FROM MARTINA HANSEN'S HOSPITAL, BÆRUM, OSLO
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TUBERCULOSIS OF THE GREATER TROCHANTER

BY

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Although tuberculosis of the greater trochanter is not one of the most common forms of metastatic tuberculosis, it is not rare. Yet it has not been much discussed in the literature. *Sven Johansson* found it in 2.33 % of his cases of bone and joint tuberculosis. *Clairmont*, *Winterstein* and *Dimtza* write that it is rare; they found only 3 cases. *Melton* found 21 cases; *Meyerding* and *Mroz* 19; *Sassen* 6; *Kremer* and *Wiese* 2; *Stracker* and *Ingianni* each 1.

TABLE 1

Sex and Age Distribution at Onset of Symptoms in 36 Patients with Tuberculosis of the Greater Trochanter.

Age	Male	Female	Total
0-10 years	2		2
10-20 „	3	8	11
20-30 „	5	7	12
30-40 „	6		6
40-50 „	3	2	5
Total	19	17	36

During the 12 years Martina Hansen's Hospital has been open, 36 cases of tuberculosis of the greater trochanter have been treated, i.e. barely 2 % of all the cases of bone and joint tuberculosis. Table 1 shows their distribution, according to

sex and age. The sexes are nearly equally represented; and, as in other manifestations of tuberculosis most cases were between 20 and 30 years of age. The right side was affected in 21 cases, the left in 15.

MODE OF SPREAD OF THE DISEASE

In most cases of bone and joint tuberculosis the infection is brought by the blood stream. The comparatively rich blood supply of spongy bone in the greater trochanter and adjoining part of the femur should, as in other bones, favour this mode of spread of the disease. Other routes of the infection in this region must be mentioned because of the favourable conditions. In almost every case of tuberculosis of the greater trochanter we find infection of its bursa, which lies like a small cape round its lateral portion. Not infrequently the disease is confined to this bursa, while the greater trochanter itself shows no demonstrable changes. It is, therefore, probable that the bursa is the primary, and the greater trochanter the secondary focus. The bursa may be infected by the blood stream as in tuberculosis hygromata of the hand and wrist; it may also be infected by gravitation abscesses from tuberculous foci at a higher level, e.g. from the vertebrae passing out of the pelvis in front of the anterior superior spine of the ilium, or through the trigonum lumbale along the muscles going to or close by the greater trochanter, i.e. in the tensor fasciae latae and the gluteal muscles, and from an ilio-sacral infection. Medial psoas abscesses on the other hand, do not usually track toward the greater trochanter, but rather come in close contact with the lesser trochanter, in which, as far as I know, there is no record of isolated tuberculosis.

Waldenström believes that tuberculosis of the bursa of the greater trochanter often begins as tuberculosis of the greater trochanter; *Fliegel,* that a psoas abscess can infect both the hip-joint and the greater trochanter, and *Kremer* and *Wiese* that the infection may be secondary.

Table 2 gives the sites of other tuberculous foci in the 36

TABLE 2

Other Tuberculous Foci in 36 Patients with Tuberculosis of the Greater Trochanter

Site of lesion	Before the onset of symptoms from the trochanter	After the onset of symptoms from the trochanter	Total
Spine	7	1	8
Sacro-iliac joint	3		3
Hip joint		3	3
Shoulder joint	3		3
Knee	1		3
Ankle	1		1
Pelvic abscess	1		1
Lungs and pleurae	10	2	12
Other T.B. lesions outside bones and joints	6	2	8
Total	32	8	40

cases of trochanteric tuberculosis, and the chronological relationship of these foci to the trochanteric disease. Spondylitis and trochanteric tuberculosis were present together in 8 cases, and in 7 of them a gravitation abscess was found on the same side as the trochanteric tuberculosis, which had begun a considerable time after the gravitation abscess. In 23 of the 36 cases there were other extrapulmonary tuberculous foci. In the remaining 13 cases, the disease of the greater trochanter was the only extrapulmonary lesion.

One would except to find that tuberculosis of the greater trochanter occurs when there is tuberculosis of the hip with peri-articular abscesses, but there is no such case in my material. In 3, however, tuberculosis of the hip developed secondarily to the tuberculosis of the greater trochanter; in all 3 cases the interval between the appearance of the two foci was so long that it is probable that the disease had spread directly from the greater trochanter to the hip. *Sassen* has also reported one case in which the hip-joint was infected

from the greater trochanter: his patient had multiple, periosteal, tuberculous pelvic abscesses, and later developed tuberculosis of the greater trochanter.

It may therefore be assumed that in 11 of the 36 patients examined there was direct spread of the disease to the region of the greater trochanter from other tuberculous lesions. In the remaining 25 cases the disease in the region of the greater trochanter was probably primary.

For both categories there remains the question whether the disease began in the bursa or in the bone. Neither clinical nor radiographic examination of my material gives a definite answer to this question, but certain observations deserve mention.

In 1 case, the focus in the trochanter was discovered during routine radiography of the skeletal system in a case with tuberculosis of the knee-joint: there was no demonstrable involvement of the bursa. In 2 other cases the destructive process had advanced so far in the greater trochanter before the bursitis gave rise to symptoms that it is natural to assume that the disease had begun in the bone.

In the remaining 33 cases there was no reason to believe that the disease had begun in the bone, and certain findings suggested that it had begun in the bursa. In 2, no sign of bone destruction could be found on the radiographs or at operation. In most of the cases the first radiographic sign of bone involvement was a periosteal ossification with blurring of the outline of the lateral surface of the greater trochanter in the position of the bursa. Usually, this periosteal reaction was present for a considerable time before there was any sign of destruction of the bone itself. In several cases slight surface erosion of the bone, just under the bursa, was observed at operation. The ilio-tibial tract and the fascia lata exert considerable pressure on the bursa, and therefore also on the subjacent bone. This fact is, in my opinion, very important, and will be dealt with below under the heading of treatment.

The early appearance of the bursitis in relation to the disease of the bone, the massive periosteal reaction, and the

fact that the bone destruction often begins as a superficial erosion on its cortex, all suggest that in many, possibly most, cases the disease begins in the bursa. As there was no demonstrable difference between the cases in which the disease started from a gravitation abscess from a focus at a higher level and those in which it began in the trochanteric region, we may assume that in this group also the disease usually begins in the bursa.

7 of the 36 patients said that the disease of the greater trochanter began either immediately or some time after considerable trauma to the trochanteric region. These statements can hardly by themselves prove that trauma helped provoke the disease, though such a possibility cannot be excluded.

SYMPTOMATOLOGY

Pain and tenderness in the trochanteric region are the most constant symptoms. They were noted in 35 of the 36 cases; the pain was worse on walking, and usually on passive adduction of the limb. A swelling corresponding to the trochanteric bursa is an early sign; atrophy of the muscles of the corresponding thigh and buttock appears much later, and, even when the disease is advanced, there is not the marked muscular atrophy, which develops comparatively early in tuberculous arthritis. Muscle insufficiency and diminished thigh-pelvis stability can be found comparatively early, but rather because of increased pain when the stability is tested than because of muscle atrophy. The same is true of the patient's halting gait.

Sinus formation is the most common complication; it was present in 22 of the 36 cases. Some of the sinuses were already present, but many only developed after operation.

TREATMENT

Tuberculosis of the greater trochanter is not so crippling as tuberculous arthritis. Yet it is to some extent difficult to

treat and it distresses the patient on account of its chronic course and frequent relapses.

Surgery is combined with ordinary general treatment of the tuberculous infection. 66 operations were performed on 31 out of the 36 cases, either before (29), or during (37) hospitalisation. In 24 the greater trochanter was resected, while in 13 the focus was excised without a radical resection of the bone. Simple incisions are not included in the figures. 2 patients each had 5 operations.

Surgery aims at the radical removal of all diseased tissue, and at resection of the greater trochanter, whenever it is affected, even if there is only a periosteal reaction or infiltration of the overlying muscle and fascial attachments is visible at operation. When the disease begins in the bursa and only secondarily attacks the greater trochanter, one would expect early periosteal changes to heal, when the source of infection has been eliminated. This hope is often disappointed, probably because of the considerable constant compression by the tractus ilio-tibialis and fascia lata, which are particularly tight when they have shrunk as the result of inflammation and scar formation.

OPERATION TECHNIQUE AND USUAL FINDINGS AT OPERATION

The technique of the radical operation (removal of all diseased tissue and resection of the greater trochanter) might be expected to be fairly simple; the region is easily accessible, and there is little to fear from the neighbouring structures, but there are some important anatomical and functional considerations.

The skin incision should be made over the posterior border of the greater trochanter from a point a little below the crest of the ilium to at least 10-12 cm. below the greater trochanter. Sinuses in the line of the incision are excised; those situated more anteriorly should be excised separately. Infiltrations in the subcutis are radically removed, and the fascia is exposed.

Whenever the bursa is found perforated, whether with or without a skin sinus, there is always some infiltration of the fascia lata and tractus ilio-tibialis, both of which, on account of cicatricial contraction, may be so taut that after longitudinal division it is almost impossible to raise their margins from the underlying structures. *Therefore, all the infiltrated or sclerotic and retracted portion of the fascia and ilio-tibial tract should be radically removed, even when there seems to be no active inflammation.*

If the fascia and ilio-tibial tract show no sign of pathological changes, they should be incised longitudinally at the posterior part of the trochanteric region. The divided fascia can now be easily retracted to both sides, and the underlying tissues are easily accessible. If the fascia is divided over the centre of the greater trochanter or anterior to it, it is difficult to pull its posterior portion far enough aside to give access to the region under the gluteus maximus without a transverse division.

In most cases the trochanteric bursa is found to be already perforated by large diverticula, sometimes raw, sometimes more fibrous and thick-walled, full of brawny connective tissue, granulation tissue, or pus, according to the activity and age of the lesion. Occasionally, these diverticula extend some way down the thigh, not infrequently anteriorly under the tensor fasc. lat. muscle. But they are largest and most constant posteriorly and proximally, deep to the gluteus maximus muscle, whose flattened attachment to the inner side of the fascia lata is usually completely destroyed. These posterior diverticula may extend right up to the incisura ischiadica.

In 2 cases a connexion between a gravitation abscess and the lesion in the greater trochanter could be traced at operation. In one, who had previously been treated for ilio-sacral tuberculosis, a sinus ran from the focus in the greater trochanter towards the lower part of the iliosacral joint. Only its lower part was patent; it resembled an ordinary diverticulum of the bursa; but further up its lumen diminished, and its

upper portion was a solid band, without any lumen. In this respect it was unlike an ordinary bursal diverticulum, of which the distal end often presents a bulbous expansion. In the other case, with a history of a spondylitic gravitation abscess, there was a similar sinus in front of the greater trochanter; extending in the direction of the region between the spinae ilii ant. sup. and inf.; it, also, dwindled above, and became a scarred band without a lumen.

Rarely, a sinus communicates directly with bone. In most cases there is sclerotic thickening, with some ossification of the periosteum of the greater trochanter under the bursa. *Stracker* examined one case microscopically, and found that the tendon attachments had been partly converted into cartilage, with ossification. Under the periosteal thickening there may be a superficial erosion of the bone, and ill-defined cavities filled with masses of granulation tissue and sequestra. It is not always easy to demonstrate either the superficial erosions, or the foci of destruction in the spongy bone radiographically before operation. The greatest value of radiography is in showing the relationship of the tip of the greater trochanter to any destructive process which may exist. *For, when the greater trochanter is resected any diseased periosteum should also be removed, and the rest of the greater trochanter isolated subperiosteally.* The periosteum of the tip of the greater trochanter however must never be removed, even when it is diseased. If the tip itself is not diseased, it can be chiselled off without disturbing the muscle attachments, and later replaced. If it is diseased, it is isolated subperiosteally, and the periosteum, if it is also suspect, is scraped as clean as possible. The gluteus medius is the most important stabilizing factor between pelvis and thigh, and its attachment must therefore not be separated from the periosteum, as without the periosteum it is very difficult to get a functionally satisfactory connexion between the muscle and femur. If the periosteum has been preserved, the new attachment heals readily. Pelvic instability, which is so common after operations

on the greater trochanter, is primarily due to insufficiency of the gluteus medius.

The next step is to chisel off most of the greater trochanter, and round off the resection surface. The periosteum with its muscle attachments is as far as possible preserved, and the remains of the broad attachment of the gluteus maximus are secured to the border of the anterior portion of the fascia. If this is not feasible, it is secured to the periosteum on the anterior surface of the resected greater trochanter. If any, however little, of the fascia lata and tractus ilio-tibialis has been excised, they must not be sutured. It is best not to close even a longitudinal incision, for fear of secondary scarring with retraction and consequent tension in, and pressure on, the underlying tissues. On the other hand, the anterior border of the fascia can be secured to the under surface of the posterior subcutis, after it has been dissected free, to facilitate closure of the wound in layers.

After the operation the limb is immobilised in good abduction to facilitate the healing of the soft tissues which have been loosened over the tip of the greater trochanter. With the same object, the patient should remain in bed for at least three to four weeks after the operation unless the tip of the greater trochanter has been left intact.

In order to facilitate the detection of small sinuses and diverticula in the subcutaneous tissues, a dye may be injected into a sinus before the operation. It rarely goes into the large and deeply situated diverticula, but these are comparatively easy to find and remove, provided one has a good view of the field of operation.

A haematoma in the wound is one of the most common postoperative complications. It could, of course, be avoided by the insertion of a drain, preferably some distance from the incision in the skin. But drainage is seldom advisable in cases of tuberculosis because of the risk of sinus formation. There is the same risk if a haematoma is evacuated through the operation wound, and the most effective method is to aspirate

a day or two after the operation through a needle thrust deep into the wound. Aspiration is repeated as long as fluid can be obtained. This procedure should be followed even when there is no clinical evidence of haematoma; in most cases, blood, or at any rate blood-stained fluid, can be aspirated.

THE FOLLOW-UP EXAMINATION

One patient could not be traced. The other 35 were re-examined, either by myself in person or by letter. The average observation period between operation and re-examination varied from 6 months to 10 years, with an average of 3.9 years. The average interval between the first symptoms and the re-examination was 11.7 years.

TABLE 3
Physical Fitness after Tuberculosis of the Trochanter.

	Total resection alone, or after other operations	Partial resection	No operations and unknown operations in other hospitals	Total
Working full-time	15	1	4	20
Reduced working capacity	1	2	2	5
Unable to work and in bed	2	1	4	7
Unknown			1	1
Dead	2		1	3
Total	20	4	12	36

Table 3 shows their fitness for work and their condition. 20 of the 36 were fully fit for work; 3 had died. 6 were partially or completely unfit because of sinuses and pain. 1 case had tuberculosis of the hip; 1 had no sinus, but the leg was painful and weak; 1 case had renal tuberculosis.

The deaths were due to other tuberculous foci in 2, and to intercurrent disease in 1 case.

Table 3 shows that the proportion of patients found to be

fit for work was highest amongst those in whom the greater trochanter had been resected.

35 of the operations (25 total and 10 partial resections) had been performed in this hospital.

TABLE 4

The Frequency of Recurrence after 35 Operations for Tuberculosis of the Greater Trochanter According to the Method of Operation.

	Resection	Partial Resection	No recurrence	Recurrence	Total
1. Cases with fistulae before operation.					
a) no recurrence	7	1	8		8
b) recurrence	4	4		8	8
2. Cases without fistulae before operation.					
a) no recurrence	12	1	13		13
b) recurrence	2	4		6	6
Total	25	10	21	14	35

NB. Partial resection was only done in cases without radiographic evidence of bone destruction in the trochanter, and without any visible superficial bone erosion at operation.

Table 4 shows the frequency of relapse after operation. 6 out of the 25 treated by total resection, and 8 out of the 10 treated by partial resection relapsed. Partial resection had only been done in the cases in which there were no radiographic changes in the greater trochanter itself, and no sinus connected with bone could be found at operation.

SUMMARY AND CONCLUSIONS

A clinical and radiographic examination of 36 patients treated for tuberculosis of the greater trochanter at Martina Hansen's Hospital in the period 1936-1948 and later followed-up, showed that:

1: Most of the cases were grouped about the age 20-30 years;

the right side was affected in 21 cases and the left in 15. There were 19 males and 17 females.

2: Gravitation abscesses tracking in the direction of the trochanteric region and directly infecting it were found in 11 of the 36 cases; the source of these abscesses was tuberculous spondylitis in 7, and iliosacral tuberculosis in 3 cases. In these cases the disease began in the bursa of the greater trochanter, the greater trochanter itself being infected from the bursitis.

3: In the remaining 25 cases it is probable that the disease was brought to the region of the greater trochanter in the blood stream—the most common mode of spread of tuberculosis. In most of these 25 cases, however, the disease may have begun in the bursa, and spread thence to the greater trochanter.

4: In 3 cases, the tuberculosis spread from the greater trochanter to the hip-joint, in which destructive tuberculosis developed. But spread of the disease from hip-joint to greater trochanter was not observed in any case.

5: Sinus formation was the most common complication and was observed in 22 cases, either before or after operation.

6: Treatment is surgical, and should consist in the radical removal of all diseased tissue in the soft structures with resection of the greater trochanter even when only its periosteum shows visible changes. Old, scarred, and sclerotic foci in the tractus ilio-tibialis and fascia lata should be removed because of the considerable tendency of these structures to shrink and thus exert increased pressure on the bone—one of the causes, probably, of the high relapse rate. The surgical technique and the most common findings at operation are described.

7: Post-operative haematomata should be evacuated by repeated puncture instead of by drainage, which is an important cause of relapse.

9: 20 of the 36 patients were fully fit for work on re-examination. 6 still had sinuses, and 3 had died.

RESUME ET CONCLUSION

Un examen clinique et radiographique de 36 malades traités pour tuberculose du grand trochanter à l'hôpital Martina Hansen pendant les années 1936/1948 et réexaminés plus tard a fait apparaître ce qui suit :

1. La plupart des cas se groupaient entre 20 et 30 ans ; le côté droit était atteint dans 21 cas, le côté gauche dans 15. Il y avait 19 femmes et 17 hommes.
2. Sur les 36 cas, on en a trouvé 11 chez lesquels il y avait des abcès de gravitation montrant des traces en direction de la région du trochanter et l'ayant directement infectée ; l'origine de ces abcès était une spondylite tuberculeuse dans 7 cas et une tuberculose ilio-sacrée dans 3. La bourse du grand trochanter était le siège primaire de la maladie, le grand trochanter ayant été lui-même infecté par la bourse.
3. Dans les autres 25 cas, il est probable que la maladie ait été amenée dans la région du grand trochanter par le sang, le mode le plus courant de propagation de la tuberculose. Dans la plupart de ces 25 cas, la maladie doit cependant avoir commencé dans la bourse et s'être étendue ensuite au grand trochanter.
4. Dans 3 cas, la tuberculose s'est étendue du grand trochanter à l'articulation de la hanche, dans laquelle une tuberculose destructive s'est développée. Mais on n'a observé dans aucun cas qu'une maladie de l'articulation de la hanche se soit étendue au grand trochanter.
5. La formation d'un sinus est la complication la plus courante et a été observée dans 22 cas, soit avant, soit après l'opération.
6. Le traitement est chirurgical et devrait consister dans l'enlèvement radical de tous les tissus malades des structures molles avec résection du grand trochanter même si l'on ne constate des modifications que dans son périoste. De vieux foyers cicatrisés sclérotiques dans le tractus iliotibialis et le fascia lata doivent être enlevés, par suite de

la forte tendance qu'ont ces structures à se contracter et à exercer alors une pression accrue sur l'os, l'une des causes, probablement, du pourcentage élevé des rechutes. La technique chirurgicale et les trouvailles les plus communes à l'opération sont décrites.

7. Un hématone post-opératif doit être évacué par des ponctions répétées plutôt que par drainage ; c'est là une importante cause de rechute.
8. Parmi les 36 malades, 20 avaient leur pleine capacité de travail au moment de la réexamination, il y avait des sinus chez 6 et 3 étaient décédés.

ZUSAMMENFASSUNG

Die klinische und röntgenologische Nachuntersuchung von 36 Patienten die wegen Tuberkulose des trochanter major am Martina Hansen Krankenhaus in der Periode 1936—1948 behandelt und später beobachtet wurden, zeigte dass:

1. Die Mehrzahl der Fälle sich um die Jahre 20—30 gruppierten; dass die rechte Seite 21 mal und die linke 15 mal ergriffen waren. 19 Männer und 17 Frauen waren erkrankt.
2. Senkungsabscesse in die Trochanterregion mit Infektion dieser Region wurden in 11 von 36 Fällen gefunden. Der Ursprung der Abscesse war in 7 Fällen in tuberkulöser Spondylitis und in 3 Fällen in iliosacral Tuberkulose zu finden.

   In diesen Fällen begann die Erkrankung in der Barsa des trochanter major und der trochantes major war von der Bursa aus infiziert worden.
3. In den übrigen 25 Fällen besteht die Wahrscheinlichkeit dass die Krankheit der Region des trochanter major auf dem Blutwegenstand — die häufigste Art der Ausbreitung der Tuberkulose.

   In der Mehrzahl dieser 25 Fälle hat die Krankheit wahrscheinlich in der Bursa begonnen und hat dann auf den grossen Rollhügel übergegriffen.
4. In 3 Fällen griff die Tuberkulose vom trochanter major

auf das Häftgelenk über, in welchem sich eine destruktive Tuberkulose entwickelte. Ein Übergreifen vom Hüftgelenk zum trochanter major wurde hingegen in keinem Falle beobachtet.

5. Fistelbildung war die häufigste Komplikation und wurde in 22 Fällen entweder for oder nach der Operation beobachtet.
6. Die Behandlung ist eine chirurgische und sallte in einer radikalen Entfernung alles kranken Gewebes der Weichteile mit der Resektion des troch. major, selbst dann wenn nur sein Periost sichtbare Veränderungen zeigt, bestehen.

   Alte, narbige und sklerotische Herde im tractus iliotibialis und der fascia lata sollten entfernt werden wegen der ausgesprochenen Neigung dieser Gebilde zu Schrumpfen und dadurch einen zunehmender Druck auf den knochen auszuüben — wahrscheinlich eine der Ursachen für die hohe Auzahl der Rezidive. Die chirurgische Technik und häufigsten Operationsbefunde werden beschrieben.
7. Ein post operatives Hæmatous sollte durch wiederholte Punktion und nicht durch Drainage entleert werden. Es ist eine wichtige Ursache des Rezidivs.
8. 20 von den 36 Patienten waren voll arbeidstüchtig bei der Nachuntersuchung, 6 hatten Fisteln, und 3 waren gestorben.

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