

became shallow, and temperature and pulse rising. The following day he remained dull and sleepy, came to an end unconsciously and died without any rigidity being present. The reporter says: "It is very much a question whether the magnesium sulphate did not contribute to the patient's death."

There are thus 14 cases on record treated with magnesium sulphate. Of 11 cases treated by subarachnoid injections 5 have recovered, a mortality of 55 per cent. This result is encouraging, inasmuch as almost all the cases in this series were of that type of tetanus which usually proves fatal; 3 cases were treated by infusion, none of them of severe type, and there were 3 recoveries.

In conclusion, it may be affirmed that by the use of magnesium sulphate it is possible to achieve complete muscular relaxation in almost all cases of tetanus; from the report of results there seems to be a distinct benefit to the patient in this condition, inasmuch as it prevents the rapid exhaustion due to convulsions and in most instances has made it possible for the patient to take nourishment. It may likewise be affirmed that, while as yet there is comparatively little clinical evidence upon which to base general statements, yet it seems possible to avoid the dangerous effects of an overdose of magnesium salts, and it is likely that when the technique has been worked out thoroughly the treatment will offer a possibility of saving a great many patients with tetanus who at the present time are given up as hopeless at first sight.

I desire to express my gratitude to Professor William S. Halsted for the privilege of reporting the case. For the fulness and accuracy of the clinical notes, I am indebted to Drs. J. H. Chesnutt and R. D. McClure.

TRACTION IN THE TREATMENT OF HIP DISEASE.

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If surgical clinics in different cities are visited one finds that there is great diversity in the manner of treating hip disease. If, however, the subject is examined more closely it will be found that the accepted principles of treatment do not vary greatly. Surgeons treating a chronic affection, with changing indications, may vary in their opinion as to which symptoms demand most attention, and in this way they may differ.

It is now generally admitted that radical operative interference in hip disease is not to be undertaken until other measures have failed; in this paper for the sake of brevity the subjects of excision, amputation, and erosion will not be considered. It is also universally believed that in combating hip disease (a tuberculous affection) as much fresh air and activity as is possible is of the greatest importance; no space will be devoted here to an exposition of the advantages of these essentials of treatment, nor of the necessity of proper nutrition.

The methods of treatment at present in general use may be grouped as follows: (1) The method with little reliance upon mechanical aids; (2) the method utilizing the Thomas splint; (3) that attempting a plaster-of-Paris fixation as the chief feature of conservative treatment; and (4) a method attributing much value to traction.

1. TREATMENT WITH LITTLE MECHANICAL AID. In neglected cases the course of the development of tuberculous coxitis is but little influenced by treatment. In the initial stage, and when little pain is present, the child may limp and avoid instinctively, or is prevented from making, violent motion of the joint; later, as the disease progresses and the tissues are more extensively involved, there may be much sensitiveness and pain, night cries from exaggerated muscular irritability, and distortion from tonic muscular spasm; finally, disorganization of the joint occurs, destruction of the head, and obliteration of the upper border of the acetabulum take place with the flexed and adducted position of the limb, firmly held "splinted" against the pelvis by stiffened muscles and contracted ligaments (Figs. 1 to 4). The acute pain, if present, ceases as the destructive osteitis becomes walled off or is supplanted by a constructive osteitis. The patient, confined, by pain or the sensitiveness of the limb on motion, to the bed or lounge, becomes able to move about, and needing crutches or a crutch on account of the distortion of the limb is able to go about with comparative freedom, and, eventually, in a large number of cases, is cured with a distorted limb. In a certain number of cases in which the process is considerable, the tuberculous detritus acts as an irritant; an abscess is developed, which may be absorbed and remain an encapsulated caseous mass, or may enlarge, force its way through the fascia and skin and evacuate itself, leaving a sinus which heals under normal conditions. Secondary infection of the tissues is, however, not infrequent, extending to the bone which becomes involved in infective osteomyelitis, which in a certain number of cases leads to extensive necrosis, chronic sepsis, amyloid disease of kidneys, and death or chronic invalidism. In a majority of cases immunity becomes established in time, and recovery takes place, leaving the patient in a more or less crippled condition.

As this process is one which lasts for years and is often characterized by alternate periods of improvement and relapse, it is not unnatural that those in charge of the nursing of the patient, seeing im-

provement follow any suggested remedy from the seton to faith cure, attribute such improvement to the applied remedy, while in reality recovery from the disease is not exceptional. The true measure of the success of a method of treatment is the amount of resulting deformity, rather than the fact of recovery from pain. Usually the child is kept in bed during the acute stage, with some arrangement for the correction of deformity. Crutches are given later to limit the weight bearing use of the limb as soon as locomotion is



FIG. 1.—Radiogram of a case of hip disease not treated by traction, showing deformity and pathological dislocation. (Bradford.)

possible. Later still, the patients are practically left to the curative process of Nature, protected from jars only by the occasional or intermittent use of canes or crutches.

Diseased bone may, in a short time, regain enough strength to bear slight strain without injury and without pain. The patient walks and is encouraged to walk by the fact of freedom from pain, but until the bone is restored to its normal strength, the danger of injury to tissue from violence, incident to ordinary activity, cannot

be avoided. Under this condition after slight bruises either a relapse occurs, or enough irritation is kept up to develop deformity. It is to these facts, that is, the occasional relapse and the gradual development of the deformity, which gives rise to the popular belief in the practical incurability of the affection. In the minds of many surgeons also without an extensive study of the course of the affection, through a long period of years and under many differing conditions and methods of treatment, an opinion becomes established that if the general health is maintained, mechanical treatment is of little importance.

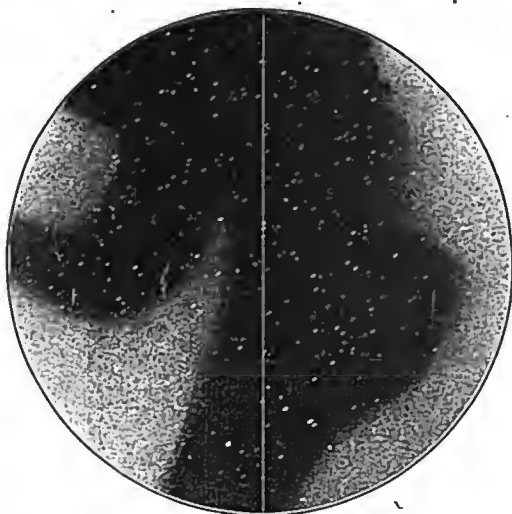


FIG. 2.—Radiogram of a case of hip disease (with abacna) twenty years after the cessation of treatment by thorough traction and protection. A strong, useful limb without deformity, with slight motion; photograph in Fig. 19. (Bradford.)

In fact, a large proportion of cases of imperfectly treated hip disease will recover eventually without treatment, but with deformity of greater or less severity; this ensues, in many cases, after years of suffering and the frequent occurrence of abscess and resulting sinuses, and not infrequently sepsis and septic osteomyelitis.

2. THE THOMAS SPLINT. The irksomeness of bed confinement, the "wire britches" (that is, the *gouttière de Bonnet*) employed by

the French surgeons, and the manifest need of some treatment for the disease, led to the introduction by Mr. Thomas, of Liverpool, of his excellent apparatus. It is somewhat singular that so admirable a contrivance as this should have found so little general acceptance in the surgical world. It is easily made, an efficient aid, inexpensive and requires a skill for adjustment no greater than can be acquired by anyone familiar with the use of appliances needed in the treatment of fractures. The advantages of the method have been often demonstrated, notably by Mr. Thomas himself, and at present by Mr. Jones, of Liverpool, and Dr. Ridlon, of Chicago; and, lately, in an excellent manner, by Dr. Bennie, of Australia; but they have not been as generally adopted by surgeons as the merits of the apparatus deserve.



FIG. 3.—Section of a hip-joint with hip disease, showing deformity and pathological dislocation. (Bradford.)

The chief reason why the Thomas splint has not met with general adoption is, in all probability, the simple one that surgeons avoid mechanical aids when possible. In the larger surgical clinics where patients are treated in great numbers, the operative demands are so great and the interest in operative methods is such, that little time and thought are given to the use of mechanisms. A mechanical appliance usually is left to juniors, or assistants, and is often imperfectly applied with unsatisfactory results. It is much easier to order the application of plaster-of-Paris, with which the student or assistant is usually familiar. In addition there are certain im-

perfections in the Thomas splint itself as an ideal appliance which prevents its enthusiastic acceptance by specialists.

It furnishes imperfect fixation, it does not prevent increased interarticular pressure, and it does not prevent the development of pathological dislocation. For larger patients it is an awkward appliance. It necessitates the use of crutches, and does not allow

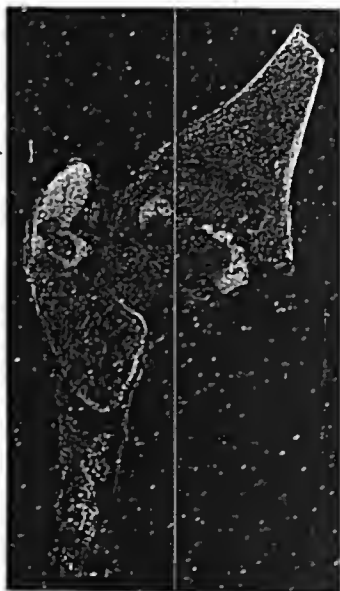


FIG. 4.—Section of a hip-joint after hip disease of a severe suppurating type. Death occurred from tuberculous meningitis three years after the patient had discarded traction treatment for hip disease; the limb was useful, and there was no deformity and no pathological dislocation at the hip. Traction had been applied efficiently for one year. (Bradford.)

the patient to sit with comfort. On the other hand, although some skill is demanded in its adjustment, this is not sufficient to prevent its ready use. It enables the patient to move or to be handled without discomfort except during the acutest stage, it diminishes or prevents flexion deformity, and it checks but does not prevent adduction. In double hip disease it is an admirable appliance. Mr. Thomas

himself made no extravagant claims for the appliance, stating that while hip disease could be cured probably as quickly without this splint, the care of the case was easier, and the patient suffered less, and there was less deformity than when it was not employed. The splint is more agreeable to patients than an efficient plaster bandage to the trunk and thigh.

3. **PLASTER-OF-PARIS BANDAGES.** A surgeon in charge of a large number of patients placed in an institution is obliged to devote his attention to the development of a method of treatment adapted to his nursing facilities. A well-applied plaster-of-Paris spica bandage, reaching from above the mammillary line to below the knee, placing the patient in a portable frame with facilities for moving the patient about freely, and an abundant supply of fresh air, combine to afford a method of treatment which is satisfactory during the acute stages of the affection, without a demand on a large nursing force. This is the treatment so successfully conducted at Berck sur Mer; but a short spica bandage, combined with crutches in common use in many clinics, as an ambulatory method of treatment of hip disease, cannot be recommended as a thorough method of treatment.

4. **TRACTION APPLIANCES.** The employment of traction, that is, a pull, in the treatment of hip disease is one which is naturally suggested by the distorted position of the limb and the muscular spasm which evidently crowds the head of the femur into the acetabulum, increasing the destructive osteitis in the direction of the pressure, aggravating the disease, and increasing the deformity. As extravagant claims, however, were at first made of the benefits to be derived from traction as the chief principle of treatment in hip disease; as expensive, elaborate appliances requiring special skill in adjustment, and much care in nursing have often been recommended in the treatment of hip disease, it is natural that the method of treatment be regarded with doubt. The active surgeon not without reason looks upon an expensive, complicated apparatus, needing special training for adjustment, as unsuited for general use. That, however, the principles of the judicious employment of traction in hip disease are sound, and that they have in practice been applied with great benefit has been abundantly shown. The method merits the careful attention of surgeons.

Although it is possible to classify the methods of treatment of hip disease in groups, in actual practice the treatment of hip disease varies greatly—from that which confines the patient for years to a couch, to attempts at "motion without friction" (as it is termed) of hips treated by splints, or to locomotion at will with the expectation that the application of a plaster-of-Paris spica will help the cure of the disease. In this maze of inconsistency, treatment should follow the clue furnished by pathological evidence which clearly indicates the advantage of the prevention of bone crowding.

If traction is applied to a normal adult hip, it will be found at

first to have no appreciable effect in distraction, that is, in drawing the head of the femur from the acetabulum, even if a considerable force or pull is applied—thirty pounds. The first effect is probably to stimulate the action of the powerful hip muscles so that the hip is held even more firmly than before. This has led some observers to infer that traction has no influence in drawing the head of the femur away from the acetabulum. If, however, a pull is applied to a diseased hip when the cotyloid ligament and the zona orbicularis are disorganized by the inflammatory process involving the capsule, it will be seen that even with a moderate pull of six pounds a marked distraction can be effected. This is demonstrated if a diseased joint is incised and the finger is inserted into the joint. It can also be shown by careful measurements of the length of a limb with a diseased hip; when a patient has been subjected to a traction pull for a few days. If any further proof is needed it will be furnished by a skiagram of a tuberculous hip-joint subjected to efficient traction. It will be seen that it is possible to draw a diseased femoral head away from the acetabulum, meeting a manifest indication to promote the healing of a joint surface affected with osteitis, and especially a hip-joint. If, in a given case even when there is little pathological relaxation of the capsule, a traction force is applied for a sufficient length of time, it will be found that a distracting effect will, in time, be accomplished. There is no doubt, therefore, that the surgeon has at his command a means of promoting healing by separating the diseased surfaces in hip disease under certain conditions.

If it is desired to immobilize the hip-joint absolutely, the difficulty of the attempt will at once be seen. Every motion of the trunk or of either extremity is transmitted to the pelvis which forms a part of the hip-joint. The futility of an attempt at exact fixation by securing the affected limb with a heavy plaster bandage, leaving the other limb free, is apparent; neither is absolute hip fixation secured by encasing the trunk with a plaster-of-Paris bandage, as it is impossible to prevent by means of a bandage the movements of the lumbar spine, or by compression upon the ribs to hold the upper portion of the trunk from motion. Furthermore, firm pressure upon the ribs prevents respiration and is impracticable. For absolute fixation it is necessary to hold firmly the whole trunk and both lower extremities. This is shown if an attempt is made to take a skiagraphic picture of a hip-joint when the patient moves the trunk.

The problem may be likened to that which would be presented if it were desired to prevent a snake from wriggling. This could be more readily done if the head of the snake were held and firm traction put upon the tail, than if the snake were placed within a glass tube. A rope made taut resists side pressure better than a slack one. Traction experiments upon a cadaver, using an efficient traction splint, made by my colleague, Dr. A. Thorndike, as well as

upon patients, demonstrated what has already been shown by Judson and others, that traction properly applied furnishes the best method of fixation to hip-joints. If the theoretical advantages of traction are accepted it should follow that practically when traction is properly applied better results should be secured than when this method is not employed (Figs. 5 to 9).

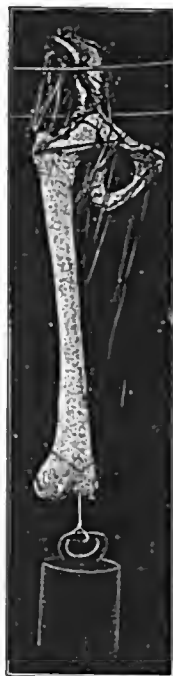


FIG. 5.—Illustrating the force of muscular contractions of the muscles controlling the hip. The weight is twelve pounds. Elastic bands are placed at the origin and insertion of each muscle, one band only for each muscle. (Bradford.)

In this connection the statistics of hip disease at the Boston Children's Hospital are of interest. Treatment, during the last thirty years, has included some form of effective traction during the acute and subacute stages of the disease, although all other known

methods of treatment have been thoroughly tried. The cases are treated largely in the out-patient department (with traction or protection splints), except in the more acute stage or when operative interference is needed. Those suffering from abscesses or in the

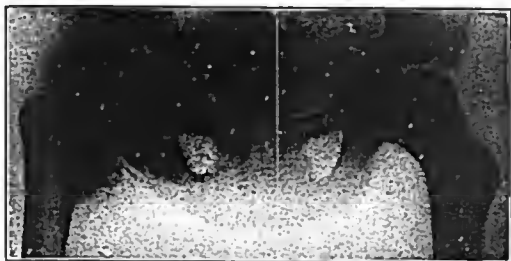


FIG. 6.—Radiogram of hip disease without traction. (Bradford.)

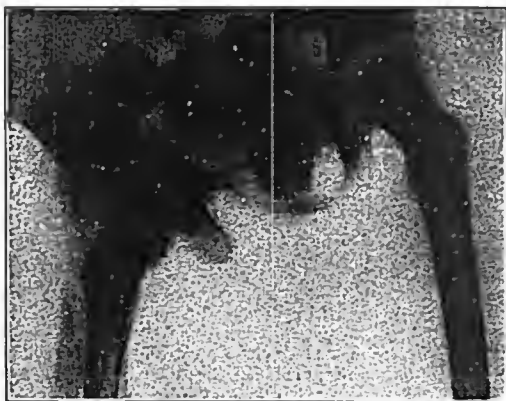


FIG. 7.—Radiogram of hip disease with ten pounds' traction. (Bradford.)

more severe or acute stages are referred to the in-service. A country convalescent home, seashore homes, district nursing, and a school for crippled children aid in the continued care of the patients.

The number of cases recorded and treated for hip diseases in the out-patient service, between the years 1883 and 1907, was 1809. Of these 983 were subsequently admitted as in-patients at the hos-

pital, representing the severer cases, and among these 502 were suppurative cases, that is, 30 per cent.

The operations other than incision of abscesses performed were as follows: between the years 1879 and 1907, 1154 cases: Amputations (at the hip-joint), 2; 1 surviving twenty years later and 1 death. Excision (including the cases subsequently amputated), 64; 9 deaths, 9 per cent. In addition to these a number of arthrotomies, curetting of the femoral head and neck, channelling of the neck, and 4 cases of dislocation of the head by incision in acetabular disease—with apparent relief. The general mortality of cases in the in-service is as follows, from the years 1895 to 1908: 606 cases of hip disease, 25 deaths, that is, 4 per cent. The causes of death were:



FIG. 8.—Amputation at the hip-joint at the age of eight years for hip disease, with extensive caries of the ilium. The amputation removed irritating pressure. The periosteum around the femur was saved in the flap. (Bradford.)

12 tuberculous meningitis; 1 empyema; 1 double hip disease; 1 hip disease and caries of the spine; 1 scarlet fever; 1 diphtheria; 1 after excision; 1 after abdominal incision for acetabular drainage; 6 from uncomplicated hip disease; total, 25. The mortality for uncomplicated hip disease was 1 per cent.

Of the 1809 recorded cases in the out-patient department, 144 are noted as having sinuses. This may be taken to indicate that in a majority of the cases with abscesses incised in the in-service there was little recurrence.

In order to determine more accurately the ultimate results, after a number of years, obtained by treatment, upward of four hundred postal cards were addressed to patients whose records showed that the affection was of sufficient severity to demand attendance at the

out-patient service for a year or more, but no patient was communicated with who was admitted after the year 1899 (the inquiry being made in January, 1908).

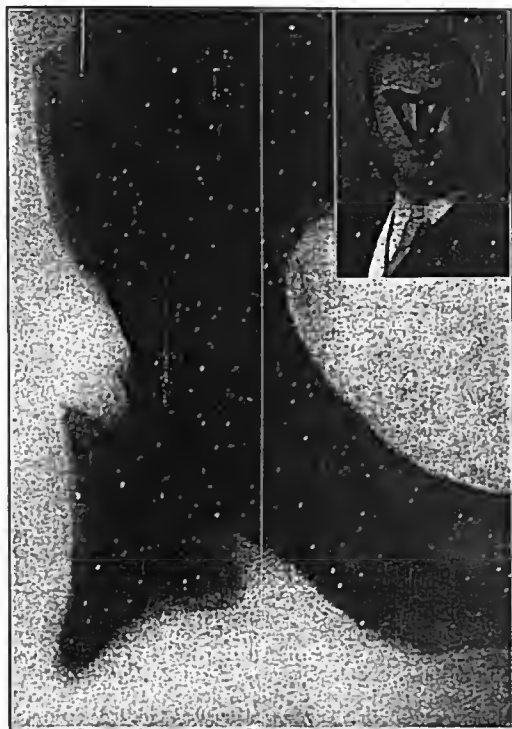


FIG. 9.—Radiogram and portrait of the same patient shown in Fig. 8 twenty years later. From the periosteum bone growth developed, enabling the patient to wear an artificial leg and aiding him to lead an active business life. (Bradford.)

One hundred and sixty-seven replies were received, stating that of these 9 had died from the complications following hip disease; 2 of these had recovered from the affection of the hip, but had died, 1 from an operation for appendicitis and the other from some dis-

case not stated, unconnected with the disease of the hip, and after he had recovered from this; that is, a mortality of 6 per cent. approximately. 32 reported their ability to walk without limp; 46 with slight limp; 52 with limp the amount not stated; 5 with a bad limp; 1 required an apparatus and crutch; 1 required a crutch. All reported their ability to work or attend school; none were bed ridden or disabled, with the exception of those requiring crutches. On further investigation more full replies were received from 98 of the 167 patients.

The amount of shortening was reported to be, none in 12; one inch and under in 26; between one and two inches in 28; between two and three inches in 11; between three and four inches in 10; over four inches in 8; in 3 the shortening was stated as slight, but the amount was not given; that is, in nearly 70 per cent. the shortening was under two inches; 35 had had abscesses; 5 had discharging sinuses; that is, 37 per cent. suppurating cases.

A personal examination was made of as many of these latter cases as could be seen, with the following results: 26 were found to be non-suppurating cases (that is, had never had an abscess); 25 were cases previously suffering from abscesses and sinuses; in none were any unhealed sinuses. Of the 26 non-suppurative cases: In 11 the motion was perfect (that is, 90 degrees or over); in 7 there was slight motion (under 10 degrees); in 8 there was no motion. There was deformity of flexion in 11 as follows: 1 of 10 degrees; 2 of 15 degrees; 1 of 25 degrees; 1 of 30 degrees; 1 of 40 degrees; 3 of 45 degrees; 1 of 50 degrees; 1 had abduction of 40 degrees after Gant's operation. There was deformity of adduction in 8 as follows: 1 of 10 degrees; 2 of 20 degrees; 1 of 25 degrees; 2 of 30 degrees; 1 of 40 degrees; 1 of 45 degrees. There was no pathological dislocation in 19, the trochanter being below the Nélaton line. In 3 the trochanter was one-half inch above the line; in 1 was one inch; in 1 was one and one-half inches; in 1 was two inches; in 1 was three inches. In the 25 suppurative cases (that is, with previous abscess), there was stiffness at the hip-joint in 11; slight motion in 7; good motion in 2 (20 degrees to 30 degrees); perfect motion (90 degrees or over) in 5. There was a permanent flexion deformity in 15 as follows: 4 with 10 degrees; 2 with 15 degrees; 2 with 20 degrees; 1 with 25 degrees; 1 with 40 degrees; 2 with 45 degrees; 1 with 55 degrees; 2 with 60 degrees. In 2 there was abduction: 1 of 10 degrees, and 1 of 20 degrees. In 12 there was adduction as follows: 5 of 10 degrees; 1 of 15 degrees; 1 of 30 degrees; 1 of 40 degrees; 2 of 45 degrees; 2 of 50 degrees. In 12 there was no pathological dislocation, the trochanter not being above Nélaton's line. In 1 the trochanter was one-half inch above the line; in 3 was one inch; in 3 was one and one-half inches; in 2 was two inches; in 1 was two and one-half inches; in 1 was three and one-half inches. In 1, a case of excision, there was no deformity, a strong useful leg, but three inches

shortening. No correction of deformity was made in these cases with the exception of 1, on whom a Gant operation had been performed. None of the patients needed crutches or apparatus. All walked about freely, any desirable distance. The results can be summarized as follows: It was found that the ultimate mortality was 6 per cent. For the cases under treatment in the hospital the mortality was 4 per cent. The percentage of abscesses for the cases under treatment was 30 to 37 per cent. The ultimate results showed useful limbs in 98 per cent. Shortening of less than two inches in 70 per cent. of the non-suppurative cases; perfect motion, 90 degrees or over, in 40 per cent. of the non-suppurative cases; absence of flexion deformity in 60 per cent., and absence of pathological dislocation in 70 per cent.

In the suppurative cases there was perfect motion in 20 per cent. In free flexion there was good motion (20 per cent.) in 10 per cent. of the cases. There was absence of deformity in 40 per cent. There was absence of pathological dislocation in 40 per cent.

To estimate the value of these results a comparison should be made with the results recorded in other institutions and under other treatments. It should be borne in mind that the statistics of the Boston Children's Hospital are not taken from selected cases or cases placed under favorable circumstances. Many of them were neglected cases with existing deformity and pathological changes when treatment was first undertaken at the Children's Hospital. Pains were taken to verify the diagnoses in the cases by the recorded testimony of competent observers through a sufficiently long period, and doubtful cases were rejected; but otherwise the cases represent those presenting themselves at a charitable hospital from the poorer class in a large American city. In the worst cases they received the benefit of a stay in a convalescent home for a time, but the greater part of the treatment was under home care.

The recent report of the results from treatment, by means of a plaster-of-Paris spica bandage with crutches, of a number of cases at a seaside home, may be used in comparison.¹

These cases were at a seaside home and the observations were upon cases two years after the beginning of treatment, ages four to fifteen years. The treatment consisted of a plaster-of-Paris bandage applied from the mammillary line to below the knee, worn constantly for four or five months, crutches and an elevated shoe on the well foot being furnished. This was followed by a plaster bandage which allowed freedom at the knee and later by a lighter appliance. The children, even with an elevated shoe, constantly laid aside their crutches, allowing the full weight to fall in walking or at play upon the diseased hips.

In 100 cases, 3 with double hip disease, there were 69 with ab-

¹ Finding Larsen, Nordiskt. Med. Archiv, 1905-1906.

scasses; 99 cases were treated conservatively, but in 29 of them it was found necessary to excise the hip; in 4 cases excision was performed at once. The ultimate functional result of the cases or mortality is not given, but the high abscess rate and the large percentage of resection is noteworthy. The mortality of hip disease in the German Surgical Clinics, according to the statistics published by Dollinger² from various surgical clinics is as follows: In suppurative cases, 27 per cent. were cured; 24 per cent. were not cured; 48.8 per cent. died. In non-suppurative cases the mortality was 16.5 per cent.

Cazin reported a mortality in 80 suppurative cases at the sea-coast hospital, of Berck sur Mer, of 12.5 per cent.; 55 per cent. were cured. Menard³ at the same institution recently reports even better figures: 1321 cases both suppurative and non-suppurative; 95 deaths; 54 in cases not operated upon; 41 in cases operated upon (that is, excision), 7 per cent.

The treatment at Berck is at present chiefly recumbent treatment, with plaster-of-Paris bandages, fixation, and largely out-door exposure in the day time on a portable frame.

The chief cause of death was tuberculous meningitis, 1 out of 56. Tuberculous meningitis was as common in cases operated upon as in cases not operated upon. The deaths from hip disease proper, that is, when other tissues were not involved, were few.

Mortality statistics quoted by Whitman⁴ are as follows: At Tübingen, 40 per cent.; Kiel, 48.59 per cent. non-operative cases, 53.96 per cent. operative; at Marburg, 35 per cent. non-operative cases, 40.4 per cent. operative cases; at Heidelberg, 46.6 per cent. non-operative cases, 58 per cent. operative cases; in Zurich, 37.7 per cent. non-operative cases, 54 per cent. operative cases; in Vienna, 17 per cent. in all cases; in Göttingen a mortality of 40 per cent. Rabi reports a mortality of 20 per cent. in a large number of cases, some of which, 14 per cent., were still under treatment. At the Alexandra Hospital, in London, the mortality was 26 per cent.

Statistics of the ultimate functional results may be quoted as follows: Dollinger: in 14 cases, 2 walked with an excellent gait, 3 fairly well, 3 limping badly, 1 requiring cane and apparatus, 1 requiring cane, 1 with a slight limp, 1 in a poor condition, and 1 bed ridden. The average shortening from 4 to 8 cm. There was pathological dislocation in all. On the average the trochanter was 2 to 3 cm. above Nélaton's line, in several cases as much as 6 cm. No mention is made of motion, or of absence of deformity. The usual percentage of abscesses in hip disease is estimated as 50 per cent. by Whitman.

² Joachimsthal's Handbuch.

³ Etude sur coxalgie, Paris, 1907.

⁴ Treatise on Orthopedic Surgery, third edition, p. 391.

It appears, therefore, that as far as can be judged by statistics, the traction treatment employed at the Boston Children's Hospital is justified by superior results. If these figures showing the superiority of the results obtained in cases in which efficient traction is employed as a principle of treatment, as compared with those in which traction is not used, are not sufficiently convincing, further evidence can be offered in the figures collected by V. P. Gihney⁵ at the Hospital of Ruptured and Crippled, New York. In the first series, 80 cases without mechanical or operative treatment, there was deformity in almost all cases. In 107 cases treated by mechanical means, not always efficiently, there was recovery without marked flexion. The mortality in Dr. Gihney's service, 288 cases, was 12 per cent. The mortality in the clinics of American cities is reported by Whitman as 12.5 per cent.

It should not be assumed that the results obtained by traction at a large civic hospital, treating largely the poorer classes with imperfect home nursing, indicate what can be accomplished if this principle of treatment is more thoroughly applied. Aseptic surgery is often imperfectly conducted in a crowded dispensary, but the results obtained are enough better than those obtained if all attempts at asepsis were discarded, to make all attempts to prevent sepsis obligatory. It is also true that better results in the treatment of hip disease are gained if the principle of traction is recognized than if it is ignored, even if the application is not as thoroughly or constantly applied as is desired. If the muscular force crowding the head of the femur into the acetabulum be estimated in a given case as a pressure of fifteen pounds and a distracting force of five pounds is applied for the greater part of the time, it may be sufficient to prevent the complete distraction of the femur and of the acetabulum and dislocation. The less pull, and the less constantly it is applied, the poorer the results. When bone destruction has already taken place in neglected cases, the results are not so good as those followed more carefully from the first. Among intelligent people and the well-to-do, with the best nursing facilities, better results are obtained in chronic cases.

Experience has justified the expectation of perfect recovery after thorough treatment, if this is undertaken before the disease has disorganized the tissue to a considerable extent. This expectation is justified in pulmonary consumption, and it is equally true in hip disease. In coxitis there is, however, the advantage for the surgeon that he has directly under his control the means of checking the irritating causes which delay cicatrization of the tuberculous tissue.

This belief is supported by the results obtained by the late C. F.

⁵ Med. Record, March 2, 1878.

Taylor,* of New York. 94 cases, of which 24 were suppurative cases, of these 17 recovered with ample motion (82 degrees to 18 degrees); in 14 cases perfectly useful limbs thoroughly healed; in 5 the limbs were useful; but sinuses remained; 2 died. Satisfactory recovery occurred in the non-suppurative cases, except in 1 who was killed in an accident after having been run over. L. A. Sayre⁷ also reported admirable results in the treatment of his private cases.

The following cases coming under personal observation may be of interest illustrating the value of traction in cases in which the final observations were made several years after the end of treatment:

CASE I.—C., a girl, aged eight years, treated in Paris by recumbency in a gouttière de Bonnet for left hip disease for six months; later, in 1877, came under the care of the late Dr. C. F. Taylor, of New York. At this time the patient was suffering from pain and sensitiveness. Traction was applied by Dr. Taylor with much thoroughness for a period of a year and a half. A large abscess developed in the upper part of the thigh; it evacuated itself. The patient wore a convalescent splint for several years. She was seen in 1903, over twenty years after the cessation of treatment, and was found to be in perfect health; there had been no sinus subsequent to the healing of the abscess twenty-two years before. Motion in flexion was over 90 degrees; abduction 30 degrees. The limb was strong, useful, and undistorted; the trochanter was below the Roser Nélaton's line. As an evidence of the extent of the early epiphyseal disease there was a shortening from arrest of growth of the femur of one and one-half inches. The patient was a healthy married woman.

CASE II.—G., a boy, at the age of six years, in 1884, was seized with right tuberculous coxitis of a severe type while living in Paris. He was treated by portable recumbency, at gouttière de Bonnet, for two years; afterward ambulatory treatment was gradually permitted and encouraged, followed by massage and electricity. At the age of twenty-one years, that is, in 1899, he returned to America with a thoroughly cured hip, but with bad deformity. There had been no abscess, but ankylosis in a faulty position had occurred with flexion of the thigh at nearly 90 degrees and 30 degrees adduction. There was marked pathological dislocation. The head of the trochanter was from two to three inches above Nélaton's line. The patient walked with a disfiguring limp. A subtrochanteric osteotomy with fixation in a strongly abducted position was performed with success, giving a useful limb and but little disfigurement of gait.

CASE III.—O., a girl, at the age of five years, in 1879 developed tuberculous osteitis of the left hip of a severe type. She was treated

* Mechanical Treatment of Disease of the Hip-joint, Boston Med. and Surg. Jour., March 6, 1879.

⁷ New York Med. Jour., April 30, 1892.

from the first by means of traction, at first temporarily with recumbency, later with an ambulatory traction splint. An abscess developed and evacuated itself, leaving a sinus. Three years following the disease of the left hip the patient was attacked by a similar process in the right hip. Traction was no longer necessary on the left hip and the child was placed upon a double Thomas splint with abduction of both hips with a weight and pulley traction on the right. The child was at this time taken to Switzerland and remained abroad for several years. The traction on the right hip was discontinued and the child was carried about on a mattress in a light basket. An abscess developed in the right hip and sinuses in both hips discharged for some time, but finally healed. In 1900 the patient was examined; there was a flexion deformity of both hips to an angle of 90 degrees; no adduction. Both sinuses had healed; 10 degrees of motion in flexion was present in the left hip and no pathological dislocation; in the right hip no motion was present and there was marked pathological dislocation. The patient was able to walk about freely and subsequently married and later gave birth to a healthy child.

CASE IV.—D., a boy, aged seven years, in 1880, developed severe disease of the right hip; severe night cries were prominent early symptoms. He was placed under efficient treatment, including traction with recumbency at first and later ambulatory treatment with traction. The case was a suppurative one; an abscess formed and evacuated itself, leaving a sinus which persisted for years and finally healed. A traction splint was worn for two or more years, but a convalescent splint was not worn constantly and a permanent flexion deformity of 45 degrees with adduction of 30 degrees developed gradually. This was corrected by means of a subtrochanteric osteotomy. Fixation in an abducted position was performed in 1905 with excellent result. On examination at this time there was stiffness at the hip-joint, but no pathological dislocation.

CASE V.—L., a girl, aged four years, in 1882, developed left hip disease without severe symptoms. Ambulatory traction treatment was carried out with thoroughness for three years. The patient was cured, was examined twenty-one years later and was found to have recovered with nearly normal motion of flexion, slightly restricted abduction, no pathological dislocation, a perfectly useful limb, but with an arrest of growth of the femur and a shortening of one and one-half inches.

As cases under exceptional care do not furnish a good basis for statistical comparison, I have not attempted to obtain the ultimate results in a large number of the cases treated outside of hospital practice in an experience in orthopedic practice of thirty years, and no statistics of those cases are offered. I wish, however, after a careful trial, without bias, of all methods of treatment, both operative and conservative, to record my conviction of the

great superiority of the conservative method in tuberculosis of hip-joint; of the great advantage of traction applied during the more acute stage to the point of distraction of the bones of the joint; and of the importance of protecting the joint from ambulatory jar for some time following the subsidence of all acute symptoms. There are three obstacles to the satisfactory cure of hip disease: (1) Tuberculous meningitis, best combated by fresh air and activity; (2) septic infection, best avoided by delaying operative interference; and (3) deformity, best avoided by proper mechanical treatment including, as of great importance, traction.



FIG. 10

FIG. 10.—Child wearing the abduction traction hip splint. (Bradford.)



FIG. 11

FIG. 11.—Rear view of the abduction traction splint applied. (Bradford.)

A valid objection to the employment of traction splints is that they are elaborate and expensive, and require special skill in nursing, beyond the reach of the general practitioner. The justice of this criticism has been so evident that many attempts have been made to simplify the apparatus needed for the efficient application of traction. It is thought that the traction splint in use at the Children's Hospital for the last three years is an improvement both in efficiency and simplicity on appliances of the sort similarly employed for the purpose of traction.

The accompanying illustrations (Figs. 10, 11, 12, 13, 14, 15, and 16) indicate the nature of this apparatus. It can be said to be but little more complicated than the well-known Thomas knee-splint, which it resembles, with the additional attachment of a perineal half-ring pressing to the well side and determining the amount of abduction, and a windlass attachment furnishing traction. The apparatus has the advantage that it does not need constant watching of the perineal straps, and that there is less chafing at the perineum

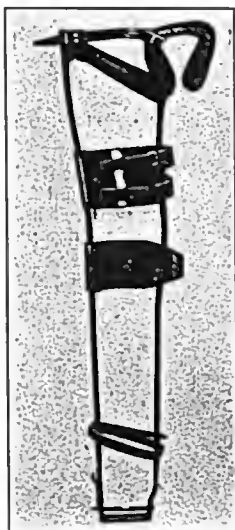


FIG. 12

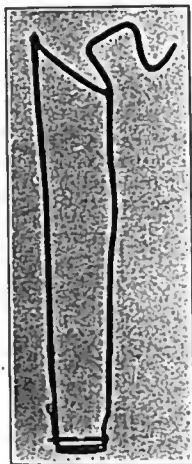


FIG. 13

FIG. 12.—Abduction traction splint padded. (Bradford.)

FIG. 13.—Abduction traction splint without padding or straps. (Bradford.)

than when straps are used. It requires no skilled nursing. The cost of the appliance is not great and it can be readily made by any skilled blacksmith. Other forms of traction have been used and attempts have been made to simplify the windlass traction attachment; the substitution of buckles and straps has frequently been tried, but the requisite gradation of pull is not well furnished by a buckle and strap attachment. A simple spindle with a drop-ring catch can be made to answer in the place of the one used in the

Children's Hospital, although the latter will be found more convenient and but slightly more expensive. If it is remembered that when traction is needed in the acuter stages some delicacy of adjustment is needed to avoid increasing muscular spasm, the difficulty of using

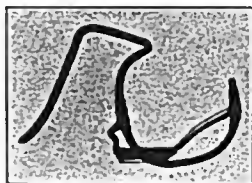


FIG. 14.—Curve of the wire of the upper rings of the abduction traction splint. (Bradford.)

buckle and strap traction satisfactorily will be seen. In fact it may be said that no conclusion as to the results to be obtained from the traction treatment in the acute stage can be drawn when buckle and strap traction is employed. With the abduction perineal rings properly



FIG. 15.—Experiment showing the amount of fixation of the hip-joint from traction, with a strong pull endurable by the patient; no motion at the fractured hip-joint; the pelvis sways with movement of the leg, with the traction reduced one-half; motion of only 15 degrees in abduction and 7 per cent. flexion was possible. The less the pull the more the motion. (Bradford.)

adjusted, there is no soiling the splints which are not removed when the patient uses the closet. When the stage of the affection is reached where traction is not needed, the apparatus can be used simply as a perineal crutch, the traction attachment being discarded with or without the removal of the abduction addition. The splint is prevented

from slipping off by a strap passing over the shoulder, as in the Thomas knee-splint.

In the early stage crutches are furnished as an additional aid in locomotion, but they may be discarded at the will of the patient.

It is manifest that traction is only needed during a certain stage of hip disease, namely, the stage when there is exaggerated muscular spasm, which can be estimated by palpation of the adductor muscles, which in the more acute stages are in a state of spasm. As has been stated, during the acuter stages, it is desirable that the patient



FIG. 16.—Showing the amount of plaster-of-Paris spica fixation. A motion of 15 degrees in abduction and 10 degrees' flexion is possible at the hip-joint, when the bandage is carried to the mammillary line. (Bradford.)

be kept in a recumbent position and prevented from the trauma of jar or twist, including exaggerated muscular pressure. This is done by means of the traction splint indicated, but it can also be accomplished by the application of a weight and pulley. This, however, requires for satisfactory efficiency the fixation of the patient upon a frame in addition to the weight pull. Weight pull should only be used temporarily.

The importance of protecting the joint from jar during the convalescent stage is theoretically clear, but is often neglected in practice

for the reason that the patients suffer no pain and desire to be freed from all encumbrances, both crutches or splints. An irritation or weakness persists, due to occasional traumatism, in the partially recovered joint, which promotes the later development of deformity, that is, flexion and adduction (Figs. 17, 18, 19, and 20).

The two following cases serve to illustrate the value of splint protection of the hip:



FIG. 17



FIG. 18

FIG. 17.—Hip disease cured with traction treatment. Treatment was begun before there was extensive bone destruction. (Bradford.)

FIG. 18.—Same as Fig. 17, showing the range of motion. (Bradford.)

CASE VI.—A young man, aged twenty-two years, was seized with severe disease of the right hip while a student at the medical school. With the aid of crutches and a traction splint he was able to continue his studies after six months' interruption. Traction after a year became unnecessary to relieve symptoms. He was bebarred from hospital service by crutches and needed as he learned from experience some form of protection from the jar of locomotion. With a hinged ischiatic crutch he was able to enter upon arduous hospital duties and the hard work of early practice. His perineal crutch, uncomfortable on account of weight, was gradually discarded, but was for years needed to check the body jar of active loco-

motion. Recovery without deformity, with no dislocation, with slight hip motion, and a strong limb, followed.

CASE VII.—H., a man, aged twenty-four years, had suffered from hip disease since he was ten years of age and had recovered to the extent that he was able to walk about with crutches; was free from pain, but had several sinuses. He was, however, dependent upon crutches and was therefore debarred from a bread-winning occupation. He was furnished with a hinged ischiatic crutch, which was fitted with some difficulty, but finally made comfortable and worn



FIG. 19



FIG. 20

FIG. 19.—Cured hip disease—twenty years after the cessation of treatment. FIG. 2 shows skiagraph of this patient; there is one inch shortening, but no deformity. (Bradford.)

FIG. 20.—Cured hip disease—twelve years after the cessation of traction treatment. A strong, useful limb without deformity. (Bradford.)

for six years as a necessary means of locomotion without which walking for any time was followed by pain and cramps. He was able to secure an important position of trust requiring activity. He subsequently was able to discard his appliance and remained in good health enjoying active usefulness and dying at the age of forty years of an acute disease.

CONCLUSIONS. It may be said that the surgeon has within his control several methods of treatment for hip disease. He can aid in the protection of the joint simply by the use of crutches,

be can aid in furnishing the patient facilities for increased activity and fresh air—the antidote to tuberculosis. He can, if he desires, prevent deformity and limit, if not prevent, bone destruction by exaggerated bone pressure, thereby checking the process and promoting bone healing.

The test of his success in treatment will not be the recovery of the patient, but the amount of resulting deformity. The aim of the surgeon in the treatment of any case without existing bone distortion should be a cure without distortion or disability. The elevation of the trochanter above the Nélaton line, adduction, abduction, or flexion, indicate that the surgeon either undertook the case too late to secure the best possible results, or that he was unable to apply thoroughly the methods of relief at his command (Figs. 19 and 20).

Traction can be employed without using expensive or elaborate apparatus; it does not demand unusual skill in nursing or from the surgeon, or more attention in the direction of the case than is within ordinary possibilities.

It can be claimed: That traction meets a pathological indication during the acute stage, that is, the stage of muscular spasm; that when used it should be applied with the purpose of furnishing distraction, that is, checking undue bone crowding; that when efficiently applied it furnishes a satisfactory measure of fixation of the joint; and that when traction is employed better results are obtained than when it is not made use of during the course of treatment of hip disease.

Patients with hip disease placed under favorable conditions recover; the death rate is low; there is no malignancy in the disease. Besides fresh air and proper nutrition, protection from jar and joint crowding are to be reckoned among the favorable conditions.

When traction is employed at an early stage and during the more acute period in a large number of cases, fewer abscesses will occur and these will heal more readily; better functional results are obtained, and a greater number of useful limbs; there is less deformity; pathological dislocation can be prevented in more cases; more cases recover with serviceable motion—than when the employment of traction is ignored or applied imperfectly.