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# DISTRACTION
# IN THE TREATMENT OF HIP DISEASE.*

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The object of this paper is to urge the employment of distraction as a means of treatment in certain conditions of hip disease, using the term distraction to indicate separation of the head of the femur from the acetabulum. It is not claimed that traction is the only form of treatment, or that fixation and rest are not also needed in certain stages, or that protection from jar is not essential.

Nor is it intended in this paper to discuss the question of the best method of applying traction, or to advocate any form of splint.

In offering a plea for efficient traction in hip disease, the purpose is not to present a new theory, but to urge for general adoption principles of treatment recommended many years ago by Davis, Taylor, Sayre, and others. An argument in favor of these seems superfluous to any one familiar with their advantages, yet it must be admitted that their efficient employment is not so general as is desirable. Various causes have limited the general use of thorough

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traction. One of these is, perhaps, the lack of pathological and experimental evidence in favor of the method. It is proposed in this paper to bring forward facts other than statistics which speak for the efficient use of traction in hip-joint disease.

If a number of pathological specimens of pronounced hip-joint disease are examined, it will be seen that the head of the femur has been crowded upward and backward. This in typical cases continues until the head of the femur is partially absorbed, the acetabulum enlarged, and finally a subluxation takes place, and the exaggerated pressure of the femur upon the acetabulum is diminished. After a while, in successful cases, cicatrization of bone follows, and ossification, with a resulting deformity—the deformity consisting of a shortened and adducted limb with subluxation, as indicated by the fact that the trochanter is higher than the Nélaton line.

This pathological process characteristic of hip disease is illustrated in a number of pathological specimens seen in the Warren Museum, which are found to resemble each other in presenting the characteristic changes, varying only in the extent of the destructive osteitis. (See Figs. 1, 2, and 3.)

The change from carious destruction is most marked in the upper portion of the acetabulum, and in the lower portion of the acetabulum there is evidence of repair in some of the specimens where there was no pressure.

From the specimens examined it is clear that in hip disease the head of the femur is crowded against the acetabulum in a direction upward and backward, and that the process of repair is more advanced where the pressure is removed.

It is a well-known fact that in hip disease, in the acute or subacute stage, a reflex spasm of the muscles about the hip exists, this spasm being in proportion to the amount of inflammation of the joint. The direction of the force from this muscular spasm can be readily demonstrated (see Fig. 4). On an os innominatum and a femur the origin and insertion of all the muscles which connect the two bones are marked, and small hook staples are inserted in the bones at the proper points. Small elastic rubber bands are made to

connect the staples on the ilium representing the origin of the muscles with those representing the insertions on the femur. If this is done a representation will be given of the direction of the muscular force surrounding the hip. The exact amount of the pressure force of the contracted muscles dependent upon the muscular tonicity will not be represented in this way, but the direction of the resulting force will be, and it will be found to be upward and slightly backward. This muscular pressure in disease is very much greater than is ordinarily supposed.

The physiologists estimate the force of a muscle fully contracted at from six to ten kilogrammes to every square centimetre of muscular surface on cross section. In an adult, at the hip joint, the muscles connecting the femur with the ilium may represent from ten to fifteen square centimetres, and although these muscles are rarely contracted to their full extent, it is evident that the amount of force when slightly contracted is by no means inconsiderable; and during an acute spasm, when the muscles are firmly contracted, the pressure driving the head of the femur upon the acetabulum must be very great even in a child. It is well known that the muscular spasm at its acute stage is both a tonic spasm and also an acutely exaggerated spasm on any jar or violence to the hip, or even on the apprehension of any jar or violence. This spasmodic stage subsides after a while if the hip is kept absolutely free from motion, but it is a matter of experience that this spasm may persist for months, reappearing upon locomotion until the morbid process is entirely corrected and the inflamed bone is solid. It is also known that fixation of the hip joint is a difficult matter, and complete fixation (that is, the prevention of even the slightest motion) is impossible. The femur can be fixed, but the ilium can not. This is true for the reason that neither the thorax nor the abdomen can be compressed to the point of firm fixation, and the lumbar spine is capable of more or less motion.

Furthermore, no amount of fixation can draw the head of the femur away from the acetabulum—that is, distract—and pathological evidence would show that where pressure is entirely removed the process of repair is promoted. Clinically it has been observed that in a number of the

severest cases of hip disease with caries of the acetabulum healing proceeds with marked rapidity after amputation of the hip joint. It would appear, therefore, that if a pulling force can be applied which would not only counteract the spasmodic muscular force, but actually distract, it is desirable to employ it, this being entirely independent of any attempt to limit the motion of the hip joint. It has been contended that the same effects could be brought about by the administration of anæsthesia and the fixation of the patient in a plaster-of-Paris spica bandage. Clinical experience, however, shows, first, that the hip is not thoroughly fixed by means of a plaster-of-Paris bandage; and second, that where muscular spasm has persisted for some time it does not relax entirely under an anæsthetic. This we have found evident in several instances of excision of the hip joint, where the finger placed upon the head of the femur at its contact with the acetabulum could detect no separation of the femur from the acetabulum. A traction force of several pounds (five to twelve pounds) was found necessary to overcome the muscular resistance, even in children enfeebled by disease and with disorganized hips, to a sufficient extent to permit the slightest distraction. An anæsthetic may and undoubtedly does diminish the pathological muscular spasm about the joint, but it does not remove it entirely.

No argument will be needed to demonstrate the fact that a certain amount of traction can be applied to the femur in hip disease. A number of experiments have been made to determine the direction and amount of traction force which is feasible and which can be worn continuously. The details of these experiments will not be given here, but it will be stated that the limit of traction has been found to be the limit of the skin to endure the strain of the adhesive-plaster pull. This amount can be placed at from ten to twenty pounds. It therefore remains to determine what is the effect of the traction force of from six to twenty pounds upon a hip joint affected by hip disease. To determine this, observations were made, first, on the cadavera of healthy hips; second, on the cadavera of diseased hips; third, on healthy individuals, and fourth, on patients suffering from hip disease.

EXPERIMENTS UPON CADAVERA.

1. *Normal Joints.*—The hip of a full-termed fœtus was prepared in such a way that the skin was removed so as to expose the muscles around the hip. It was found that under a slight amount of traction distraction was possible. This was not only visible to the eye, but it was also demonstrable on a specimen on which the skin was removed without disturbing the ligaments or muscles. A needle was inserted in the head of the femur and another in the ilium slightly above the acetabulum, a slight amount of force separating the two needles. An adult dissecting-room specimen was taken, the femur amputated below the trochanter, and the pelvis fixed. The skin was not removed and a traction force was applied. Needles were inserted into the femur and into the ilium, the skin and muscles being incised in such a way that the traction force would not disturb their relative position. Traction of a hundred pounds was applied, and it was found that the needles were separated an eighth of an inch. After the specimen had been soaked in weak alcohol for some time distraction of an eighth of an inch was easily effected by a pull of five pounds.

On a large amount of material placed at our disposal by Professor Dwight, of Harvard College, it was clearly shown that traction distracted in all cases of femora in children dissected or undissected, and in all specimens of infants, and that the checks to distraction in adults in cadavera lay in the resistance, first, of the capsular ligament, especially of the anterior bands of the ilio-femoral ligament; second, in the resistance of the cotyloid ligament, and to a slight degree in atmospheric pressure. In children the lower edge of the acetabulum presents no resistance to a traction in the line of the axis of the body. (See Fig. 5). In adults this presents a resistance, but if the limb is abducted the resistance is avoided. Both in children and in adults, if the femur is extended to its utmost limit, the anterior bands of the ilio-femoral ligament lying on the front of the capsule prevent all distraction on any force which it is feasible to apply. If the capsule and cotyloid ligaments are disorganized, distraction is easy.

2. *Diseased Joints.*—In a specimen of a case of hip disease of six months' duration, where death took place from scarlet fever, it was found that distraction was easily made by the slightest traction. (See Fig. 6.) In this specimen the cotyloid ligament was disorganized, but the strong ligamentous fibers of the capsular ligament alone served as a check to separation of more than half an inch on traction. But within that limit even the weight of the pendent fragment of the femur distracted, as is seen in the accompanying illustration.

### MEASUREMENTS UPON LIVING SUBJECTS.

Experiments upon living subjects demonstrate that traction distracts under certain circumstances.

A number of experiments have been made on the subject of traction by several observers.*

Brackett demonstrated that in certain cases in hip disease distraction resulted from traction.

The following observations have been made with much care to produce further evidence.

Measurements were made in traction both in health and in disease.

The experiments here reported were made at the Children's Hospital, and the writers are indebted to Dr. John Dane for the perfection of the method by which the experiments were carried out, and for his most careful work in connection with them.

The method of experiment was as follows: The patient was placed upon a hard table with the head against the wall, and perineal straps upon each side were secured to the head of the table by stout webbing. In some instances shoulder straps of a similar character were also added. This was for the purpose of preventing the child from slipping on the table as far as possible. All measurements were taken from the wall. Measurements

* Koenig, Paschen, and Morosoff, quoted by Lannelongue, *Coxotuberculose*, Paris, 1886. *Deutsch. Zeit. für Chir.*, 1873, iii, 256. *Bull. et mém. de la Soc. de chir.*, 1886, xii, 31. *Boston Med. and Surg. Journal*, 1880, ciii, 65, and August 30, 1888. Brackett, *Trans. of the Am. Orthop. Assoc.*, vol. ii; also, *Trans. of the Am. Orthop. Assoc.*, vol. vi, p. 127.

at different points were taken by different observers. The anterior superior spine was marked with a hair line in ink on both sides, and in some of the experiments the great trochanter was marked as well. A mark was also made at the site of the external malleolus. A tape was carried from the wall touching these marks on the side experimented upon, and on the other side it was carried to the anterior superior spine to show any tilting of the pelvis which might occur. Traction on the leg was made by means of webbing straps fastened to a lacing which did not go below the knee. Traction, therefore, was made wholly upon the thigh. Traction was made by means of a spring balance fastened to the webbing straps below the foot. In each experiment traction was first made of ten pounds; then of twenty pounds. To prevent any error caused by the slipping of the skin around the sole of the foot, a plaster-of-Paris bandage or a stout cotton bandage was applied from the toes to the knee, and upon this bandage the site of the external malleolus was marked. The heel was made to slide upon a glass plate to avoid friction. In making the experiments any case where the heel left the plate during the traction was thrown out as inaccurate. The experiment was made as follows:

An observer was detailed to watch the mark made over the anterior superior spine; another observer was detailed to notice the mark at the external malleolus; a third noted the anterior superior spine on the well side, and in some of the earlier experiments, to check the correctness of the method, independent observers were placed either at the knee or at the great trochanter. In most instances three observers were employed, one at the anterior superior spine, one at the external malleolus on the diseased side, and the other at the anterior superior spine on the well side. (See Fig. 7.)

The patient was placed upon the table as prepared, and each observer read the position that the line marked with ink upon the part of the patient he was to watch measured on the tape. Traction of ten pounds was made. Each observer noted the position under the new conditions, and they were put down by the recorder. Traction of

twenty pounds was made, and each observer noted the position of the line on the tape. These were also noted by the recorder. In every experiment, unless otherwise stated, the experiment was immediately verified with the observers changed. The method of observation, in short, was to measure the distance of the external malleolus from the wall; knowing the distance of the anterior superior spine, to make traction upon the leg, see how much the external malleolus had descended; then, noting how much the anterior superior spine had been pulled down, to find the amount of separation between the external malleolus and the anterior superior spine, this giving the amount of distraction of the hip-joint surfaces. The method of these experiments has been related in detail because upon its accuracy the value of these experiments depends.

Various sources of error were eliminated. The fact that traction was made upon the thigh alone eliminates any source of error from stretching of the knee-joint ligaments.

An error due to the stretching of the skin may be disregarded in these observations. The skin of the thigh is pulled down, but the skin of the leg is not pulled upon. Consequently, any such stretching would tend to show less lengthening than really occurred.

### OBSERVATIONS ON HEALTHY JOINTS.

The first experiment, which is of special interest, is not in the table. A girl of seven, with dorso-lumbar Pott's disease, had an abscess which pointed at the outer side of the thigh. This was opened by an incision of three inches, exposing the trochanter. The hip joint was healthy. Some days after operation the girl was laid upon a table, secured in place, and an upright was erected upon the table with the needle pointing at the marked spot on the exposed trochanter. Ten pounds of traction produced no measurable effect; traction of twenty pounds produced lengthening of a quarter of an inch, as seen by the mark on the trochanter as compared with the fixed point adjacent—*i. e.*, the needle. If traction of twenty pounds was made, the head of the trochanter could be seen to descend; if traction was suddenly relaxed, the head of the femur could be seen to move upward.

## TRACTION IN HEALTH.

| Case No. | Sex. | Age. | Condition. | Traction in pounds. | Result in inches. | |
|---|---|---|---|---|---|---|
| 1 | Male. | 6 years. | Hip disease on other side. Healthy hip examined. | 10 | ⅛ lengthening. | Verified by change of observers on repeated experiment. |
| | | | | 20 | ¼ " | |
| 2 | Male. | 7 years. | Hip disease on other side. Healthy hip examined. | 10 | ¼ " | Verified by change of observers on repeated experiment. |
| | | | | 20 | ¼ " | |
| 3 | Female. | 7 years. | Healthy hip examined. Hip disease on other side. | 10 | ⅛ " | Not verified. |
| | | | | 20 | ⅛ " | |
| 4 | Male. | 7 years. | Healthy. | 10 | ⅛ shortening. | Verified by change of observers. |
| | | | | 20 | ⅛ lengthening. | |
| 5 | Male. | 10 years. | Healthy hip examined. Hip disease on other side. | 10 | ⅛ " | Verified by change of observers. |
| | | | | 20 | ¼ " | |
| 6 | Male. | 12 years. | Two observations on healthy hip: | | | |
| | | | First experiment..... | 10 | No change. | Verified by change of observers. |
| | | | | 20 | No change. | |
| | | | Second experiment..... | 10 | No change. | Verified by change of observers. |
| | | | | 20 | ⅛ lengthening. | |
| 7 | Male. | 16 years. | Healthy hip examined. Hip disease on other side: | | | |
| | | | First experiment..... | 10 | No change. | Verified by change of observers. |
| | | | | 20 | ⅛ shortening. | |
| | | | Second experiment..... | 10 | No change. | Verified four times. |
| | | | | 20 | ⅛ shortening. | |

The fourth experiment is of interest, as it was done upon a young and particularly well-developed girl without any disease. Traction of ten pounds, instead of causing lengthening, caused an eighth of an inch shortening.

The seventh experiment, which was done upon a young man sixteen years old, was of the same character. Traction of ten pounds produced no effect, but traction of twenty pounds produced an eighth of an inch shortening. This was verified four times with all the observers changed, and the result in each case was the same. It is not easy to explain this phenomenon. Possibly in these cases the amount of traction applied stimulated the healthy muscles to contraction, which vitiated the measurement by altering the axis of the leg. In the fourth experiment twenty pounds altered this and produced a half inch lengthening in a boy of seven years of age. It seems probable that in the seventh experiment, where the boy was sixteen years old, a larger amount of traction than twenty pounds would have produced a lengthening.

### OBSERVATIONS UPON DISEASED JOINTS.

In these experiments traction was made in the line of the body, and, unless otherwise stated, the amount of malposition present was not enough to be noted.

As evidence of accuracy of these measurements it is to be remembered:

1. At the time of the experiment the observers were entirely ignorant of its result.

2. The error caused by the slipping of the skin tends to diminish the amount of distraction as shown by these experiments.

3. The experiments agree with each other and with those of other observers.

The experiments in general need no comment, except that it is interesting to note that in Experiment 8 the child had never had traction applied before, and in that case the largest amount of distraction occurred. That is to say, it seemed as if in the other cases where traction treatment had been used a certain amount of previous stretching of the muscles might have existed. In Case XII traction of twenty pounds seemed to be insufficient to cause separation

| Case No. | Sex. | Age. | Length of disease. | Character of disease. | Amount of traction in pounds. | Result in inches. | |
|---|---|---|---|---|---|---|---|
| 1 | Male. | 5 years. | 7 months. | Acute. | 10 | No change. | Verified. |
| | | | | | 20 | ¼ lengthening. | |
| 2 | Female. | 5 years. | 3 months. | Acute and sensitive. | 10 | ¼ " | Not verified on account of pain. |
| | | | | | 20 | ½ " | |
| 3 | Male. | 4½ years. | 1 year. | Quiescent; fifteen degrees of motion. | 10 | No change. | Verified with different observers. |
| | | | | | 20 | ⅛ lengthening. | |
| 4 | Female. | 6 years. | 3 years; sinuses. | Acute; no malposition; few degrees of motion. | 10 | ⅛ " | Not verified. |
| | | | | | 20 | ¼ " | |
| 5 | Male. | 6 years. | 2¼ years. | Convalescent; old abscesses. | 10 | ¼ " | Verified. |
| | | | | | 20 | ⅜ " | |
| 6 | Male. | 7 years. | 3 years. | Very sensitive; abscess, spasm, slightly abducted. | 10 | ⅜ " | Verified. |
| | | | | | 20 | ⅜ " | |
| 7 | Male. | 7 years. | 3 months. | Acute; some motion. | 10 | ⅛ " | Verified. |
| | | | | | 20 | ¼ " | |
| 8 | Female. | 8 years. | 1 year. | Acute and spasm; not very painful. | 10 | ¼ " | Verified. Never had traction applied before. |
| | | | | | 20 | ⅜ " | |
| 9 | Male. | 10 years. | 3 years. | Moderately sensitive; very little motion. | 10 | No change. | Verified. |
| | | | | | 20 | ⅛ lengthening. | |
| 10 | Male. | 10 years. | 3 years. | Not sensitive; forty-five degrees of motion. | 10 | ¼ " | Verified. |
| | | | | | 20 | ⅜ " | |
| 11 | Male. | 12½ years. | 3½ years. | Convalescent; good motion. | 10 | ⅛ " | Verified. |
| | | | | | 20 | ¼ " | |
| 12 | Male. | 16 years. | Indefinite; over a year. | Forty-five degrees of motion. | 10 | No change. | Verified. |
| | | | | | 20 | No change. | |

of the joint surfaces, the disease having persisted some time.

The conclusions which can be drawn from this table seem to be the following: That traction of ten pounds in children before puberty as a rule produces lengthening of the leg in hip disease, and that this lengthening is due to separation of the joint surfaces; that the amount of this separation varies in different instances, being in general less in older children than in young ones, and also varying in individual cases under apparently the same conditions, perhaps on account of some anatomical peculiarity; that twenty pounds traction, as a rule, produces more separation than ten pounds.

It is probable that in the later cases of hip disease, where cicatrization of the capsular tissue may be supposed to have taken place, distraction is not as readily made.*

What has hitherto been stated in this paper would indicate that it is desirable to apply distraction to the hip joint in hip disease. It remains for the complete demonstration of the proposition presented to show the effect upon the diseased joint if traction is efficiently applied for a long period. This can be done both by clinical facts and by pathological specimens.

### CLINICAL FACTS.

While it is difficult to present clinical evidence in a matter of this sort to any one not able to examine personally the cases quoted, yet a few cases are here reported. The cases were taken from the records of the Children's Hospital, and the patients have been under the care of various surgeons in service at the hospital, all, however, carrying out treatment by more or less efficient traction during the requisite stages. They were not continuously, and in some cases not at all, under the personal care of the writers. They represent cases where, from the history of the results, there could be no doubt as to the existence of well-marked disease at the joint, and are selected because of this fact. They are all hospital cases with treatment at their homes under the direction of the out-patient de-

* *Transactions of the American Orthopædic Association*, 1893, vol. vi, p. 127.

partment after their discharge from the hospital as well as in the wards of the hospital during the acute stages when necessary. They do not represent the best results which can be obtained under more thorough nursing, under the direction of a trained nurse or an intelligent mother in exceptional cases. They are hospital cases treated in a routine way. They are intended to illustrate the fact that in cases thoroughly and properly treated by traction subluxation can be prevented; that in cases of the severer types, if treated early, some motion of the hip joint can be preserved; and that in the less severe cases, or cases where prompt and early treatment was possible, this can be expected.

In the cases here reported the diagnosis of hip disease was certain. All cases were rejected where the evidence of hip disease was doubted, both from the records and from the statements of the examiners. The record of motion is also without doubt in the cases where it is recorded, as it was made with particular care, and all cases were rejected where there was any doubt. The motion was tested by placing the patient on the back, with one hand upon the pelvis, the other manipulating the thigh. The examination, diagnosis, and subsequent observation were made by experienced observers. The cases had all been under observation for a long period.

The cases may be grouped: First, as those of hip disease of a severe type, as proved by the development of abscess or the arrest of growth; second, cases without abscess, but with persistent spasm, limitation of motion, and deformity, and a long period of pain and sensitiveness; third, the lighter form of disease treated before the severe symptoms had been developed. These cases may be regarded as representative ones seen in the clinic at the Children's Hospital where continued treatment was carefully carried out.

### CASES OF SEVERER TYPE.

Case I.—Annie F. entered the out-patient department of the hospital in February, 1888, being at that time fifteen years old. The disease had been in progress for two years, one of which had been spent in bed. Pain had been severe and night cries frequent. An abscess had formed, and the joint was

flexed and fixed. Traction treatment was begun and continued for two years with traction splint and crutches. A protection splint was worn for four years more.

*Present Condition.*—Twenty-one years old; strong, healthy woman; weight, one hundred and twenty-one pounds. The sinus has been healed three years. There is motion in flexion of ten degrees at the hip joint. There is no motion in other directions. Patient walks well. There is a three-inch shortening, but the trochanter is not above Nélaton's line. There is no deformity. (See figure, Case I.)

Case II.—Nellie M. entered out-patient department of the hospital September, 1884, when eleven years of age. The disease had lasted for three years. There had been much pain, and the patient had been treated by high shoe and crutches. Abscesses had been present and a sinus remained. Persistent muscular spasm and pain. Traction treatment was carried out, and a traction splint worn for three years and a half; after this a protection appliance was worn and is still worn, although no symptoms have been present for a long time.

*Present Condition.*—Twenty-one years of age, strong and healthy. Walks firmly without splint, but with a limp. The trochanter is below Nélaton's line. There is shortening of two inches from difference in growth. Motion of the joint limited except in flexion. (See figure, Case II.)

Case III.—George K. entered the out-patient department of the hospital in March, 1887, when fifteen years and a half old. The disease had existed for four months. Traction splint was applied. The hip became sensitive, and an abscess appeared the following year. Muscular spasm lasted for two years and a half. Traction was continued for three years, and a protection splint worn four years longer.

*Present Condition.*—Twenty-two years old; healthy, strong man, walking without a splint. There is an inch and a half shortening of the leg, but no subluxation, the trochanter being below Nélaton's line. The position of the leg is normal. There is no motion. (See figure, Case III.)

Case IV.—Hattie H. came to the out-patient department of the hospital in March, 1886, when five years old. Disease was of six months' duration. The leg was flexed to an angle of forty-five degrees. There was much pain and sensitiveness. The muscular spasm continued for nearly two years, and an abscess followed. Traction treatment was carried out for two years, a traction splint being worn a good portion of the time. A protection splint was used for three years more.

*Present Condition.*—At the age of thirteen the child is

strong and well. The trochanter is below Nélaton's line. There is a shortening of half an inch. Flexion of ninety degrees is possible. Walks without a limp. There is no deformity.

CASES OF THE SECOND CLASS.

CASE V.—Sophie R. entered the out-patient department of the hospital in January, 1886, when six years of age. The disease had lasted for nine months and the hip was fixed. There was pain, and the spasm lasted for two years. Treatment by traction was carried out for three years and by protection for two years more. No abscess occurred.

*Present Condition.*—January, 1893, there was half an inch shortening. Flexion was possible to a right angle. Rotation and abduction limited.

CASE VI.—Clara L. came to the out-patient department of the hospital in March, 1888, when seven years old. The disease had existed for two years. At the time when first seen at the hospital there was a distortion; the leg was abducted, fixed, and very sensitive, with persistent pain and sensitiveness. The muscular spasm lasted for three years. Bed treatment and admission to the hospital were required for pain and sensitiveness. No abscess developed. Treatment by traction was continued for three years and a half. A traction splint was worn for three years, protection splint for four years and a half afterward.

*Present Condition.*—The patient is thirteen years old, strong and well; slight motion at the hip joint. There is no deformity except slight permanent flexion. The diseased limb is two inches shorter than the other; the trochanter, however, is below Nélaton's line.

CASE VII.—Robert H. was brought to the hospital in March, 1888, when four years old. The disease had lasted about two months. There was much muscular spasm at the hip, with marked pain, which persisted for some time, with swelling about the hip. Bed treatment was carried out for a month. The muscular spasm improved after six months, but remained for two years. Traction treatment was applied during all that time, and a traction splint worn while the patient was up. A protection splint was worn for two years more.

*Present Condition.*—At the age of ten the patient walks without a limp. There is a shortening of half an inch in the affected limb, but no deformity. Motion is possible to ninety degrees in flexion; rotation is limited.

CASE VIII.—Esther M. came to the out-patient department of the hospital in 1888, when eight years old. Disease had lasted for six months. The hip flexed and adducted. Pain was

severe. No motion at the hip joint was possible. Pain and sensitiveness were marked and bed treatment necessary. Treatment by traction was carried out for three years, and protection for three years more. Protection splint is still worn as a precaution.

*Present Condition.*—The patient is fourteen years of age, strong and well, and can walk without a splint. Forty-five degrees of motion is possible in the direction of flexion. There is an inch and a half of shortening, but the trochanter is not above Nélaton's line. There is no deformity.

Case IX.—Lizzie C., brought to the out-patient department of the hospital in May, 1886, when eight years old. Disease had lasted six months. Leg was fixed and abducted and there was no motion. Muscular spasm continued for five years. There was no abscess, but patient required entrance to the hospital and bed treatment several times. Traction treatment by means of weight and pulley and traction splint continued for six years; protection for two years more.

*Present Condition.*—Sixteen years of age, strong and healthy girl, with a shortening of half an inch. Ten degrees of motion possible at the hip joint. There is no malformation nor deformity. Can walk without pain, but at times wears the protection splint.

Case X.—Anastasia H. entered the hospital in 1886, when five years old. Disease had been in progress for several months. Night cries had been noticed for three months. Admission to hospital for bed treatment. Patient remained in hospital three months. There was no abscess. Spasm continued for two years. There were pain and persistent adduction. Traction treatment carried out for two years and a half; protection for a year and a half longer.

*Present Condition.*—Thirteen years old; girl is strong and well, walks without a splint and with no perceptible limp. There is an inch shortening, but no deformity. Motion of ninety degrees possible, but limitation in other motions. (See plate, Case X.)

Case XI.—Nellie M. C. entered the out-patient department of the hospital in April, 1886, when five years old. Disease had lasted six months. Hip was flexed and fixed at an angle of forty-five degrees and very sensitive. Spasm remained for two years. Traction was carried out for two years and a half, and protection for five years longer.

*Present Condition.*—Child thirteen years of age, strong and well. There is a permanent flexion of ten degrees, but no deformity. There is a shortening of an inch and the child walks with a limp, but needs no apparatus.

CASES TREATED AT AN EARLY STAGE.

Case XII.—James G. entered the out-patient department of the hospital in April, 1890, with a history of pain in the knee at night for several weeks. Pain continued for some time. Limitation of motion. There was, however, but little muscular spasm. A traction splint was applied and worn continuously for two years. In August, 1892, a protection splint was applied and has been worn since that date.

*Present Condition.*—The position of the leg at present is normal. There is no shortening. Motion beyond ninety degrees. There is no muscular spasm.

The diagnosis in this case is based upon the pain which persisted, the limitation of motion, and the length of time which the muscular spasm persisted. (See figure, Case XII.)

Case XIII.—Eva C. The patient entered the out-patient department of the hospital November, 1891. There was severe pain, with night cries, muscular spasm, and deformity, and these symptoms had persisted for several weeks. The patient entered the wards of the hospital and remained in bed with traction treatment for six weeks. A traction splint was worn for a year and then removed by the parents, the child being considered by them in perfect health. The child was allowed to use the leg freely, and a relapse occurred after six months, with pain, night cries, spasm, and deformity. Traction treatment was renewed after a preliminary bed treatment with fixation and traction.

*Present Condition.*—At the present time, three years and a half after commencement of treatment, there is slight permanent flexion and free motion of twenty degrees. There is no subluxation and no shortening. Patient still wears a traction apparatus.

This case is reported as indicating a lack of perfect result. Treatment was discontinued by parents for several months and a relapse occurred.

The case is still under observation, but the ultimate result, which could in all probability have been without limp, will be a slight limp.

PATHOLOGICAL EVIDENCE.

The effects of traction, when thoroughly carried out, can be seen in the accompanying specimens.

The first is that of a boy of nine, who was attacked with hip disease of an acute form six years before. He was treated with traction efficiently for a long time, first with recumbent fixation, later with an ambulatory traction splint

and crutches, and afterward by a protection splint. An abscess developed in the early stages, was incised, and it subsequently healed entirely. The boy recovered completely after a number of years from his hip disease, having, however, a limb which was slightly shorter (an inch and a half) than the other and with limited motion. The position was good, and the leg was thoroughly useful and remained so two years after the discontinuance of all treatment, the boy being as active as any boy at this time. He was, however, subsequently seized with tubercular meningitis, being of a tubercular family, and died. At the autopsy complete cure of the hip disease was found, and this specimen also shows that there has been no widening of the acetabulum, and but little alteration in the shape either of the acetabulum or head of the femur. (See Fig. 8.)

A comparison of this specimen with those of severe hip disease where traction was not used speaks most emphatically for the thorough use of the method.

This second specimen is of the head and neck of the femur where excision was done after two or three years of efficient treatment by traction, but the reparative process was not sufficient in this case to establish a cure; the patient's general condition failed, and excision was done. It is to be noticed that there is very little alteration in the shape of the head of the excised femur. (See Figs. 9 and 10.) This, compared with the accompanying specimen of an excision of a patient with hip disease of similar severity and duration where no traction had been applied, would appear fairly to show the effect of traction in saving the head of the femur from destruction.

It can not be supposed that the best results can be obtained by the application of inefficient traction. A sufficient amount of traction, constantly applied during the stage of muscular spasm, is needed. It is, of course, not the only therapeutic measure which is required; fixation and protection are also needed at the various stages. If traction is not applied properly, or is applied at the wrong time, or is insufficient in extent, it is no more efficient than a drug injudiciously or wrongly used or administered at the wrong time. Judgment is required in the use of this measure as of any other, and a great deal of care and attention to de-

tail is necessary to insure the constant application of from eight to ten or fifteen pounds' traction uninterruptedly for two or three or six months, not only on the part of the surgeon, but on the part of the nurses and assistants. It is owing to the defect in this respect that in many cases treatment by traction is ineffectual, and the results obtained are not as satisfactory as desired. This leads to an unjust condemnation of the methods of treatment by traction by those who have tried this method, and, having met with unsuccessful results, have blamed not their own method of application, but the method in general, which is as irrational as if any one who administered a drug in an insufficient dose should lay the failure to the drug, when it is properly due to its faulty administration.

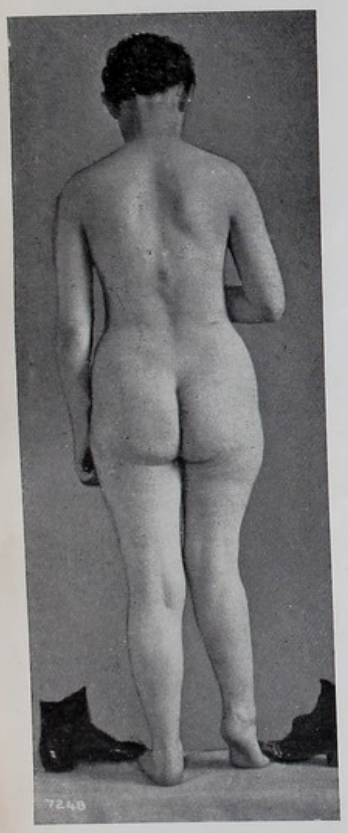
The thorough use of traction—*i. e.*, to the point of distraction—requires on the part of the surgeon not only a familiarity with the mechanical details of apparatus and the proper application, adaptation, and fitting of appliances suitable in each case, but the ability to arrange for such co-operation and assistance on the part of nurses or attendants as shall insure the continuance of the necessary amount of traction at all times. If this is not done the results are not complete, just as the lack of asepsis in an assistant or nurse may vitiate results in an operation, no matter how careful the surgeon may be personally. In the same way if, through the neglect of a nurse, a hip which needs continued traction of ten to fifteen pounds for protection against blows from muscular spasm is left during an acute stage for a time with a traction of two pounds, the joint may be seriously damaged.

Unusual care is required both in the management of cases and in the direction of hospital services. This care, however, is not greater than is possible if sufficient attention is given to the subject and the surgical indication borne in mind.

In conclusion, it is claimed that at a certain stage in hip disease traction force is desirable; that the amount of traction should be in proportion to the amount of muscular spasm, and continued as long as the spasm persists. It is also clear and demonstrable that an efficient traction force distracts, and it is manifest that distraction, or the separa-

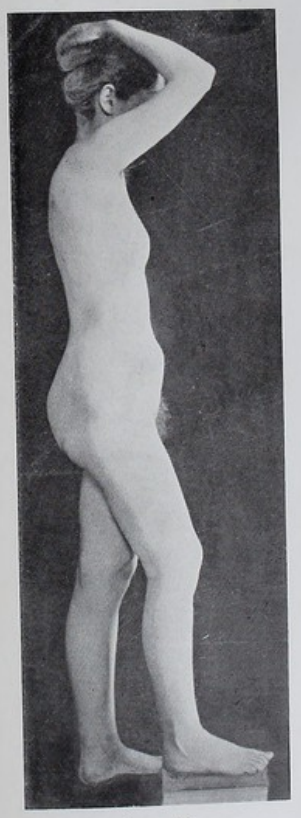
tion of one inflamed bone from an adjacent inflamed bony surface, is desirable ; that in this way every chance is given to promote cure and cicatrization of the previously inflamed bone. If an indication for surgical treatment is ever clearly written in pathological specimens, certainly that of distraction should never be overlooked. It should always be remembered that in treating hip disease at a certain stage the object should not be simply rest, or fixation, or protection from jar, but actual distraction, and that traction short of this is inefficient.

DR. BRADFORD'S AND DR. LOVETT'S ARTICLE.



CASE I.

CASE I.

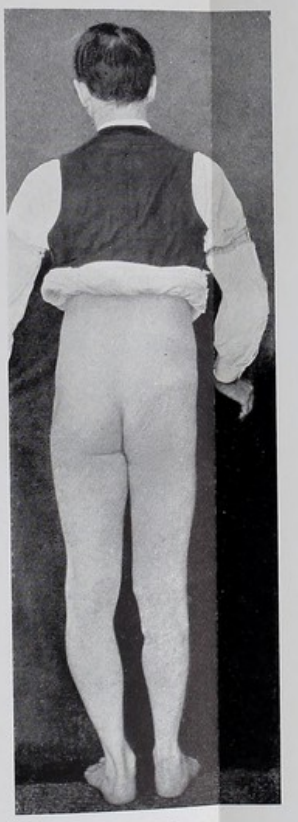


CASE II.

CASE II.

Case III.

Case III.



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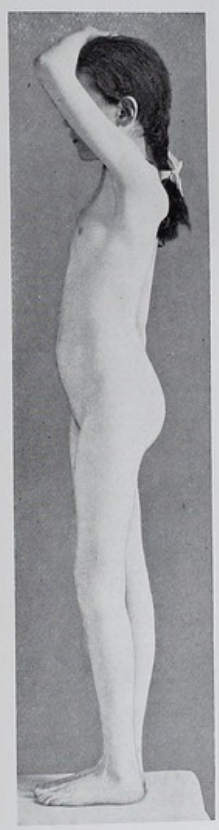
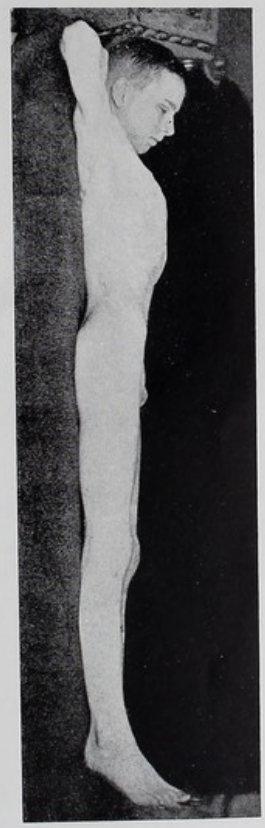


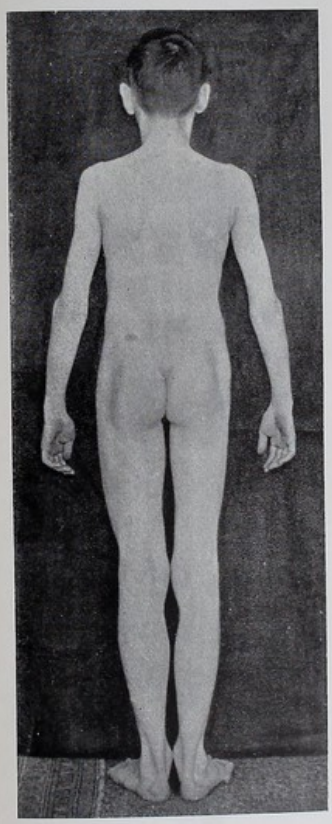
Case X.

Case X.

Case XII.



Case XII.



Case XII.

Case XII.

Fig. 1.

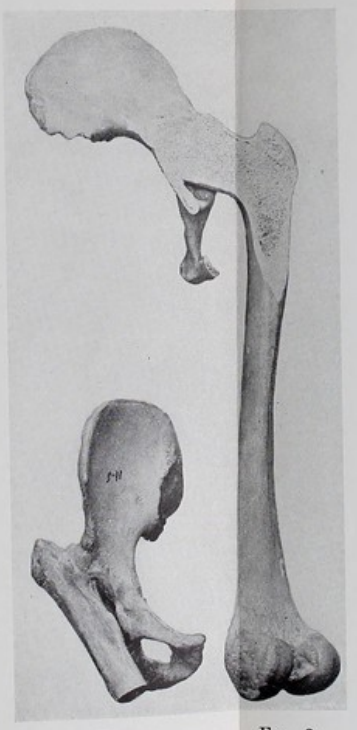


Fig. 2.

Fig. 3.

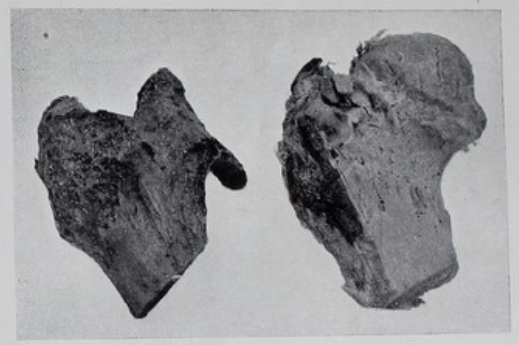


Fig. 10.

Fig. 9.

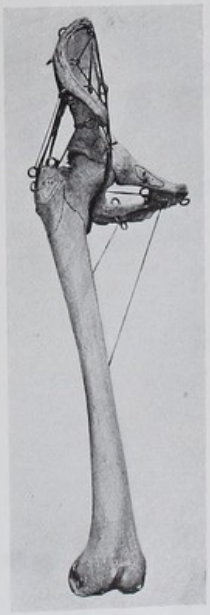


Fig. 4.

Fig. 5.

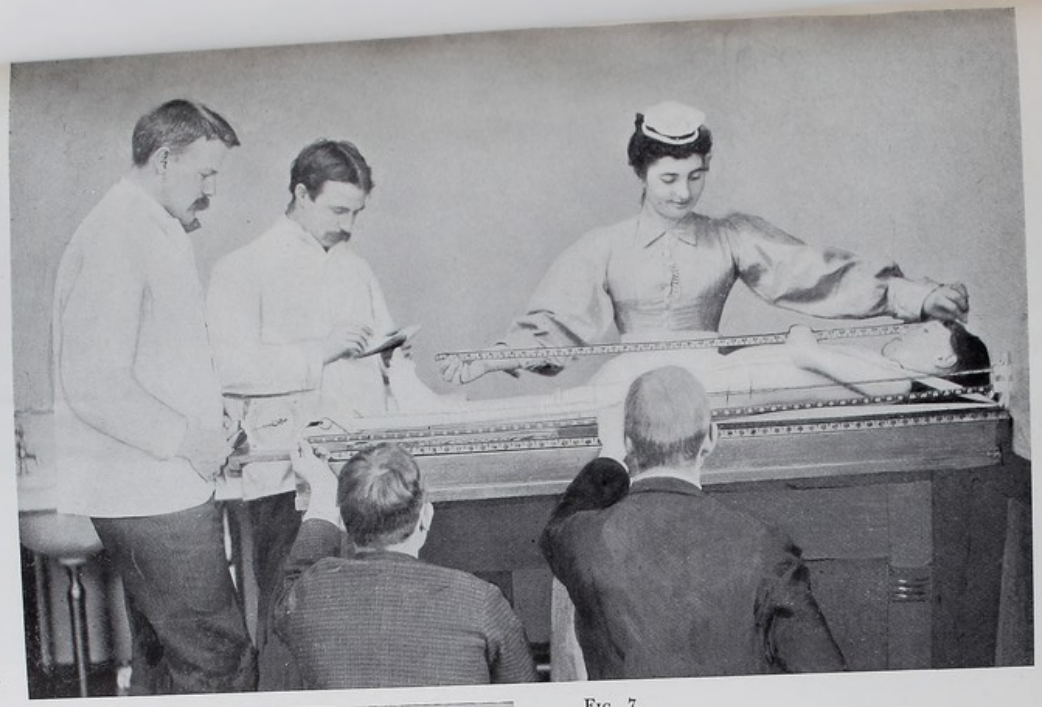


Fig. 7.

Fig. 6.

Fig. 8.