In the *Rotunda Hospital Reports*⁴ 1918-27 (nine years) there were 124 cases, with a mortality of 7.3 per cent. Hitschmann⁵ gives the following figures: Döderlein 19 per cent., Kernig 18.2 per cent., Mende 15 per cent., Lefebvre 19.3 per cent., and Charlaies 15.5 per cent.

Summary.

1. Placenta praevia is one of the most dangerous complications of childbirth.
2. Haemorrhage is a prominent feature, and often there is a history of previous recurring haemorrhage.
3. Since haemorrhage, shock, and sepsis are the commonest causes of death, it is better to empty the uterus soon when the patient is in good condition, rather than attempt to temporize.
4. Central placenta praevia has the greatest maternal and foetal mortality, and there is scope for a slightly higher proportion of Caesarean sections in this type of case, especially when the foetus is alive and near full term.
5. Of the children, 75 per cent. were premature, so that the foetal mortality was high, no matter what treatment was adopted.
6. Careful ante-natal supervision should reduce considerably both maternal and foetal mortality.
7. Experience of Willett's treatment was limited, but it has given good results when used.

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OPERATIVE TREATMENT IN TUBERCULOSIS OF THE LARGER JOINTS.*

BY

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PART I.

SCOPE.

OUR subject is of the utmost importance to all who have to deal with "surgical tuberculosis," and is therefore bound to raise questions of great interest to the practitioner as well as to the orthopaedic surgeon. I appreciate very much the honour of opening the discussion. First I sought guidance on the interpretation of the term "larger" joints, and was told that the hip, knee, ankle, shoulder, elbow, and sacro-iliac joints were inside and the spine outside the term.

Then I noted that we are limited to operations "in the treatment of tuberculosis," and I would suggest that while diagnostic operations are so intimately concerned with treatment that they can rightly be reviewed in passing, operations for the correction of deformities left by tuberculosis, or operations designed to restore movement to fixed and soundly healed joints, must be excluded. We have to-day, therefore, no concern with operations other than those helpful in the treatment of unhealed tuberculosis. Surgery may be required for the *complication* of pyogenic infection, but I think that is another story, to be mentioned rather than discussed here, for we shall have fully enough to do if we concentrate on uncomplicated tuberculosis.

We are now at a critical time—conservative treatment in open-air hospitals has become well accredited, for its immediate results are known to be good. We must be careful lest we allow good "results" to become bad "end-results." So-called "results" merely represent an interim report in the hospital records. Our main concern, and the true test of our work, is the end-result—the lasting health and activity of the patient, or the reverse. Alan D. Smith and W. H. Watters, writing in the *Journal of the American Medical Association* for January 21st, 1928, give the following figures:

"1. Of 208 patients treated for tuberculosis of the hip at the Country Branch of the New York Orthopaedic Dispensary and Hospital from 1904 to 1921, forty-six, or 22 per cent., were found to have wrong diagnoses. We believe that such mistakes are

inevitable unless the diagnosis is established by aspiration and guinea-pig inoculation, or by exploratory operation.

"2. Thirty-six patients, or 24 per cent. of 150 cases, followed for three years or more, died, the majority from tuberculosis.

"3. Seventy-one cases, or 47 per cent., still were active when last examined.

"4. Forty-one cases, 27 per cent., were quiescent with little or no motion and with some degree of deformity.

"5. Only two patients were free from symptoms and had a useful range of motion."

There is no reason to suppose that these figures are representative. For "end-results" depend on several factors which vary in different countries and different clinics. "End-results" depend partly on (1) the type and (2) the period of treatment in hospital, and partly on the environmental care afterwards. At the Wingfield Orthopaedic Hospital, Oxford, we have been able to take such care of the environment of our patients after they leave hospital, and to see them so regularly, and to admit them again promptly if necessary, that I think we can, in the great majority of cases, achieve healing, both of the joint and of the lymphatic tuberculosis. But as regards both phases of the infection we have had failures, and it is from the failures that we have most to learn.

Now we cannot afford to allow open air and rest to become discredited: they are fundamental needs, and cannot be replaced. Therefore we must learn to make our end-results come into line with our results. And here we make contact with our subject; for surgery has a big part to play in the stabilization of results. Big but limited. It is to discuss that part, its limits and its importance, its successes, its difficulties, and its failures, that we are met.

REVIEW OF SURGICAL TUBERCULOSIS.

With added experience we must again face the question, "When, if ever, is surgical tuberculosis properly surgical?" But before we begin to answer it, it is well to look squarely at the disease we are fighting and to review critically the parts that can be played by various operative (and non-operative) methods in its treatment.

Now I said in a paper read at the Provincial Meeting of the Tuberculosis Society at Cambridge on April 11th, 1924:

"Tuberculous disease of a joint or a bone is serious enough, but it is a weed with a very deep root; you may pluck the head, but the root will not come with it. A bone focus is a proof of established tuberculous infection of the body; but even this is not all, for the new focus is tangible evidence that the invasion of the body is advancing."

I feel now that the metaphor was partially misleading, for I have become convinced that the seeds of dissemination lie in the root of the disease and not in its flower. No doubt then, as now, I was preaching to the converted, but it is well to reassert this basic truth over and over again until the whole profession absorbs it. The family doctor knows the true facts, the orthopaedic surgeon is learning them, but in the general hospitals, with the relatively early discharge of patients which is necessary, the slow evolution of surgical tuberculosis cannot be watched.

On the other hand, the experience of surgical tuberculosis one gets on the staff of a hospital such as the Wingfield has all the makings of a scientific experiment on a large scale; for one sees the cases in our scattered out-patient departments before their hospital period, and lives surrounded by them, and in touch with them even after their discharge. It is a living and lasting experiment, and one learns more and more as the years pass. The experiment is characterized not only by the large number of cases, but by their unlimited variety in age, type, and environment. I am being led to a conception of the disease which has points that may be new and are, I think, valuable. Certainly they concern intimately to-day's subject.

In the second part of this paper I hope to give some of the findings of the experiment. For my present purpose I must anticipate them and pick out one striking point. In most of the patients in whom new lesions occurred, not as a result of the original bacillary shower, but at a later stage—that is, during or after hospital treatment—the joint lesion has at the time of the new development been removed or arrested, and in the latter there have been no signs of activity or reactivity in the joint lesion preceding or at the time of the development of the new lesion. This is a clear indication that the bacillæmia

* Read in opening a discussion in the Section of Orthopaedics at the Annual Meeting of the British Medical Association, Manchester, 1929.

shower can, and usually does, come from somewhere other than the joint lesion. The question comes to one's mind: *Does a bacillaemic shower ever arise from a joint lesion—and indeed can it do so?—or is it always the result of lymphatic tuberculosis?* Bacillaemic showers are proved to be a frequent occurrence in experimental animal tuberculosis; by analogy they occur in man. How can bacilli get into the blood? Only through lymph channels or direct into veins (arteries, of course, are readier to give than to receive).

Now tubercle bacilli in bone and joint foci are found in two places: (1) with ease and in considerable numbers in caseous debris; and (2) in small numbers and often with great difficulty in the granuloma, and generally in the centre of infiltrated and more or less necrotic areas quite out of touch with any lymph channel or blood vessel.

It appears impracticable for the tubercle bacilli in a chronic granuloma to pass by any channel into the blood stream. Probably only in very active fungating and extending lesions do tubercle bacilli ever reach the blood stream from a lesion developing from a bone or joint focus, and, if they ever do, probably very rarely and in very small numbers.

Now in our work activity occurs only at an early stage or in very rare cases of patients who offer no effective resistance to tuberculosis. Those of us who have done an early arthroscopy and a subsequent excision know how quickly and to what a remarkable degree the early hot active inflammation is subdued. It is clear that the bacilli in the later stage cannot reach the blood directly, but it is just possible that they might reach the lymph channels, the regional glands, and eventually the blood. Apparently they do not, for the regional lymph glands to which the joint drains are never secondarily enlarged. Besides, granulation tissue is Nature's method of corking all channels (blood and lymph) against bacterial invasion. In a septic wound we feel safe from septicaemic penetration of bacteria when granulations cover the raw surface.

Do the bacilli, then, come only from the lymphatic tuberculosis?

First, we know already that bone and joint foci are metastatic from the glands—are the result of a shower from the glands—that alone is a proof of lymphatic responsibility.

Secondly, the lymph glands are filters, in the course of the current which flows ever toward the blood stream.

Thirdly, when the mediastinal and retroperitoneal glands are tuberculous the debris does not find its way to the surface of the body. Altogether it seems evident that debris rich in tubercle bacilli is carried along with the natural flow through the lymph vessels and the thoracic duct into the blood stream.

Tuberculosis of the glands appears, then, to be the great, if not the sole, source of tubercle bacillaemia. Bone and joint lesions, on the other hand, are secondary or metastatic lesions, and they appear to be "end" lesions, closed, "blind," or "static," and in themselves only dangerous as sources of toxæmia, or by their direct extension, or infections; not as potential mothers of further metastatic lesions.

Unfortunately the lymphatic lesion is out of reach, out of sight, and too often out of mind; and an active unarrested focus in a gland left after the joint lesion has healed is, I believe, a far greater danger to the patient than an unarrested focus in a joint.

THE FIELD FOR SURGERY.

Operation can remove the joint focus, or result in a synostosis which protects it from strain, but the operations we are discussing cannot have any direct bearing on the deep-seated glands. Patients in whom the tuberculosis has been carried from glands to a large joint suffer danger to the joint itself, and danger to life. To save the joint perfectly intact means exceedingly early provisional diagnosis and immediate treatment, and sufficient long-continued general treatment. In most such cases a certain diagnosis cannot at the present day be made, and they cannot appear as definitely tuberculous in statistics. (Nevertheless the patient so treated is glad of the free use of his joint.) In other cases where the lesion is extra-

articular (for example, neck of femur) the joint can often be saved from infection sufficiently heavy as to overcome the joint's resistance.

Now for the dangers to life:

Danger No. 1.—Persistent joint disease, with long-continued toxæmia, secondary infection, lardaceous disease, and only a very gradual and long-delayed danger to life.

Danger No. 2.—Persistent lymphatic disease with frequent bacillary showers, and a constant danger of new metastatic lesions, including meningitis and miliary tuberculosis. The sword of Damocles—a much more threatening danger.

Our operations concern Danger No. 1. Either we remove the lesion by excision or amputation, or we promote and protect its healing by extra-articular arthrodesis. These operations do not save the joint, for they fix it; nor the patient's life, for the glands remain a potent source of danger. This may seem to belittle the importance of surgery. Not so. It is true that we must depend on general treatment to heal the glands, but it is not true that we can rely on an equal healing of the joint. For to the joint the vastly important factor of mechanical strain is added. And it is essential that the profession should recognize that without operation we cannot bring about a *safe and permanent cure* of most major tuberculous joint lesions in adolescents and adults. This may seem a statement directly contrary to the wonderful "results" obtained by all our open-air hospitals. So it is. But not to the true end-results. The "results" of such hospital treatment appear delightful, but the "end-results" can be very disheartening. A granulomatous lesion which at the end of hospital treatment was sound to Thomas's tests repeated week by week will often prove unsound to the wear and tear of the subsequent years.

From the mass of cases which come to us we can distinguish two very different types:

1. Patients in whom the joint lesion is still grumbling, though the gland focus has apparently long ago healed. These are cases in which the general resistance is sufficient for healing (and the glands have healed), but this important factor of mechanical strain persistently prevents the lesion from healing. In such the problem does seem a local one, and its complete solution may well lie in operation, whether radical, or, when radical operation is impracticable or appears unnecessary, extra-articular arthrodesis. This group mainly concerns adolescents or adults with long histories.

2. A larger group of patients in whom the joint lesion is a sign of lowered general resistance to tuberculosis. These are cases with short histories, multiple lesions, recurrences, or new lesions. In such cases operation is *not yet* indicated. The lesion is almost certainly bacillaemic, and everything must give way to physical rest and metabolic activation. Many cases fall between these two groups.

General treatment requires time, so does post-operative fixation. Naturally one wants the sentences to run concurrently so far as possible. Probably general treatment should always be given a start—in adults of some months, and in children of some years. It is possible that one should always wait until one has a number of negative results from blood culture *in vitro* or by guinea-pig inoculation. The value of such tests is a point which is now under investigation at the Wingfield Hospital. Certainly showers of bacilli should have ceased to issue from the lymphatic system into the blood before the patient is allowed to pass from good to poor environment. Whether one should wait to operate until such a stage is reached depends on several variables. Partly it depends upon whether the operation is radical or conservative, also on the general trend of the patient's health, time, and circumstances.

The view has been expressed that a major lesion—for example, a tuberculous epididymis—should not be removed because its value as a source of tuberculin is thereby lost, and the specific reaction of the whole body to tuberculosis is thus lessened. It is, I suppose, a matter of the optimum dosage in each case. My own view is that the smaller and the less active the lesion in the patient, the quicker and sounder he heals under the best environment. And I would suggest that with the metastatic source of toxæmia gone there is more than enough left to promote reaction; for the source of the bacillaemic showers remains. I think the argument for retaining the metastatic lesion is based on misleading figures in which comparison is made between

cases treated radically, and for that (illogical) reason sent out sooner, and those treated without operation. The longer period of general treatment necessitated by the retention of the metastatic focus would naturally lead in a significant proportion of cases to more advanced healing of the primary focus. The same length of general treatment after removal of the lesion would, in my opinion, be likely to prove even more effective. Comparisons can only be fair when an equal period of general treatment has been given to both groups.

I would suggest, then, that the first and fundamental principle is to provide general conservative environmental treatment good enough, and for long enough, to heal the lymphatic tuberculosis; that the first indication of such healing is the total disappearance, to clinical and possibly to laboratory tests, of signs and symptoms of bacillaemia; and that general treatment should be prolonged for at least a year after this indication has been reached.

Then I would say that operation is often also a fundamental need to remove a focus that is causing persistent harmful toxæmia, that is unlikely to heal at all, or at least not sufficiently soundly and strongly as to stand safely the mechanical strains to which it will be subjected. Sound healing of a joint is not enough. The tissues of which it is composed must also be sufficiently thick and stout and strong, and must connect surfaces suitably adapted. Where that is impossible without operation the surgeon must be prepared to strengthen the foundations or buttress the building, or do both.

The part the surgeon can play in the treatment of tuberculous joints is:

1. To remove a tuberculous focus metastatic in origin, and a potent source of toxæmia.

2. To buttress or rebuild a part of the skeleton which cannot otherwise safely carry the strains it will have to bear.

He operates at a time so chosen as:

1. To interfere least with the improvement of his patient's vitality—indeed, in some middle-aged or old patients radical measures are necessary in order to make that improvement possible.

2. To supply him with materials which will answer his needs (this applies to buttress building).

Radical operations may have to be done comparatively early (to save life and limb in the middle-aged or old); extra-articular arthrodesis is best done later.

A CONCEPTION OF BONE AND JOINT TUBERCULOSIS.

A truly balanced view of lymphatic and metastatic tuberculosis is the only sound foundation of our discussion. I put forward the following conception of bone and joint tuberculosis, in two statements, with the reasons that have led me to these conclusions.

A.—Lymphatic tuberculosis is *open* to the blood—that is, it is *bacillaemic*.

I. Tuberculous glands lead to bacillaemic showers. This is clear because:

1. Metastases occur when glands are the only pre-existing lesion.
2. It is clearly the glands and not the joint lesion that have caused new lesions in those of my cases in which the joint lesion has been previously excised or amputated.

II. Bacillaemia in active tuberculosis is frequent. This is probable:

1. On the analogy with the proved occurrence of this in animal experiments.
2. Because tubercles of different ages can be demonstrated post mortem.
3. Because of the clinical experience that trauma is associated with bone tuberculosis, and the explanation lying in the coincidence of local lowered resistance with a bacillary shower.

III. Glands are likely to cause bacillaemia. Because:

1. If they break down internally the debris would follow the natural flow through the lymph channels into the thoracic duct and so into the blood stream.
2. It seems likely that this is a common way of disposal of the debris of mediastinal and retroperitoneal lymphatic tuberculosis. Certainly an unpleasant idea, but in a sense reassuring as to the powers of our blood and vascular tissues.

B.—Bone and joint tuberculosis is *closed* to the blood—that is, it is merely *toxaemic*.

I. In granulomata tubercle bacilli are only found at the centre, and far from any vascular channel. The bacilli are found in caseous material, in pus, in giant cells, and at the very core of densely infiltrated areas.

II. The bacilli appear far out of contact with lymph channels (unless the granuloma is split open by force). Further, it is my experience that one never finds the regional glands to which a tuberculous bone or joint drains enlarged or showing any signs of infection with tuberculosis. This in itself goes far to prove the closed nature of these lesions.

III. In my experience of very prolonged cases where the mechanical factor seems to have kept a joint grumbling long after the general disease has been healed, new metastatic lesions do not occur despite activity of the joint disease, nor after radical treatment followed by only short general treatment.

If these statements present a truly balanced view of the disease with which we have to deal the indications and the scope for surgery can be examined clearly and reasonably assessed.

PART II.

GENERAL INDICATIONS FOR OPERATION.

In order to give subsequent speakers something to bite upon I am stating very briefly my own views as to the general indications for operation.

FOR DIAGNOSIS.

Arthroscopy is indicated when the diagnosis cannot otherwise be made.

Time.—At the earliest moment, for in doubtful cases good diagnostic material is not easily come by; and the better and longer the treatment the more the granuloma retires into its shell.

FOR TREATMENT.

(a) Adults.

Indication.—Radical operation is the rule.

Time.—As soon as the patient's general condition is on the mend.

Type.—Excision and arthrodesis.

Exceptions.—(1) For sacro-iliac only extra-articular arthrodesis.* (2) For the hip add also extra-articular buttressing. (3) For the ankle, astragalectomy or amputation. (4) When amputation is indicated—for example, many cases of tuberculous hip, knee, or ankle, over middle age.

(b) Children.

Indication.—Whenever sufficient damage has been done to the joint to make movement incompatible with permanent safety from relapse (or mechanical arthritis).

Exceptions.—Those cases in which there is little granular tissue and in which the surfaces are well adapted.

Time.—After more than one year of treatment, when recalcification is shown on radiograms, and only when the patient is, or becomes, over 10 years of age.

Type.

Sacro-iliac.—Extra-articular reinforcement (Verrall).

Hip.—Ordinarily extra-articular arthrodesis, but when the granular tissue is massive and likely to prevent effective extra-articular arthrodesis (either by leading to absorption of the graft or by giving no firm fulcrum to aid the graft in bearing strain), excision should be added.

Knee.—Restricted excision and arthrodesis. The knee is very slow to heal and very liable to recrudescence, therefore often requires arthrodesis. It is an accessible joint with good big surfaces. Its drawback is the proximity of the two growth discs; therefore the excision must be superficial, and long grafts are quite unsuitable. Further, unless the limb is well protected during the years of growth distortion is likely from the application of strains quite different from those which the metaphyseal bone is prepared to expect.

Ankle.—An individual problem. I think unsettled, except that where the lesion appears to be confined to the astragalus it should be removed. I have had few cases in children, and all these have been treated conservatively.

Shoulder.—Excision and arthrodesis.

Elbow.—Operation not indicated.

In addition: Drainage operations for pyogenic infection of tuberculous joints are sometimes required. For the hip I use a method of transverse incision and wide transverse excision

* I use a double Verrall graft. There are three objections to the use of Smith Petersen's method in tuberculosis, (1) because it places the free graft in the midst of the infected joint, (2) because the graft is necessarily composed of decalcified bone, and (3) because the graft depends for its recolonization on the intoxicated cells of the neighbourhood.

of muscles, with suture of the skin edges deep down close to the joint; and with most satisfactory results. This I described in *The Robert Jones Birthday Volume*.

PART III.

RESULTS OF OPERATION.

With regard to results I think it will be most helpful if I briefly summarize my experiences.

DIAGNOSIS.

*Arthroscopy.**—Certain bacteriological or histological diagnosis is most needed in those very early cases, clinically synovial, which otherwise cannot be identified with certainty. Unfortunately in my experience we have had a number of such cases in which in the specimen of synovia removed tubercle bacilli have not been found either by a prolonged microscopic search or by inoculating a guinea-pig; in these the histological diagnosis has often been non-committal.

TREATMENT.

Hip.

Adults.—I have recently published my views and experiences of hip operations.† In general, I would say that the difficulties lie less in the technique than in the human materials. Operations which are most satisfactory in cases where the morbid anatomy is similar but non-tuberculous often fail where the bones are decalcified and devitalized by tuberculosis. This is particularly true of grafting operations. At present I feel that the solution lies in early radical excision and late grafting. And in certain types and older ages I think amputation is indicated.

Children.—Of those treated by excision and arthrodesis none have been done long enough for a final report. I am finding it sometimes necessary as a result of much granulated tissue, but always as part of, or preliminary to, extra-articular arthrodesis. In those treated by extra-articular arthrodesis I have had about an equal number of satisfactory results and of failures, from absorption at the middle of the graft, due to the non-recolonization of the graft, or failure in obtaining a firm hold at one or other end. There have been no cases of sepsis, sinus formation, or sequestration. The graft has to pass close to the granuloma, and is therefore liable to become infected itself, or to fail to take hold or thicken on account of lack of initiative shown by the devitalized bone cells of the neighbourhood. The difficulties in obtaining a really effective arthrodesis may be great, but the indications are at least correspondingly strong. The hip shares with the knee an increasing notoriety for grumbling persistence and recrudescence, and has long possessed a unique name for deformation, insidious and malign. It adducts and flexes, and nothing but synostosis will stop it.

Knee.

Adults.—Local result uniformly good. End result: new lesions in other parts of the body have developed in several cases. That is to be put down to failure in general treatment. For severe septic infection of tuberculosis of the knee in adults I believe in amputation, not excision. On one occasion such a knee was excised by another surgeon—widespread sepsis, pyaemia, late amputation, and death followed.

Children.—None operated on. I have recently seen a girl of 19 whose knee had been excised in 1921. She has 7 inches of shortening! The lower epiphysis of the femur had been damaged by the surgeon and growth had ceased. I am still keeping the tuberculous knees of children in callipers, but I have become convinced that excision in children older than 10 with much articular damage may well prove right.

Ankle.

Adults.—Mainly treated by conservative measures. Operations only two astragalectomies, one of these done elsewhere. The local results have been good, but only two cases have been treated, one by Mr. Joyce at the Wingfield Orthopaedic Hospital, the other elsewhere.

Children.—None operated on.

Shoulder.

Adults.—I have only excised one tuberculous shoulder. The local result was excellent, but a year later generalized tuberculosis developed and the patient died.

Children.—None operated on.

Elbow.

Adults.—I have excised only one. The local result was good, but bony ankylosis has been delayed.

In Part II I made my suggestions definite—to invite criticism, and brief—to invite fuller and better statement. Further, I would add the warning that generalizations such as these are only general guides, and cannot be applied to any single patient, for each needs personal consideration.

* On this subject see an article on joint disease by R. K. Ghormley in the *Journal of Bone and Joint Surgery*, vol. viii, No. 4, October, 1926.
† *The Robert Jones Birthday Volume*, p. 347.

THREE HUNDRED CASES OF TUBERCULOSIS OF THE HIP-JOINT:

THEIR LATE END-RESULTS, AFTER AN AVERAGE PERIOD OF SIX YEARS AND NINE MONTHS.

BY

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USUALLY the accumulation of statistics gathered from clinical data is of little value. Nevertheless, there are times in the life of a surgeon when he is impelled to review the end-results of the treatment he has employed, hoping to encourage himself by finding that his efforts have met with success, and also wishing, by examining his failures, to find their cause and so, if possible, improve his future patients' chances.

It is with these ends in view that the study of the first 300 cases of tuberculosis of the hip-joint treated in the King Edward VII Hospital, Sheffield, has been undertaken; only those cases are included which have been re-examined personally by the author at least two years after, and an average period of six years and nine months after discharge from the hospital.

Girdlestone¹ has written: "The diagnosis of tuberculous hip disease rests on probabilities until either destruction has advanced to such a degree as makes the radiogram evidential, or abscess formation renders a conclusive test possible in the finding of tubercle bacilli."

The first difficulty, then, was to be sure of the diagnosis; in many cases tuberculosis of the hip was confirmed by radiographic or bacteriological means. This eliminated three of the other common conditions which may be mistaken for it—namely, pseudo-coxalgia, coxa vara, and infection with pyogenic organisms (usually the staphylococcus). The remaining common type of arthritis of the hip-joint is the so-called "transient arthritis," which is due to toxins from a local focus of inflammation. It is impossible to be sure in all cases that patients with apparently early tuberculosis of the hip are not in reality suffering from this affection, and it is almost certain that some patients with this condition have been included, especially in the group of cases in which recovery was complete. However, every effort has been made to eliminate such patients by excluding all those in which the symptoms disappeared permanently with one month's treatment. Apart from taking care that the above conditions were observed, no selection of cases has been made.

THE TREATMENT EMPLOYED.

The usual methods for improving the general health of the patients were used, and included nursing in the open air, real and artificial heliotherapy, and a generous but simple diet containing abundance of foods with high vitamin A and D content.

The local lesions were dealt with by those conservative methods of treatment first used so successfully in this country by Sir Henry Gauvain, together with various modifications on the lines advocated by Sir Robert Jones, Girdlestone, and others. Briefly the methods employed may be described as follows.

1. Acute Stage with Active Progressive Disease.

The principles underlying treatment at this stage are immobilization in bed, with traction to counteract muscle spasm. The ordinary weight-extension with pulley, the Pyrford frame described by Perkins,² and other forms of fixed extension were used in the treatment of the patients under discussion, according to the degree of activity of the disease and amount of deformity. Traction was maintained in one of these ways until the spasm of the muscles had disappeared and until deformity had been corrected as far as possible.

2. Transition Stage.

After deciding by clinical and radiographic examination whether a movable or a fixed joint would be the probable end-result, one of two different forms of treatment was adopted. In the former instance weight-extension was