ARTHRODESIS IN TUBERCULOSIS OF THE HIP JOINT

An Analysis of Fifty Cases

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The treatment of tuberculous arthritis of the hip joint is essentially conservative. Prolonged rest, fixation of the joint, good food, fresh air, sunlight, and other aids to improvement in general condition and the building-up of resistance to infection, are all necessary. Such treatment must remain the principal weapon in our armamentarium. Nevertheless there are certain indications for fixation of the joint by arthrodesis. When there is no secondary infection the result of conservative treatment is almost invariably a fibrous ankylosis. Even fibrous ankylosis is sometimes sound and capable of withstanding the stresses and strains of everyday life, but in a proportion of cases there is instability which may result in recurrence of disease, progressive deformity, or persistent pain in a joint which appears otherwise quiescent. The indications for arthrodesis may be summarised as follows:

1. Unsound fibrous ankylosis at the end of the initial period of conservative treatment;
2. Painful fibrous ankylosis without deformity;
3. Late development of flexion-adduction deformity.

It is important that a careful selection of cases should be made. Operation should be performed only when the disease is judged to be quiescent; to operate when there is clinical or radiographic evidence of activity is definitely contra-indicated. In young children it is difficult to achieve bone ankylosis, and arthrodesis should be postponed until the child has attained the age of twelve or thirteen years, deformity being corrected by weight and pulley traction; the additional period of hospital treatment which is required is of little disadvantage as compared with the failure of premature arthrodesis. In elderly patients multiple tuberculous foci are very frequent—not only in the lungs and kidneys but also in other bones and joints, and the risks of operation are seldom justifiable. Arthrodesis of the hip joint is not a life-saving measure; its purpose is to convert a weak and yielding ankylosis into a sound, immobile, and painless fixation which will not yield to weight-bearing.

In recent years a number of surgeons have expressed dissatisfaction with the failures of osseous fusion after extra-articular ilio-femoral arthrodesis. Badgley and Hammond (1942) published the end-results of arthrodesis for tuberculosis of the hip in seventy-one patients. They reported good results in 52 per cent., fair in 22 per cent., poor in 8 per cent., and a mortality of 18 per cent. These failures led to the development of other methods of extra-articular fusion, notably ischio-femoral arthrodesis. Brittain (1942) described thirty-five cases of ischio-femoral arthrodesis, nineteen for tuberculosis of the hip. Of these, 80 per cent. showed osseous fusion after the first operation and a further 8 per cent. fused after subsequent operations. Knight and Bluhm (1945) reported seven cases of ischio-femoral arthrodesis for tuberculous arthritis in which one to two year end-results were available; in all, ten operations were performed and osseous fusion took place in six (60 per cent.). Freiberg (1946) using the same technique, reported six cases; in four there was osseous fusion and one had slight movement one year after operation.

THE MERITS OF EXTRA-ARTICULAR ILIO-FEMORAL ARTHRODESIS

In the experience of the writer, a well-planned extra-articular ilio-femoral arthrodesis gives results equal to, if not better than, any other form of operation. It has the advantage of being comparatively easy to perform; it causes little post-operative shock; and there are few complications. In a high percentage of cases there is not only solid incorporation of the

graft but also firm osseous intra-articular fusion even when no intra-articular operation has been performed (Figs. 1–6). Between 1932 and 1946, at the Wrightington Hospital

TABLE I

AGE AT THE TIME OF OPERATION

Age group (years)	Number of cases	Per cent.
0 – 10	4	8
11 – 20	29	58
21 – 30	13	26
31 – 40	4	8
Totals	50	100

(Lancashire County Council), fifty patients had arthrodesis of the hip joint as part of their treatment for tuberculous arthritis. Of these, twenty-nine were males and twenty-one females. The youngest patient was six years of age and the oldest thirty-eight years at the time of operation. Table I shows the number of cases in each age group. It will be shown that the age at which the operation was performed had an important bearing upon the success or failure of the procedure.

FIG. 1

Case Z. S., female, aged 15 years: Extra-articular arthrodesis for tuberculosis right hip 1944. Radiographs three years after operation showing solid incorporation of the graft and also sound intra-articular fusion.

FIG. 2

Case E. C., male, aged 19 years: Extra-articular arthrodesis for tuberculosis left hip, 1945. Radiographs two years after operation showing not only firm incorporation of the graft but also intra-articular osseous fusion.

Table II shows the duration of the disease in years. In seventeen of nineteen patients in the group 0–5 years, arthrodesis was performed at the end of primary conservative treatment, when there was clinical and radiographic evidence of quiescence of disease in the affected joint but with unsound fibrous ankylosis. No operation was performed during what was judged to be the active phase of the disease; the average duration of conservative

treatment before operation was two and a half years. The remaining patients were re-admitted to hospital for arthrodesis after apparent healing of the disease.

TABLE II

DURATION OF THE DISEASE

Duration in years	Number of cases	Per cent.
0 – 5	19	38
6 – 10	22	44
11 – 15	5	10
16 – 20	2	4
21 – 25	1	2
25 – 30	1	2
Totals	50	100

Condition of the joint before arthrodesis—In every patient there was unsound fibrous ankylosis of the joint. In the case of the seventeen patients in whom arthrodesis was performed at the end of the period of conservative treatment there was no deformity. Of the remainder, five (15·2 per cent.) had painful fibrous ankylosis without deformity, and twenty-eight (84·8 per cent.) had flexion-adduction deformity. It is now our practice to arthrodese all cases with unsound ankylosis at the end of the active phase, provided only that they are of the correct age and that there are no contra-indications such as multiple foci of tuberculous infection. When deformity was present it was corrected, when possible, by means of weight and pulley traction before operation. The pull was first applied in the line of deformity, and the position of the limb gradually altered as deformity was corrected until the optimum position for arthrodesis was obtained. Few failed to respond, the average time required for correction being about six weeks. When this method failed, trans-trochanteric osteotomy was performed before undertaking arthrodesis. Of the twenty-eight patients with flexion-adduction deformity, twenty-one were treated by weight and pulley extension, three by transtrochanteric osteotomy, and four by combined intra- and extra-articular arthrodesis with correction of deformity at the time of operation.

Type of operation—Three types of operation have been used: 1) intra-articular arthrodesis; 2) extra-articular ilio-femoral arthrodesis; 3) combined arthrodesis.

Intra-articular arthrodesis—In this operation the joint is opened, articular cartilage is removed from the femoral head and acetabulum, and an attempt is made to remove all diseased tissue. The operation is not very satisfactory because disproportion between the remains of the femoral head and acetabulum makes it difficult to secure bone fusion.

Extra-articular ilio-femoral arthrodesis—This is the operation of choice, the object being to provide a bridge between the ilium and great trochanter. The joint is not opened and the whole procedure is more or less remote from diseased areas. A flap of bone is turned down from the outer table of the ilium with its iliac attachment unbroken at the lower border; the free upper end is implanted into the great trochanter. Preservation of attachment of the bone flap to the ilium is believed to be important. It is important too that the operation should be attempted only in patients over twelve years of age, because in younger patients the high proportion of cartilage to bone in the trochanteric region results in frequent failure of union at the trochanteric end. The Albee operation, with grafts taken from the iliac crest or from the tibia may be used, but the author believes that bone fusion is not then obtained with the same certainty as when an attached iliac flap is used.

Combined arthrodesis—This is a combination of the two previous methods. Bone fusion readily occurs, but the reliability of the procedure is not so much greater than that of extra-articular fusion as to justify the increased post-operative shock, and the risk of breakdown of the wound through the opening of recently infected tissues.

FIG. 3

FIG. 4

Case E. L., female, aged 20 years: Extra-articular arthrodesis right hip, 1935; patient died of pulmonary tuberculosis and tuberculous meningitis five years later. Post-mortem specimen shows the solid incorporation and great thickness of the graft (Fig. 3), and also intra-articular osseous fusion (Fig. 4).

FIG. 5

FIG. 6

Case A. H., female, aged 8 years: Extra-articular arthrodesis, 1938. Radiograph before operation (Fig. 5) shows extensive tuberculosis of the right hip joint. Four years after operation (Fig. 6) the graft is solidly incorporated and there is intra-articular osseous fusion.

After-treatment—The limb is immobilised after operation for a period of from six to nine months. Weight-bearing is usually permitted three months after operation.

TABLE III

TYPE OF ARTHRODESIS

Type of operation	Number of cases	Per cent.
Intra-articular .	2	4
Extra-articular .	38	76
Combined . .	10	20
Totals . .	50	100

Only two intra-articular operations have been performed. One resulted in sound bone ankylosis but the other is still unsound two years after operation. The ten cases of combined arthrodeses were performed early in the series. All resulted in firm bone fusion.

Complications—Post-operative complications have been few. In forty-six cases (92 per cent.) the wound healed by first intention. Three (6 per cent.) developed sinuses which, however, healed before discharge of the patient from hospital. One patient died; the cause of death was toxaemia following complete breakdown of the wound and acute secondary infection. It is probable that the disease was still active at the time of operation. An attempt was made to remove the graft, but firm union appeared to have taken place and this was confirmed at autopsy. No case developed secondary tuberculous foci as a result of the operation, although one died five years later from tuberculous meningitis and pulmonary tuberculosis.

END-RESULTS ON DISCHARGE FROM HOSPITAL

The end-results in forty-nine cases, estimated at the time of discharge from hospital, are analysed in Table IV. In thirty-eight (77·5 per cent.) there was bony ankylosis; three (6·1 per cent.) had sound fibrous ankylosis; eight (16·3 per cent.) had unsound fibrous ankylosis, but it is to be noted that in four of these, bone fusion developed subsequently.

TABLE IV

CONDITION OF THE JOINT ON DISCHARGE

Condition of the joint	Number of cases	Per cent.
Wound healed . .	49	100
Bone ankylosis . .	38	77·5
Sound fibrous ankylosis .	3	6·1
Unsound fibrous ankylosis	8	16·3

The average time elapsing between operation and the development of sound bony ankylosis was 7·8 months. It should be observed that by bony ankylosis is meant solid incorporation of the graft with or without evidence of intra-articular osseous fusion. But even when extra-articular arthrodesis alone is performed, a high percentage of cases develop later evidence of intra-articular bone fusion, due no doubt to the complete immobility which is produced by firm fusion of the extra-articular graft. Of thirty-eight cases in which the operation was strictly extra-articular, twenty-two (57·8 per cent.) developed intra-articular bone fusion (Figs. 1–6). It has not been possible, however, to determine the length of time which is required for secondary intra-articular fusion to take place.

FIG. 7

FIG. 8

Case H. R., female, aged 23 years: Extra-articular arthrodesis, 1945. Radiograph before operation (Fig. 7) shows tuberculosis of the right hip. Two years after operation (Fig. 8) there is solid incorporation of the graft.

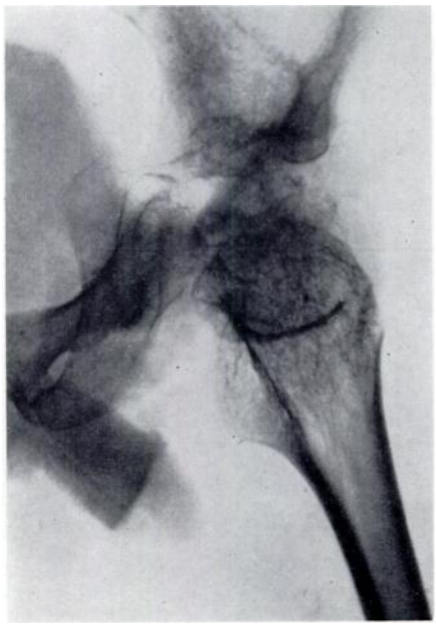

FIG. 9

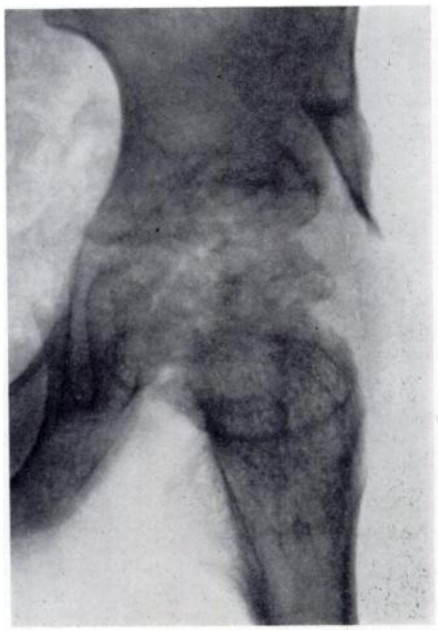

FIG. 10

Case B. R., male, aged 6 years: Extra-articular arthrodesis, 1939. Radiograph before operation (Fig. 9) shows extensive tuberculosis of left hip. Two years after operation (Fig. 10) the distal half of the graft has undergone absorption; there is unsound fibrous ankylosis of the joint but the disease is quiescent.

Table V shows the condition of the graft on radiographic examination in forty-seven patients. Firm incorporation occurred in thirty-seven (Figs. 3–8); non-union at the trochanteric end was present in eight, but four of these eventually fused. Destruction of the graft occurred in one case. This was in a boy six years of age. Absorption of the distal half of the graft took place through failure of union to the trochanter. The proximal end continued to grow and is seen as a solid buttress of bone, but there is unsound fibrous ankylosis of the joint (Fig. 10). One graft fractured near its iliac attachment, and united later; unfortunately there was active disease in the joint which spread to the trochanter and distal part of the graft (Figs. 11–13). In no case did sequestration of the graft take place.

TABLE V

CONDITION OF THE GRAFT ON DISCHARGE
(As determined by X-ray examination)

Condition of the graft	Number of cases	Per cent.
Solid incorporation . .	37	78·7
Non-union to ilium . .	0	0
Non-union to trochanter .	8	17·2
Fracture of the graft .	1	2·1
Destruction of the graft .	1	2·1
Sequestration of the graft .	0	0
Totals	47	100

Analysis of the condition of the joint and the condition of the graft on discharge according to age groups (Tables VI and VII) shows that the proportion of failures was greatest in the first age group—below ten years. In every case it was at the trochanteric end that fusion failed, and there can be little doubt that failure was due to the high proportion of cartilage to bone in the trochanteric region at this period of life. The most successful results were in the age groups between eleven and thirty years. After the age of thirty, results were again poor.

TABLE VI

CONDITION OF THE JOINT ON DISCHARGE
ACCORDING TO AGE GROUPS AT TIME OF OPERATION

Age group (years)	Condition of joint		
	Bone ankylosis	Sound fibrous ankylosis	Unsound fibrous ankylosis
0 – 10	1 (25%)	0	3 (75%)
11 – 20	23 (79%)	3 (10·3%)	3 (10·3%)
21 – 30	12 (100%)	0	0
31 – 40	2 (50%)	0	2 (50%)

TABLE VII

CONDITION OF THE GRAFT ON DISCHARGE
ACCORDING TO AGE GROUPS AT TIME OF OPERATION

Age group (years)	Condition of graft (as determined by X-ray examination)					
	Firm fusion	Non-union to ilium	Non-union to trochanter	Fracture of graft	Destruction of graft	Sequestration of graft
0 – 10	1 (25%)	0	2 (50%)	0	1 (25%)	0
11 – 20	23 (79%)	0	6 (20·6%)	0	0	0
21 – 30	11 (100%)	0	0	0	0	0
31 – 40	2 (66·6%)	0	0	1 (33·3%)	0	0

LATE END-RESULTS

Late end-results were considered only after a minimal period of two years from the time of operation. Forty-two patients fulfilled this condition and the group was made up as follows: Untraced 2. Healed disease 38. Active disease 1. Died 1.

The two untraced cases had bone ankylosis of the joint on discharge from hospital and it is probable that they have had no further symptoms. Analysis of the working capacity of the other forty patients is shown in Table VIII.

TABLE VIII

WORKING CAPACITY

Working capacity	Number of cases	Per cent.
Full	35	87·5
Part	1	2·5
Nil	3	7·5
Died	1	2·5
Totals	40	100

The one death occurred in a patient re-admitted to hospital five years after operation with pulmonary tuberculosis; she died from tuberculous meningitis. Post-mortem examination showed that disease in the hip joint was healed, and there was firm bony ankylosis.

Condition of the joint—(Table IX). Thirty-five patients (87·5 per cent.) have sound bone ankylosis of the hip; two (5 per cent.) have sound fibrous ankylosis without symptoms and are in full employment; two (5 per cent.) have unsound fibrous ankylosis, and although they are free from symptoms further surgical intervention will probably be necessary.

TABLE IX

CONDITION OF THE JOINT

Condition of the joint	Number of cases	Per cent.
Bone ankylosis	35	87·5
Sound fibrous ankylosis (disease healed)	2	5
Unsound fibrous ankylosis (disease healed)	2	5
Unsound fibrous ankylosis (disease active)	1	2·5
Totals	40	100

One patient only has active disease and is at present under treatment (Figs. 11–13). He has developed an abscess in the lateral aspect of the thigh and radiographs show spread of destruction to the trochanter and lower end of the graft. In the earlier stages the graft fractured and it was un-united on discharge from hospital; in spite of active disease the fracture subsequently united. Reviewing this case in the light of his present condition it is reasonable to assume that failure of the extra-articular operation was associated with the large sequestrated part of the femoral head, and it would probably have been better to have carried out a combined intra-articular and extra-articular arthrodesis.

FIG. 11

FIG. 12

FIG. 13

Case C. A., male, aged 36 years: Extra-articular arthrodesis, 1942. Fig. 11 shows pre-operation film—tuberculosis of the right hip. Fig. 12 shows the condition on discharge from hospital eleven months after operation; there is a fracture of the upper end of the graft. Fig. 13 shows the condition three years after operation; the fracture has united but disease is still active and has spread to the lower end of the graft. In view of the sequestration of the femoral head shown in Fig. 11 this case might have been treated better by the combined operation (see text).

Working capacity according to the condition of the joint is analysed in Table X. One patient, who has bone ankylosis but whose working capacity is nil, has developed ankylosing spondylitis since discharge from hospital.

TABLE X

WORKING CAPACITY ACCORDING TO THE CONDITION OF THE JOINT

Condition of the joint	Full	Part	Nil	Died
Bony ankylosis	33	0	1	1
Sound fibrous ankylosis (disease healed)	2	0	0	0
Unsound fibrous ankylosis (disease healed)	0	1	1	0
Unsound fibrous ankylosis (disease active)	0	0	1	0

Recent X-ray examination has been possible in all forty cases reviewed as late end-results, and the condition of the grafts is shown in Table XI. Thirty-five (87·5 per cent.) show solid incorporation; in four (10 per cent.) there is non-union to the trochanter; one (2·5 per cent.) shows some destruction of the graft.

TABLE XI

CONDITION OF THE GRAFT ON X-RAY

Condition of the graft	Number of cases	Per cent.
Solid incorporation	35	87·5
Non-union to ilium	0	0
Non-union to trochanter	4	10
Fracture of the graft	0	0
Destruction of the graft	1	2.5
Sequestration of the graft	0	0
Totals	40	100

Nine of the ten cases discharged from hospital with failed fusion of the graft have been re-examined two or more years from the time of operation. Four now show firm incorporation of the graft and bone ankylosis. Of the other five, two have sound fibrous ankylosis with the disease healed, two have unsound fibrous ankylosis with healed disease, and one shows unsound fibrous ankylosis with active disease. The working capacity of the cases is as follows:

Full . . . 6 (4 bone ankylosis, 2 sound fibrous ankylosis).
Part . . 1 (Unsound fibrous ankylosis, healed disease).
Nil . . . 2 (1 unsound fibrous ankylosis with healed disease and 1 with active disease).

SUMMARY

1. Fifty cases of arthrodesis of the hip joint in tuberculous arthritis are analysed; in forty cases the late end-result has been ascertained two or more years after operation.

2. The indications for arthrodesis are discussed. The operation should not be performed when disease is active; it should not be undertaken before the age of twelve to thirteen years; it is not advisable in elderly patients; it may be contra-indicated when there are multiple foci of infection. Subject to these limitations every patient with unsound ankylosis after adequate conservative treatment should be treated by arthrodesis; painful fibrous ankylosis and late onset of deformity are definite indications.

3. Three types of operation have been used: intra-articular arthrodesis; extra-articular ilio-femoral arthrodesis; combined intra- and extra-articular arthrodesis. Extra-articular ilio-femoral arthrodesis is preferred, deformity being first corrected by traction or osteotomy.

4. Post-operation complications were few; the mortality rate was low (2 per cent.).

5. There was bone ankylosis with solid incorporation of the graft in 87·5 per cent., failure of union of the graft (to the trochanter) in 10 per cent., and destruction of the graft in 2·5 per cent.

6. Late end-results show full working capacity in 87·5 per cent. of patients, part working capacity in 2·5 per cent. and inability to work in 7·5 per cent.

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