon bevor tuberkulöse Veränderungen des Wirbels sich zeigen.

Wenn tuberkulöse Spondylitis im Lendenteil der Wirbelsäule befürchtet wird, ist die Verschiebung eines Wirbels nach hinten ein positiver Fund. Eine derartige Beobachtung spricht dafür, dass der Prozess in einem an die angegriffene Zwischenwirbelscheibe grenzenden Wirbel zu finden ist.

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