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# ALBEE TREATMENT OF TUBERCULOUS SPONDYLITIS

BY

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The purpose of the present work is to give a survey of the patients with tuberculous spondylitis, altogether 54, who in the Seashore Hospital at Juelsminde have been treated with osteosynthesis of the vertebral column ad modum Albee, in the 5-year period of 1937—41. In connection herewith some remarks will be made about the most favorable point of time for the performance of this operation, based on the findings on serial X-ray examination, together with som remarks as to the most expedient size of the Albee bridge. The therapeutic results are reported on the basis of reexaminations.

As to the historical development of the operative technique and the clinical and roentgenological aspects of spondylitis, the reader is referred to some more comprehensive work on this question (*e.g.*, Knud Bierring: Kliniske undersøgelser over spondylitis tuberculosa med særligt henblik paa behandling med Albee's operation. (Dissertation. Copenhagen, 1934)).

## SURVEY OF MATERIAL

*Indications and Contraindications.*

All spondylitis patients are treated operatively with exception of those who present the following contraindications: Fistular spondylitis, but not abscess, unless this is situated in

the operating field or increasing considerably; serious florid tuberculosis of other organs, especially pulmonary tuberculosis; age over 55—60 years; cervical spondylitis, as in this region the operative treatment does not appear superior to conservative treatment. Of course, no operation is performed in a healed process (block formation).

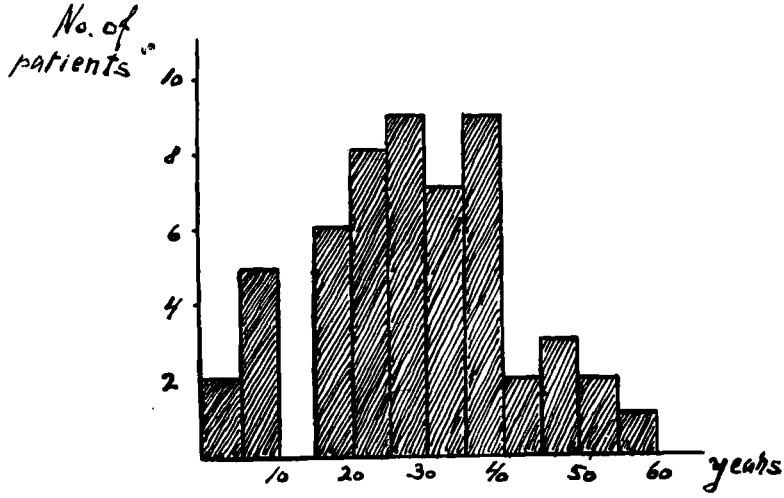


*Fig. 1.*
Age of the patients at the time of the operation.

Children are submitted to surgical treatment regardless of their age, but in the present material no patient was under 4 years.

The non-operated material from the same patient material is mentioned briefly. It comprises 76 patients, 67 adults and 9 children. In 41 of these patients the tuberculous process had healed, mostly under block formation. 22 patients presented a fistula, 5 patients had cervical spondylitis, and 3 had previously been subjected to osteosynthesis elsewhere. In 4 patients osteosynthesis was performed at the end of the above-mentioned 5-year period, and 1 patient is still under treatment with a view to eventual operative treatment.

Of these 76 patients 13 died. The causes of death have been

as follows: Fistular spondylitis (5 cases); tuberculous meningitis (3 cases); tuberculous sepsis (1 case); uremia (renal tuberculosis, 1 case); laminectomy for severe compression of the spinal cord (1 case); tracheotomy on a child with cervical spondylitis together with a deep abscess round the trachea (1 case);

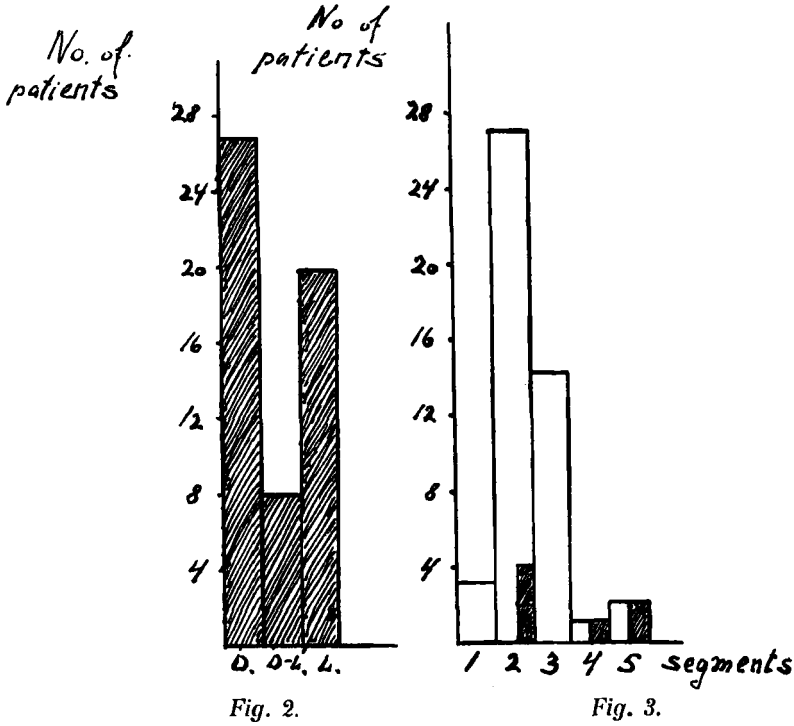


*Fig. 2.* *Fig. 3.*

*Fig. 2.*
Localization of the focus in the various cases.

*Fig. 3.*
Graph. presenting the number of patients with respectively 1, 2, 3 etc. segments involved.
The black columns represent children.

and sepsis after costotransversectomy, intrathoracic abscess with mixed infection (1 case).

The 54 patients treated with osteosynthesis of the vertebral

column within the 5-year period of 1937—41 include 27 women, 20 men and 7 children.

The age distribution of these patients is presented graphically in Fig. 1, and the localization of the foci in Fig. 2, where the locations are divided into three groups: dorsal, dorsolumbar and lumbar.

In these 54 patients (with 55 operated foci) the lesion affected altogether 133 segments, 111 in adults, 22 in children, *i.e.*, an average of 2.5 segments per patient, or 2.4 segments in adults, and 3.1 in children. For comparison, Hans Thomsen found an

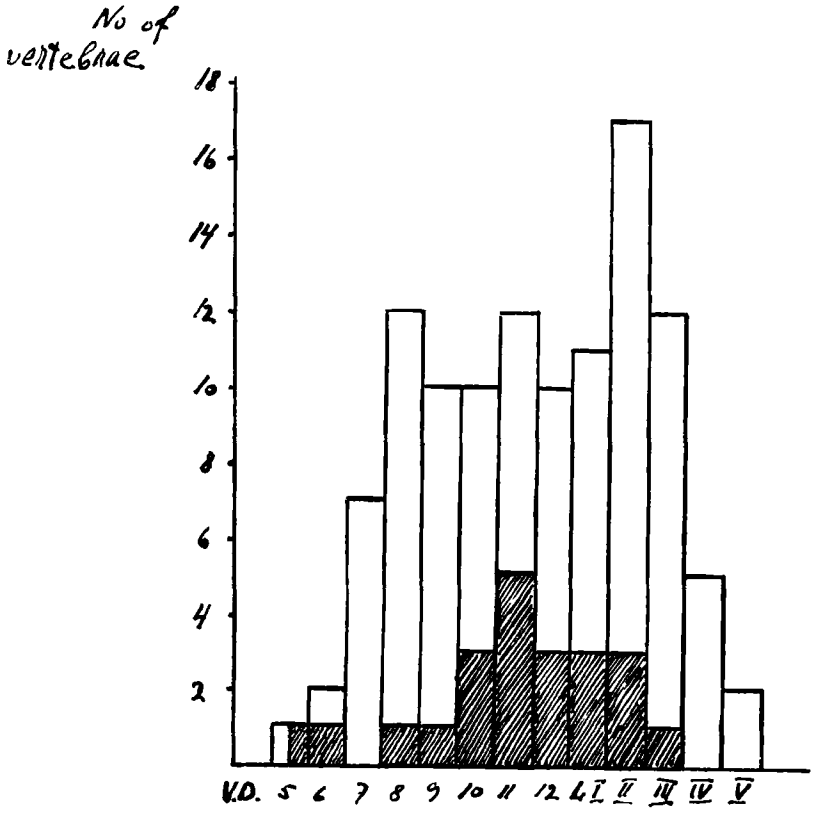


*Fig. 4.*
Frequency of the affection in the individual vertebræ.
The black columns represent children.

average of 2.4 segments for a material of 575 cases decided on by the Invalidity Insurance Council. Bierring states, on the basis of his own material and several foreign statistics, that the average number of segments involved varied from 2.2 to 2.8, with the larger average for the children.

For illustration of this point under another angle, Fig. 3 shows in how many patients respectively 1, 2, 3 etc. segments are affected.

Fig. 3 shows that only in 3 adults was the lesion limited to one vertebra, while 2 vertebræ were affected in 27 patients, and 3 vertebræ in 14; only 1 had 4 vertebræ affected, and in 2 no less than 5 vertebræ were involved. Among the children, 4 had 2 vertebræ affected, 1 had 4, and 2 had 5.

The frequency with which the individual vertebræ are attacked is illustrated in Fig. 4. It is seen to be almost the same for the individual segments of the lower half of the dorsal column and the upper part of the lumbar column. Still, vertebra L 2 is the one most often attacked in the adults. In the children the lesion is localized most often to the dorsolumbar part of the column. This is quite in keeping with Hans Thomsen's findings in the material from the Invalidity Insurance Council.

*Degree of Gibbosity.*

The size of the gibbosity gives some impression of the extent of the vertebral destruction. It has been graded therefore in four degrees. 1° is merely palpable; 2° is visible when the patient is undressed; 3° can be seen when the patient is dressed; and 4° covers the monstrous gibbosities.

In the present material, 1° was present in 9 cases, 2° in 38 cases, 3° in 3. Monstrous gibbosities did not occur; and 4 patients had no gibbosity whatever.

*Other Tuberculous Manifestations.*

Of these patients 48 (89 %) have presented altogether 74 tuberculous manifestations other than spondylitis, distributed as follows:

| | |
|---|---|
| Tuberculous abscesses of the skin | 1 |
| Cervical adenitis, tuberculous | 3 |
| Tuberculosis of abdominal lymph glands | 1 |
| Epididymitis | 3 |
| Erythema nodosum | 1 |
| Tarsal tuberculosis | 1 |
| Lupus of the face | 1 |
| Tuberculous osteoarthritis of the hip | 1 |
| „ „ „ „ elbow | 1 |
| „ „ „ „ knee | 3 |
| „ „ „ „ shoulder | 2 |
| „ „ „ „ ankle | 1 |
| Tuberculous ostitis of the ribs | 1 |
| Exudative pleurisy | 13 |
| Primary complex in the lungs (calcification) | 18 |
| Tuberculous salpingitis | 1 |
| „ tenosynovitis of the hand | 1 |
| „ baciluria (renal focus not demonstrated) | 4 |
| Renal tuberculosis | 1 |
| Pulmonary tuberculosis | 16 |
| | 74 |

*Abscess Formation.*

This phenomenon has been present in 41 patients (76 %), clinically or roentgenographically, in 24 of whom it could be demonstrated only by roentgenography. In one case (No. 25) the abscess appeared in the Albee scar; it will be mentioned under postoperative complications.

Considering the cases with clinical abscess formation as distinguished from the cases in which the abscess formation could be made out only by roentgenography and their distribution over the various parts of the vertebral column, we find the characteristic distribution shown in Table 1.

TABLE 1.
*Distribution of Abscess Formation.*

| | Clinical abscess (including roentgenographic) | Only roentgenographic abscess |
|---|---|---|
| Dorsal column | 3 | 20 |
| Dorsolumb. column | 4 | 2 |
| Lumbar column | 9 | 3 |

As will be noticed, abscess formation round the dorsal column will most often be recognizable only on X-ray examination, whereas an abscess arising from lumbar spondylitis in most cases can be ascertained clinically.

One patient (No. 14) had a temporary fistula after incision into an abscess (in another hospital), but it had healed before the operation.

*Compression of the Cord.*

Symptoms of medullary compression were recorded in 15 cases (28 %). In 10 of these patients the spondylitis was localized to the dorsal column, in 2 to the dorsolumbar, and in 3 to the lumbar column.

In most of these cases the pressure symptoms were relatively slight: accentuated tendon reflexes, patellar and pedal clonus, and positive Babinski's sign. In 5 patients (Nos. 11, 31, 42, 49, 50), however, there had been a more or less pronounced degree of paraparesis of the lower extremities. Four of these patients had dorsal spondylitis, one dorsolumbar spondylitis. In most of the patients these symptoms subsided already under the preoperative confinement to bed.

On reexamination, symptoms of medullary compression were present in 4 cases (10 % of the reexamined patients); 3 of them had not presented symptoms of this kind before the operation. In 3 of them the symptoms consisted in true paraparesis.

## DECISION ON THE POINT OF TIME FOR THE ALBEE OPERATION

Presumably the Albee operation is to be looked upon as an orthopedic measure, and hence many surgeons do not perform the operation before the destruction has stopped. In this connection, it is to be mentioned that experiences as to operation early in the phase of evolution have been very slight, primarily because really recent cases come under treatment but seldom,

but also because the disease often gives no symptoms till relatively late, and because the nature of the lesion not infrequently is mistaken for some length of time.

This does by no means imply that an early diagnosis is of minor importance. On the contrary, the period of expectation for the phase of evolution to subside can be used with profit for an introductory conservative treatment, in which efforts are made

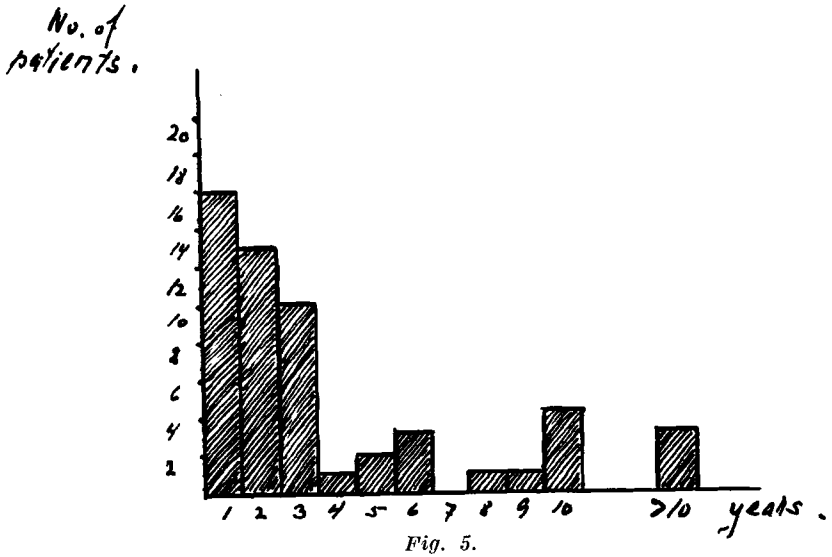


*Fig. 5.*
Duration of the symptoms prior to the operation.

to counteract the development of a gibbosity and to improve the general condition of the patient.

Here in the Seashore Hospital it is the general practice to keep the patient under observation for about 3 months. If the process shows no roentgenographical progress in this period, the operation is performed.

The interval between the appearance of the first symptoms and the time of the operation in the present material is shown in Fig. 5.

As will be noticed in 39 of the cases, *i.e.*, in 72 % of the material, the osteosynthesis was performed within 3 years after the first appearance of the symptoms.

Of course, the duration of the symptoms of spondylitis is not identical with the real duration of the disease or of the destructive phase, as this affection often gives no symptoms until relatively late. On the other hand, the symptoms may very well continue and even often be accentuated after the destructive phase has stopped. It is at this very point of time, in the reparative phase, that the inserted bridge is of particular value, being more effective than any external method of treatment by making the focus quiescent and thus promoting the reparative processes.

In order to follow the duration of the destructive processes and in this way try to estimate the duration of the evolutionary period, I have examined series of roentgenograms taken at intervals of about half a year. But it is impossible to determine the interval between the initial infection of a vertebra and the point of time when the changes become recognizable on X-ray examination. After experiences with other tuberculous bone lesions, however, it will presumably be fairly correct to estimate this interval as being from 3 to 6 months. Then comes the period in which the progress of the process has to be followed, till it turns quiescent. So it seems safe to set the duration of the evolutionary phase at from 1 to 3 years, though up to 4—5 years for children.

In the present material the duration of the destructive phase, reckoned from the first roentgenogram, has been as given in Table 2.

This means that in 35 of the patients (65 %) the destructive

TABLE 2.

*Duration of the Destructive Phase in Relation to the First Roentgenogram.*

(Recorded in number of foci.)

| | at 1' roentgenogram | Destruction ceased after 1 | 2 | 3 | 4 | 5 | 6 years | Not ceased |
|---|---|---|---|---|---|---|---|---|
| Adults | 31 | 7 | 5 | 2 | 0 | 0 | 0 | 3 (after 3, 2½, 1½ years) |
| Children | 4 | 1 | 0 | 0 | 0 | 1 | 0 | 1 (after 4½ years) |

phase has been concluded at the commencement of the observation.

On comparison between the time for the cessation of the destruction (Table 2) and the interval from the first appearance of symptoms to the operation (Fig. 5)—which in many cases will correspond to the time for the cessation of the destruction

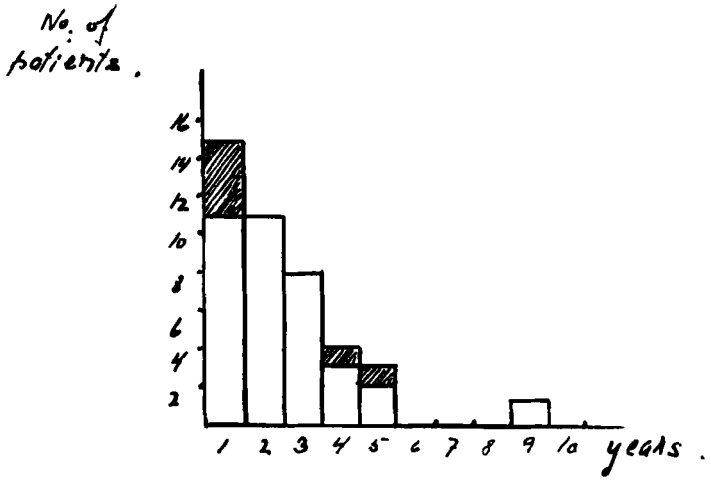


*Fig. 6.*
Duration of the destruction.
The black columns represent children.

—we find the length of time that has passed from the appearance of the first symptoms to the juncture when the destruction at any rate has ceased; for it is quite possible that it may have ceased at an earlier juncture. This is illustrated in Fig. 6.

In 8 cases the destruction had ceased at the time of the first X-ray examination, but it cannot be decided how long before this had taken place. In 4 patients it had not stopped definitively (Nos. 7, 13, 38, 42). Thus the destructive phase ceased within the first three years after the onset of symptoms in 34 patients (63 %).

For control, I have then looked into when the destructive phase has ceased in relation to the time of the operation (Table 3).

TABLE 3.

*Duration of the Destruction in Relation to Operation.*

(Recorded in number of foci.)

| | Destruction ceased: | | | | |
|---|---|---|---|---|---|
| | before op. | after 1 | 2 | 3 years | Not ceased |
| Adults | 40 | 5 | 0 | 0 | 3 |
| Children | 5 | 0 | 0 | 1 | 1 |

Thus the destructive process has not progressed in 45 patients (80 %) after the osteosynthesis was performed.

## THE OPERATION

The technique has been the one usually employed (see Bierring). As to the modifications adopted the reader is referred to the papers of Hans Thomsen (Ugeskrift for Læger 1938, p. 398, and 1939, p. 1506).

Except in two cases, in which a rib was used for the bridge, the bridge has invariably been taken from the tibia. Ether anesthesia was employed in every case (with Ombredanne's mask).

There has been no fatal outcome of the operation (in a total of 58 Albee operations, 4 having been performed since the end of the period here considered). In a material of 1960 operations, collected from altogether 11 hospitals or departments, Bierring found the total operation mortality to be 1.3 %, varying from 1 % to 3.8 %.

*Extension of the Albee Bridge.*

Many surgeons have adopted the general principle to let the bridge cover at least two normal vertebræ above the ones affected and two normal vertebræ below. But, is it necessary, let alone most expedient, to let the bridge cover so many segments?

In the spondylitic material of the Invalidity Insurance Council, Hans Thomsen has found that of 100 patients treated with the Albee operation 15 are "permanent invalidity bene-

ficiaries". Among these 15 patients, the cause of invalidity in 7 was an almost complete loss of mobility in the vertebral column "as if they had a rod in their back" and in these cases the bridges were found to cover 7—9 segments. Only in one case was the destruction more extensive, while in the remaining 6 patients the affection involved only 1—3 segments. These 6 patients were disabled by the therapeutic measure, not by the disease.

With a view to the fact that the destructive process in a majority of the cases had ceased at the time of the operation, it urges to consider whether it might not be *sufficient to block the affected vertebræ together with 1, at the most 2, normal.* In many cases, especially when the tuberculous process is localized to the adjacent surfaces of two vertebræ, it will be sufficient merely to block the segments attacked.

The extension of the osteosynthesis in Bierring's and the writer's materials is shown in Table 4.

TABLE 4.
*Extension of the Osteosynthesis.*
Bierring's figures in parenthesis.

| | | Extension of the osteosynthesis | | | | | |
|---|---|---|---|---|---|---|---|
| | Affected vertebræ | + 1 | + 2 | + 3 | + 4 | + 5 | + 6 normal vertebræ |
| Adults | 21 | 11 | 9 | 4 | 2 | 0 | 0 |
| | (1) | (2) | (5) | (11) | (13) | (16) | (4) |
| Children | 2 | 1 | 0 | 1 | 3 | 0 | 0 |
| | 0 | (2) | (3) | (4) | (3) | (3) | 0 |

*Postoperative Complications.*

Hematoma in the wound of the leg has occurred in 14 cases, and oedema of the leg in 4, in a total of 15 patients.

Symptoms from the urinary tract have appeared in 8 patients in the form of urethral colic accompanied by the passage of calculi or hematuria. (Similar symptoms were present in one patient prior to the operation.)

Hematoma in the Albee wound occurred in 1 patient. Here

the paraspinal space had been filled with bone-marrow. After puncture, the hematoma did not return.

Small epithelial defects appeared in the Albee scar in two patients; they soon healed in both cases.

Fistulation of the Albee scar occurred in one patient, a little more than one year after the operation. The patient was readmitted and the fistula healed in a couple of months.

Unilateral peroneal paresis appeared in one case; it subsided slowly.

Finally, abscess formation in the Albee scar occurred in one case, in which a rib had been used for the bridge. Tubercle bacilli were demonstrated in the pus from this abscess. The presence of a tuberculous focus in the rib employed cannot be excluded with certainty. About one year after the operation the abscess had disappeared; the costal bridge was absorbed.

*Postoperative Course.*

With few exceptions, all the patients have been confined to bed for 3 months after the operation, resting in the plaster cast which was made before the operation; and then they commenced to get up. On an average, they have been discharged from the hospital after 3 additional months. With the preoperative observation period of 3 months, the total stay in the hospital thus amounts to about 9 months.

For the children the postoperative confinement to bed has generally lasted 2—3 months longer than for the adults.

A bandage in the form of a celluloid corset has been employed in the after-treatment of 6 children and 6 adults, *i.e.*, about 13 % of the adults. In a schematic survey of the material, the length of time which the bandage has been worn after the operation is given in months, except where the bandage is still being worn, which is signified merely by +.

## REEXAMINATION

(41 patients)

As in this patient material the columnar osteosynthesis was performed within the period of 1937—41, the observation period must naturally be relatively short, and the outcome of the reexamination will therefore be liable to some uncertainty. In most cases, however, such conditions as progression of the tuberculous process and complications in the form of compression of the spinal cord, abscess formation, etc., will be manifest within the first year after the operation. Further, it is safe to reckon that it may easily take at least one year before the full capacity for work is recovered, when the lesion involves such a serious disease as tuberculous spondylitis.

For these reasons, in working up the therapeutic results I have omitted all the patients who were operated upon within the past year.

One patient had died (No. 22).

This was a man, 21 years old. A little over one year after a successful Albee operation for spondylitis involving the 11' and 12' vertebræ, he was readmitted with a large deep abscess and a new focus in the 3' and 4' lumbar vertebræ. Fistulation and a mixed infection developed, and about a year after he died with sepsis, after repeated hemorrhages from the fistulæ.

There thus remain 41 patients, at the reexamination of whom 13 had an observation period of at least 3 years, 10 at least 2 years and 18 at least 1 year.

Of the 12 patients who were operated on during the past year, 4 are still under treatment. One of these 4 patients is soon to be discharged; the remaining 3 have been readmitted, 2 for abscess formation, 1 for paraparesis.

### *Present State of Health.*

Of the 41 patients, 30 are well, with regard to the columnar affection. Two of these patients are under treatment for other affections, however, one (No. 6) for multiple tuberculous foci in

the bones, the other (No. 39) for tuberculosis of abdominal lymph glands. This means that 28 patients (68 %) appear to be perfectly well.

Improvement is recorded for 7 patients, who practically all have occasional attacks of pain in the musculature of the back, especially on working. One patient (No. 38) is readmitted; in his case the destructive process has not stopped definitely.

No improvement is recorded for 4 patients. They are all under treatment at this writing; 2 have paraparesis (Nos. 33 and 42); 2 have new foci, one with fistulæ and mixed infection (No. 10), the other with a large abscess (No. 41).

*Mobility of the Vertebral Column.*

Fair mobility of the vertebral column, meaning at least two-thirds of the normal mobility, is found in 29 patients (68 %), including perfectly normal mobility in 14 cases. In 12 patients the mobility is lower than two-thirds of the normal. In five of these patients (Nos. 10, 21, 24, 38, 42) the mobility is very slight. Nos. 10 and 21 have two foci in the vertebral column; in No. 21 both foci were treated with osteosynthesis, each with its own bridge, each covering two segments. No. 24 has a complicating coxitis. In Nos. 38 and 42 the process is not yet altogether quiescent. Apart from No. 21, in whom the bridge covers four segments, in none of these cases does the bridge extend over more than three segments.

*Fate of the Bridge.*

In 33 patients the bridge is found to have fused solidly with the spinous processes into which it was inserted. In 4 cases the bridge has been interrupted between, or failed to fuse with, all the spinous processes osteosynthesized, although without compromising the result aimed at, as the affected segments still are blocked solidly. In those cases in which the bridge has extended down in the sacrum, *i.e.*, in 3 of these 4 cases, it is interrupted at the level of the intervertebral space between the fifth lumbar vertebra and the sacrum, probably owing to differences in

mobility in these two parts of the spinal column. It seems superfluous, therefore, to let the bridge extend down into the sacrum except in sacrolumbar spondylitis.

In two patients with thoracic spondylitis (Nos. 16 and 42) the localization of the bridge cannot be ascertained with certainty but, at any rate, the affected segments are covered by it.

All told, then, the result aimed at with the operation has been obtained in 39 patients (93 %).

Pure fusion of the bridge was observed in 3 cases, two of which (Nos. 24 and 25) are the only ones in which a costal bridge has been employed. The third of these patients, a child (No. 7), shows pseudarthrosis formation in several places.

In two children (Nos. 5 and 6) the bridge was long very indistinct on X-ray examination or suggestive of "pseudarthroses". After respectively 3 and 4½ years, however, both patients presented a well-defined bridge which had fused well with the surroundings. In these cases as well as in a few other similar cases, particularly in children, in whom an osteo-periosteal flap of the tibia has been used for bridge, it appears to take a long time before these transplants organize into solid bony bridges.

In 3 of the cases in which the destruction has not yet ceased, the bridge has healed well. In the fourth (No. 7) the possibility cannot be excluded that the continually spreading process may be the cause of the "pseudarthrosis formation". Apart from this, the bridge appears to be well organized.

*Occupation and Working Capacity.*

Altogether 16 patients stated that they are fully able to work, while 12 claimed their working capacity was approximately normal, *i.e.*, at least two-thirds of the normal. This group includes 5 children who are in full attendance at school and participate in ordinary playing without any inconvenience. Functionally satisfactory results have thus been obtained in 28 patients (68 %).

A working capacity between one-third and two-thirds of the normal was found in 5 cases, and a working capacity below one-

third in 1; for the 7 patients who were still under treatment the working capacity is reckoned as nil.

TABLE 5.
*Occupations and Working Capacity of the Patients in the Present Material.*

| Occupation | M. | F. | Total | Working capacity Good | Fair | 1/3-0 | |
|---|---|---|---|---|---|---|---|
| Domestic work | | 14 | 14 | 10 | 2 | | |
| Agriculture | 4 | | 4 | 3 | | 1 | |
| Heavy manual labor | 6 | | 6 | 3 | 1 | 2 | |
| Rather strenuous work Total | 10 | 14 | 24 | 16 | 3 | 5 | 24 |
| Office and business | 4 | 1 | 5 | 3 | 2 | | |
| Light manual work | 3 | 3 | 6 | 4 | | 2 | |
| Less strenuous work Total | 7 | 4 | 11 | 7 | 2 | 2 | 11 |
| Children | | | 6 | 5 | | 1 | 6 |
| Total | | | 41 | 28 | 5 | 8 | 41 |

The material is divided after the occupations of the patients into two groups, one covering more strenuous work with relatively heavy demands on the physical ability of the worker, the other covering less strenuous work; in this way the working capacity that has to be characterized as unsatisfactory is ascertained in nearly one-third of the cases in both groups, suggesting that the nature of the ocupation is of minor significance to the future working capacity of the patient. So, when the lesion of the spinal column and its eventual sequelæ have been remedied, the patients should be able to resume their old occupation regardless of the physical requirements it may imply.

In the present material only two patients have changed occupation, namely: No. 3 who turned from factory work to painter's trade, and No. 17 who changed from barber's trade to commercial work.

*Schematic Survey*

| Pt. No. | Sex | Age at onset | Other tuberculous manifestations: Pulmonary | Other tuberculous manifestations: Extrapulmonary | Localization of spondylitis | Abscess: Clinical | Abscess: Roentgenographic | Neurological symptoms | Degree of gibbosity | Operation: Age at oper. | Operation: Duration of illness before oper. in years | Operation: Date of oper. | Operation: Extent of bridge | Operation: Complications: Crural hematoma | Operation: Complications: Crural oedema |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | F. | 21 | Exud. pleur. pulm. tbc. | 0 | D 8—9—10 | 0 | + | 0 | 2 | 26 | 5 | 14/4 1937 | 2+3+1 | 0 | 0 |
| 2 | F. | 29 | 0 | 0 | L 2—3 | 0 | 0 | 0 | 2 | 30 | 1 | 19/7 1937 | 1+2+S | 0 | 0 |
| 3 | M. | 18 | 0 | Epididymitis | L 4—5 | + | 0 | 0 | 2 | 20 | 2 | 26/7 1937 | 1+2+S | 0 | 0 |
| 4 | M. | 21 | 0 | 0 | D 7—8 | 0 | + | 0 | 2 | 22 | 2 | 29/7 1937 | 2+2+1 | 0 | 0 |
| 5 | M. | 3 | Primary complex | 0 | D 10 – 11 | 0 | + | 0 | 2 | 4 | 1 | 9/11 1937 | 2+2+2 | 0 | 0 |
| 6 | F. | 3 | Pulm. tbc. | Osteoarthrit. of shoulder, knee, ankle | D 11—12— L 1—2—3 | 0 | + | 0 | 2 | 6 | 2 | 19/11 1937 | 0+5+0 | 0 | 0 |
| 7 | F. | 4 | Primary complex | Osteoarthrit. of knee | D (10—11)— 12 L (1—2) | 0 | 0 | 0 | 2 | 4 | 1/2 | 8/2 1938 | 2+1+2 | 0 | 0 |
| 8 | F. | 36 | Exud. pleur. | Cervical spondilitis | D 5—6—7 | 0 | + | + | 2 | 37 | 1 1/2 | 18/2 1938 | 1+3+2 | 0 | 0 |
| 9 | F. | 26 | Exud. pleur. | Osteoarthrit. of elbow | L 4—5 | 0 | + | 0 | 1 | 27 | 1 1/2 | 12/4 1938 | 1+2+S | 0 | 0 |
| 10 | M. | 24 | Pulm. tbc. | Urine: + TB. Spondyl. L 5 | D 11—12 | 0 | + | + | 0 | 24 | 1/2 | 19/4 1938 | 1+2+1 | 0 | 0 |
| 11 | F. | 7 | Primary complex | 0 | D 9—10—11 | 0 | + | + | 3 | 17 | 10 | 14/7 1938 | 2+3+2 | 0 | 0 |
| 12 | M. | 30 | 0 | Epididymitis | D 8—9—10— 11—12 | 0 | + | + | 2 | 39 | 10 | 23/7 1938 | 0+5+0 | + | 0 |
| 13 | M. | 36 | Exud. pleur. pulm. tbc. | 0 | D 8—9—(10) | 0 | + | + | 2 | 36 | 1 | 27/7 1938 | 1+2+1 | 0 | 0 |
| 14 | F. | 25 | Exud. pleur. | 0 | L 2—3 | + | + | + | 0 | 26 | 1/2 | 12/9 1938 | 1+2+1 | 0 | 0 |
| 15 | M. | 31 | Primary complex | 0 | D 10—11—12 | + | + | 0 | 2 | 36 | 5 | 23/9 1938 | 2+3+1 | 0 | 0 |
| 16 | F. | 5 | Pulm. tbc. | 0 | D 8—9 | 0 | + | 0 | 2 | 6 | 1 | 15/10 1938 | 2+2+2 | 0 | + |

*of the Material.*

| Operation | | Post op. | | Reexamination | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Complications | | | | | | | Abscess | | | | | Disablement benefit | Occupation |
| Urethral colic | Other complications | Confinement to bed in mths. | Bandage for mths. | Year after oper. | State of health (possible symptoms) | Capacity for work | Clinical | Roentgenographic | Neurological symptoms | Fate of bridge | Mobility of vertebral column | | |
| 0 | 0 | 2 | 5 | 3 | Well | Normal | 0 | 0 | 0 | 2+3+1 | Normal | Past | Housewife |
| 0 | 0 | 3 | 0 | 3½ | Well | > 2/3 | 0 | 0 | 0 | 1+2+0 | > 2/3 | Present | Wife of farmer |
| + | 0 | 3 | 0 | 2 | Well | Normal | 0 | 0 | 0 | 1+2+0 | 2/3 | Present | Painter's apprentice (fact. worker) |
| + | 0 | 3 | 6 | 1½ | Well | > 2/3 | 0 | + | 0 | 2+2+1 | Normal | Past | Mechanic |
| 0 | Epithelial defect | 4 | + | 3 | Well | | 0 | 0 | 0 | 2+2+2 | Normal | 0 | |
| + | 0 | 5 | + | 4 | Well as to spine. Still in hosp. | | 0 | + | 0 | 0+5+0 | < 2/3 | 0 | |
| 0 | 0 | 7 | + | 3 | Improved | | 0 | + | 0 | 0+5+0 interrupt. | < 2/3 | 0 | |
| 0 | 0 | 3 | 0 | 4 | Well | Normal | 0 | 0 | 0 | 1+3+2 | > 2/3 | 0 | Seamstress |
| 0 | 0 | 2½ | 0 | 3 | Well | > 2/3 | 0 | 0 | 0 | 0+2+0 | 2/3 | 0 | Wife of optician |
| + | 0 | 3 | 0 | 4 | Readm. with new focus | 0 | + | + | 0 | 0+2+1 | Poor | 0 | Laborer |
| 0 | 0 | 3 | 0 | 1½ | Well | > 2/3 | 0 | 0 | 0 | 2+3+2 | 2/3 | 0 | Seamstress |
| 0 | 0 | 3 | 0 | 1 | Well | Normal | 0 | + | 0 | 0+5+0 | Normal | Past | Ship's mate |
| + | Fistula in scar | 3 | 0 | 3 | Improved | < 2/3 | 0 | + | + | 1+3+0 | < 2/3 | Present | Agent |
| 0 | 0 | 3 | 0 | 2 | Well | Normal | 0 | + | 0 | 1+2+1 | Normal | Past | Housemaid |
| 0 | 0 | 4 | 0 | 3 | Well | > 2/3 | + | + | 0 | 2+3+1 | > 2/3 | Past | Farmer |
| + | Hemtaoma in scar | 6 | 0 | 2½ | Well | | 0 | 0 | 0 | 3+2+0 | Normal | 0 | |

*Schematic Survey*

| Pt. No. | Sex | Age at onset | Other tuberculous manifestations: Pulmonary | Other tuberculous manifestations: Extrapulmonary | Localization of spondylitis | Abscess: Clinical | Abscess: Roentgenographic | Neurological symptoms | Degree of gibbosity | Operation: Age at oper. | Operation: Duration of illness before oper. in years | Operation: Date of oper. | Operation: Extent of bridge | Complications: Crural hematoma | Complications: Crural oedema |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | M. | 4 | 0 | Tarsal tbc. | D 11—12—L 1 | 0 | 0 | + | 2 | 19 | 14 | 23/10 1938 | 1+3+0 | 0 | 0 |
| 18 | F. | 24 | Primary complex | Cervical adenitis | L 1 | + | + | 0 | 2 | 25 | 1 | 8/11 1938 | 1+1+1 | 0 | 0 |
| 19 | F. | 31 | Exud. pleur. pulm. tbc. | 0 | L 1—2—3 | + | 0 | 0 | 2 | 33 | 2 | 23/11 1938 | 0+3+0 | 0 | 0 |
| 20 | M. | 37 | 0 | 0 | D 7—8 | 0 | + | 0 | 2 | 40 | 3 | 11/1 1939 | 0+2+0 | 0 | 0 |
| 21 | M. | 51 | Exud. pleur. pulm. tbc. | 0 | D 9—10—(11) L 1—2 | 0 | + | 0 | 2<br>2 | 54 | 2½ | 20/4 1939 | 0+2+0<br>0+2+0 | + | 0 |
| 22 | M. | 17 | Exud. pleur. | Spondylitis L 3—4 | D 11—12 | 0 | + | 0 | 2 | 19 | 2 | 29/6 1939 | 0+2+0 | 0 | 0 |
| 23 | F. | 20 | Exud. pleur. prim. compl. | 0 | L 3 | 0 | 0 | 0 | 0 | 23 | 3 | 11/7 1939 | 0+1+1 | 0 | 0 |
| 24 | M. | 31 | Primary complex | Cervical adenitis. Coxitis | L 2—3 | 0 | 0 | 0 | 1 | 34 | 3 | 22/7 1939 | 0+2+0 costal bridge | | |
| 25 | F. | 45 | Primary complex | Erythema nodosum | D 10—11 | 0 | 0 | 0 | 1 | 47 | 2 | 25/7 1939 | 0+2+0 costal bridge | | |
| 26 | F. | 17 | Exud. pleur. prim. compl. | 0 | D 10—11 | + | + | 0 | 2 | 17 | ½ | 26/9 1939 | 1+2+0 | + | 0 |
| 27 | M. | 24 | 0 | Tub. abscess of skin | L 1—2 | 0 | + | 0 | 1 | 25 | 1½ | 18/10 1939 | 0+2+0 | + | 0 |
| 28 | F. | 1 | Primary complex | Lupus of face | D 11—12—L 1—2 | + | + | 0 | 2 | 7 | 6 | 19/10 1939 | 0+3+0 | 0 | 0 |
| 29 | M. | 14 | Primary complex | 0 | D 8—9 | 0 | 0 | 0 | 2 | 15 | ½ | 15/3 1940 | 1+2+1 | + | + |
| 30 | F. | 27 | 0 | 0 | D 12—L 1—2 | 0 | 0 | 0 | 2 | 37 | 10 | 27/4 1940 | 0+3+0 | 0 | 0 |
| 31 | M, | 47 | 0 | Epididymitis | D 11 – 12 | 0 | + | + | 2 | 49 | 2 | 21/5 1940 | 1+2+0 | 0 | 0 |

*Cont. 1.*

| Operation | | Post op. | | Reexamination | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Complications | | | | | | | Abscess | | | | | | | |
| Urethral colic | Other complications | Confinement to bed in mths. | Bandage for mths. | Year after oper. | State of health (possible symptoms) | Capacity for work | Clinical | Roentgenographic | Neurological symptoms | Fate of bridge | Mobility of vertebral column | Disablement benefit | Occupation |
| 0 | 0 | 3 | 0 | 2½ | Well | Normal | 0 | 0 | 0 | 1+3+0 | ⅔ | 0 | Merchant School (barber's apprentice) |
| 0 | 0 | 4 | 0 | 3½ | Well | Normal | 0 | 0 | 0 | 1+1+1 | Normal | Past | Housewife |
| 0 | 0 | 3 | 0 | 3 | Well | Normal | 0 | 0 | 0 | 0+3+0 | ⅔ | Past | Wife of laborer |
| 0 | 0 | 3 | 0 | 2½ | Well | Normal | 0 | 0 | 0 | 0+2+0 | $<$ ⅔ | Past | Farm hand |
| 0 | 0 | 3 | + | 2 | Improved | $<$ ⅓ | 0 | 0 | + | 0+2+0<br>0+2+0 | Poor | Present | Farmer |
| 0 | 0 | 3 | 0 | | Died 2 yrs. after oper. | | | | | 0+2+0 | | 0 | Clerk |
| 0 | 0 | 3 | 0 | 2 | Well | $>$ ⅔ | + | 0 | 0 | 0+1+1 | Normal | Past | Wife of laborer |
| + | | 3 | 0 | 3 | Improved (coxitis) | $<$ ⅔ | 0 | 0 | 0 | Partial absorption | Poor | Present | Laborer |
| 0 | Fistula in scar | 3 | + | 2 | Improved sometimes pain | $<$ ⅔ | 0 | 0 | 0 | Partial absorption | ⅔ | Past | Wife of laborer |
| 0 | 0 | 4 | 0 | 2 | Well | Normal | + | + | 0 | 1+2+0 | Normal | 0 | School for housekeeping |
| + | 0 | 3 | 0 | 2 | Well | Normal | 0 | 0 | 0 | 0+2+0 | Normal | Past | Farm hand |
| 0 | 0 | 6 | + | 1½ | Well | | + | 0 | 0 | 0+3+0 | Normal | 0 | |
| 0 | Epithelial defect | 3 | 16 | 1½ | Well | Normal | 0 | 0 | 0 | 1+2+1 | ⅔ | 0 | Draper's apprentice |
| 0 | 0 | 3 | 0 | 2 | Well | Normal | 0 | 0 | 0 | 0+3+0 | $>$ ½ | Past | Wife of architect |
| 0 | 0 | 3 | 0 | 1 | Well | Normal | 0 | + | 0 | 1+2+0 | $<$ ⅔ | 0 | Laborer |

*Schematic Survey*

| Pt. No. | Sex | Age at onset | Other tuberculous manifestations: Pulmonary | Other tuberculous manifestations: Extrapulmonary | Localization of spondylitis | Abcsess: Clinical | Abcsess: Roentgenographic | Neurological symptoms | Degree og gibbosity | Operation: Age at oper. | Operation: Duration of illness before oper. in years | Operation: Date of oper. | Operation: Extent of bridge | Operation: Complications: Crural hematoma | Operation: Complications: Crural oedema |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 32 | F. | 20 | Exud. pleur. | Urine:+TB. Spndl. D 12—L 1 | D 10—11 | + | 0 | 0 | 2 | 26 | 6 | 9/7 1940 | 0+2+0 | 0 | 0 |
| 33 | M. | 18 | Pulm. tbc. | 0 | D 6—7—8 | 0 | + | 0 | 2 | 21 | 3 | 17/7 1940 | 1+3+0 | + | 0 |
| 34 | F. | 18 | Primary complex | 0 | D 12—L 1—2 | 0 | + | 0 | 2 | 38 | 20 | 12/8 1940 | 0+3+0 | 0 | 0 |
| 35 | M. | 24 | Exud. pleur. | 0 | D 10—11 | 0 | 0 | 0 | 2 | 26 | 2 | 16/8 1940 | 0+2+1 | + | 0 |
| 36 | F. | 16 | Primary complex | 0 | L 2—3 | + | + | 0 | 2 | 17 | 1 | 30/8 1940 | 0+2+0 | 0 | 0 |
| 37 | F. | 8 | Pulm. tbc. | 0 | D 10—11 | 0 | + | 0 | 2 | 9 | 1 | 11/9 1940 | 1+2+0 | + | + |
| 38 | M. | 44 | 0 | Osteoarthrit. of shoulder | L 1—2 | 0 | 0 | 0 | 1 | 46 | 2½ | 11/10 1940 | 0+2+0 | 0 | + |
| 39 | F. | 24 | Pulm. tbc. | Osteoarthrit. of knee. Abdominal adenitis | L 2—3 | 0 | 0 | 0 | 2 | 24 | ½ | 23/10 1940 | 0+2+0 | 0 | 0 |
| 40 | F. | 27 | Exud. pleur. pulm. tbc. | Tub. salpingit. | D 7—8—9 | 0 | + | 0 | 2 | 36 | 9 | 10/12 1940 | 0+3+0 | 0 | 0 |
| 41 | F. | 25 | 0 | Spondylitis D 11—12 L 1—2 | D 7—8—9 | 0 | + | 0 | 2 | 32 | 7 | 7/2 1941 | 0+3+0 | + | 0 |
| 42 | M. | 45 | 0 | Renal tbc. | D 8—9 | 0 | + | 0 | 2 | 55 | 10 | 27/5 1941 | 1+2+0 | 0 | 0 |
| 43 | F. | 26 | Pulm. tbc. | 0 | L 2—3—4 | 0 | 0 | 0 | 2 | 30 | 4 | 8/7 1941 | 0+3+0 | 0 | 0 |
| 44 | F. | 25 | Primary complex | 0 | L 1—2 | 0 | 0 | + | 1 | 28 | 2 | 12/8 1941 | 0+2+0 | + | 0 |

*Cont. 2.*

| Operation | | Postop. | | Reexamination | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Complications | | | | | | | Abscess | | | | | | | |
| Urethral colic | Other complications | Confinement to bed in mths. | Bandage for mths. | Year after oper. | State of health (possible symptoms) | Capacity for work | Clinical | Roentgenographic | Neurological symptoms | Fate of bridge | Mobility of vertebral column | Disablement benefit | Occupation |
| 0 | 0 | 3 | 0 | 1 1/2 | Well | > 2/3 | 0 | + | 0 | 0+2+0 | Normal | Present | Wife of laborer |
| 0 | 0 | 3 | 7 | 1 1/2 | Adm. with paraparesis | 0 | 0 | + | + | 1+3+0 | > 2/3 | Present | Hotel porter |
| 0 | 0 | 3 | 0 | 1 1/2 | Improved sometimes pain | 2/3 | + | + | 0 | 0+3+0 | 1/3 | Present | Wife of laborer |
| + | 0 | 3 | 0 | 1 | Well | Normal | 0 | 0 | 0 | 0+2+1 | 2/3 | Past | Office clerk |
| + | 0 | 3 | 0 | 1 1/2 | Well | Normal | 0 | 0 | 0 | 0+2+0 | Normal | Present | Ladies' hairdresser |
| 0 | 0 | 3 | + | 1 | Well | | 0 | + | 0 | 1+2+0 | Normal | | |
| 0 | 0 | 3 | 0 | 1 | Process not ceased Readm. | 0 | 0 | 0 | 0 | 0+2+0 | Poor | 0 | Trained conductor |
| 0 | 0 | 3 | 0 | 1 | Well as to spine. Readm. abdom. aden. | 0 | 0 | 0 | 0 | 0+2+0 | 2/3 | Present | Housemaid |
| 0 | 0 | 3 | 0 | 1 | Well | < 2/3 | 0 | 0 | 0 | 0+3+0 | Normal | Present | Office clerk |
| 0 | 0 | 3 | 0 | 1 | Readm. with new focus | 0 | + | + | 0 | 0+3+0 | 1/3 | Present | Wife of farmer |
| 0 | 0 | 3 | 0 | 1 | Readm. with paraparesis | 0 | 0 | + | + | ? | Poor | 0 | Carpenter |
| 0 | 0 | 3 | 0 | | Readm. with abscess | | | | | | | Present | Wife of farmer |
| 0 | 0 | 3 | 0 | | Readm. with abscess | | | | | | | Present | Wife of clerk |

*Schematic Survey*

| Pt. No. | Sex | Age at onset | Other tuberculous manifestations | | Localization of spondylitis | Abscees | | Neurological symptoms | Degree of gibbosity | Operation | | | | Complications | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pulmonary | Extrapulmonary | | Clinical | Roentgenographic | | | Age at oper. | Duration of illness before oper. in years | Date of oper. | Extent of bridge | Crural hematoma | Crural oedema |
| 45 | F. | 17 | Pulm. tbc. | 0 | L 3—4 | 0 | 0 | 0 | 0 | 35 | 18 | 9/9 1941 | 0+2+0 | + | 0 |
| 46 | F. | 20 | Primary complex | 0 | D 8—9 | 0 | + | 0 | 3 | 20 | 1/2 | 16/9 1941 | 1+2+1 | + | 0 |
| 47 | M. | 7 | Pulm. tbc. | 0 | D 5—6 | 0 | 0 | 0 | 2 | 7 | 1/2 | 19/9 1941 | 1+2+2 | 0 | 0 |
| 48 | M. | 20 | Primary complex | 0 | L 2—3 | + | 0 | 0 | 1 | 21 | 1 1/2 | 24/9 1941 | 1+2+0 | + | 0 |
| 49 | F. | 23 | Primary complex | Tub. ostitis. Costal fistula | L 2—3 | + | + | 0 | 1 | 28 | 5 1/2 | 7/10 1941 | 0+2+0 | 0 | 0 |
| 50 | F. | 39 | 0 | 0 | D 7—8 | 0 | + | + | 2 | 40 | 1 | 14/10 1941 | 0+2+1 | + | 0 |
| 51 | F. | 32 | 0 | 0 | D 12—L 1 | 0 | 0 | + | 2 | 34 | 2 | 17/10 1941 | 0+2+1 | 0 | 0 |
| 52 | F. | 35 | Exud. pleur. pulm. tbc. | Urine: +TB. | D 12—L 1—2 | + | + | 0 | 3 | 38 | 3 | 18/11 1941 | 0+3+0 | 0 | 0 |
| 53 | F. | 48 | 0 | Tub. tenosynovitis of hand | L 3—4 | + | 0 | 0 | 1 | 50 | 2 | 21/11 1941 | 1+2+0 | 0 | 0 |
| 54 | M. | 30 | 0 | Tub. cervical adenitis | L 2 | 0 | + | + | 2 | 33 | 3 | 10/12 1941 | 1+1+1 | 0 | 0 |

*Relation to the Invalidity Insurance Council.*

In this material, 20 patients have never received disablement benefit. Of these twenty patients, 7 are children, one (No. 8) is not a Danish subject; one (No. 10) receives public aid of other nature; one (No. 38) is provided for through civil service employment; and one (No. 54) has applied for disablement benefit but his case has not been decided on. This means that 9 of the patients have not applied for any benefit or have not been reckoned as disabled in the sense of the law.

*Cont. 3.*

| Operation | | Post op. | | Reexamination | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Complications | | | | | | | Abscess | | | | | | | |
| Urethral colic | Other complications | Confinement to bed in mths. | Bandage for mths. | Year after oper. | State of health (possible symptoms) | Capacity for work | Clinical | Roentgenographic | Neurological symptoms | Fate of bridge | Mobility of vertebral column | Disablement benefit | Occupation |
| 0 | 0 | 3 | 0 | | | | | | | | | 0 | Housewife |
| 0 | 0 | 3 | 0 | | | | | | | | | Present | Housemaid |
| 0 | 0 | 4 | + | | Still in hosp. | | | | | | | 0 | |
| 0 | 0 | 3 | 0 | | | | | | | | | Present | Farm hand |
| 0 | 0 | 2½ | 0 | | | | | | | | | Present | Probationary nurse |
| 0 | 0 | 3 | 0 | | Readm. with paraparesis | | | | | | | Present | Wife of farmer |
| 0 | peroneal paresis | 3 | 0 | | | | | | | | | Present | Wife of farmer |
| 0 | 0 | 3 | 0 | | | | | | | | | Present | Shoemaker's widow |
| 0 | 0 | 3 | 0 | | | | | | | | | Present | Wife of laborer |
| 0 | 0 | 3 | 0 | | | | | | | | | Applied for | Merchant |

Of the total material, 34 (63 %) have received disablement benefit; in 12 of these cases the compensation has been discontinued, while 22 still receive support. Of these twenty-two invalidity beneficiaries, 4 are still receiving the benefit 3 years after the operation, 2 after 2 years, and 7 after 1 year.

The following tabulation gives a schematic survey of the clinical aspects of the individual patients. The location of the bridge is recorded by three figures the middle one of which gives the number of segments affected, while the two others give

the number of normal vertebræ covered by the bridge above and below the affected ones.

## SUMMARY

An account is given of a material comprising 54 patients suffering from tuberculous spondylitis and treated with osteosynthesis ad modum Albee.

None of the patients has died in connection with the operation. One patient died about two years after the operation from the sequalæ of a fistulous spondylitis with mixed infection.

The material comprises altogether 133 affected vertebræ, averaging 2.5 segments per patient.

In nine-tenths of the cases other tuberculous manifestations are recorded. Abscess formation are recorded in three-fourths of the patients, and symptoms of compression of the spinal cord in one-fourth.

Serial roentgenographic examination has been employed in order to estimate the duration of the destructive phase. In this way the destruction was found to have stopped within three years after the appearance of the first symptoms in about two-thirds of the patients.

In a little less than three-fourths of the cases the osteosynthesis was performed within three years after the first appearance of symptoms.

The most serviceable length of the Albee bridge is discussed. In 23 patients only the affected segments were blocked; and in 12 cases the bridge covered also one normal segment, and in 9 cases, two normal segments.

Mention is made of the postoperative complications and the postoperative course of the cases.

The account of the reexamination covers 41 patients as all those who were treated operatively within the past year are omitted here. The working capacity is found to be good in two-thirds of the cases; and two-thirds of the patients are found to be perfectly well.

As to the fusion of the bridge with the surrounding bony structures, the result aimed at with the operation has been obtained in nine-tenths of the cases. In all those cases where the bridge extended down into the sacrum, "pseudarthrosis" developed at the level of the interval between the fifth lumbar vertebra and the sacrum. In two cases where a costal bridge was employed, the healing was poor.

Hardly two-thirds of the total number of patients have received disablement benefit, and this compensation has again been discontinued for one-third of the beneficiaries.

## RÉSUMÉ

Il est rendu compte d'observations portant sur 54 malades souffrant de spondylite tuberculeuse traités par ostéosynthèse ad modum Albee.

Aucun des malades n'est décédé comme suite de l'opération. Un malade mourut environ deux ans après l'opération des séquelles d'une spondylite fistuleuse avec infection mixte.

Les observations comprennent au total 133 vertèbres malades, soit en moyenne 2,5 segments par malade.

Dans 9/10 des cas d'autres manifestations tuberculeuses ont été enregistrées. Chez trois quarts des malades on a pu relever la formation d'un abcèz et chez un quart il y avait des symptômes de compression de la moelle épinière.

Des examens radiographiques en série ont été effectués afin de déterminer la durée de la phase destructive. Il a été établi par ce moyen que chez deux tiers des malades la destruction s'arrête dans l'espace des trois ans qui suivent l'apparition des premiers symptômes.

Chez un peu moins de trois quarts des cas l'ostéosynthèse a été pratiquée dans les trois ans qui ont suivi les premières manifestations des symptômes.

La longueur la plus utile du pont d'Albee est discutée. Chez 23 malades seuls les segments atteints ont été bloqués. Dans 12 cas, le pont couvrait aussi un segment normal et dans 9 cas deux segments normaux.

Les complications postopératives et le cours post-opératif de la maladie sont mentionnés.

Le compte-rendu des examens complémentaires porte sur 41 malades, tous les cas traités opérativement durant l'an dernier ayant été omis. L'aptitude au travail était bonne dans deux tiers des cas et deux tiers des malades pouvaient être considérés comme entièrement guéris.

En ce qui concerne la croissance du pont avec les tissus osseux environnants, de bons résultats ont été obtenus dans neuf dixième des cas. Dans tous les cas où le pont descend dans le sacrum, il s'est développé une « pseudarthrosis » au niveau de l'intervalle entre la cinquième vertèbre lombaire et le sacrum. Dans deux cas où un pont costal a été utilisé, la guérison était mauvaise.

Sur le nombre des malades envisagés ici, deux tiers ont bénéficié de la pension d'invalidité et un tiers de ceux-ci ont pu y renoncer plus tard.

## ZUSAMMENFASSUNG

Es wird über ein Material von 54 Patienten berichtet, die an tuberkulöser Spondylitis litten und mit Osteosynthese ad modum Albee behandelt wurden.

Keiner der Patienten starb in Verbindung mit der Operation. Ein Patient starb etwa zwei Jahre nach der Operation an den Folgen einer fistulösen Spondylitis mit Mischinfektion.

Das Material umfasst insgesamt 133 angegriffene Wirbel, durchschnittlich 2,5 Segmente pro Patient.

In $^{9}/_{10}$ der Fälle waren andere tuberkulöse Erscheinungen zu verzeichnen. Eine Abszessbildung wurde bei $^{3}/_{4}$ der Patienten festgestellt und Symptome von Kompression des Rückenmarks in $^{1}/_{4}$.

Eine Serien-Röntgenuntersuchung wurde vorgenommen, um die Dauer der destruktiven Phase abzuschätzen. Auf diesem Wege wurde festgestellt, dass die Zerstörung bei $^{2}/_{3}$ der Patienten innerhalb von drei Jahren nach dem Auftreten der ersten Symptome zum Stillstand gekommen war.

In etwas weniger als $^3/_4$ der Fälle wurde die Osteosynthese innerhalb von drei Jahren nach dem ersten Auftreten der Symptome ausgeführt.

Die günstigste Länge der Albee-schen Brücke wird erörtert. Bei 23 Patienten wurden nur die angegriffenen Segmente überbrückt; in 12 Fällen deckte die Brücke auch ein normales Segment und in 9 Fällen zwei normale Segmente.

Die postoperativen Komplikationen und der postoperative Verlauf der Fälle wird erwähnt.

Der Bericht über die Nachuntersuchung umfasst 41 Patienten, wobei alle die, welche im letzten Jahre operativ behandelt worden sind, weggelassen wurden. Die Arbeitsfähigkeit wurde in $^2/_3$ der Fälle gut befunden; und $^2/_3$ der Patienten konnten für vollständig gesund erklärt werden.

Was die Verwachsung der Brücke mit der Struktur des umgebenden Knochengewebes betrifft, so ist das mit der Operation beabsichtigte Ergebnis in $^9/_{10}$ der Fälle erzielt worden. In allen den Fällen, wo die Brücke sich bis zum Sacrum hinab erstreckte, hat sich in der Höhe des Zwischenraums zwischen dem fünften Lumbalwirbel und dem Sacrum eine »Pseudoarthrose« entwikkelt. In zwei Fällen, wo eine Costalbrücke Anwendung gefunden hatte, war die Heilung schlecht.

Knap $^2/_3$ der Gesamtanzahl der Patienten haben Invalidenrente erhalten, und diese Vergütung konnte bei $^1/_3$ der Rentenempfänger wieder wegfallen.

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