means of absolute surgical cleanliness (asepsis,) and by the use of those chemical agents which destroy the bacteria not removed by cleanliness itself (antisepsis). Surgical cleanliness differs from the housewife's idea of cleanliness in that its details seem frivolous, because it aims at the removal of microscopic particles. Stains such as housewives abhor, if germ-free, are not objected to in surgery. The hands and arms, and especially the finger nails of the surgeon and assistants and nurses, should be well scrubbed with hot water and soap by means of a nail brush immediately before the operation. The patient's body about the site of the operation should be similarly scrubbed with a brush and cleanly shaven. Subsequently the hands of the operator, assistants and nurses, and the field of operation, should be immersed in, or thoroughly washed with, corrosive sublimate solution (1-1000, or 1-2000). Finger rings, bracelets, bangles, cuffs worn by the surgeon, assistants or nurses, must be removed before the cleansing is begun, and the clothing covered by a clean white apron large enough to extend from neck to ankles and provided with sleeves.

The instruments should be similarly scrubbed with hot water and soap and all particles of blood and pus from any previous operation removed from the joints. After this they should be immersed for at least fifteen minutes in a solution of betanaphthol (1-2500), which must be sufficiently deep to cover every portion of the instruments. After cleansing the instruments with soap and water, baking in a temperature a little above the boiling point is the best sterilizer. During the operation the sterilized instruments should be kept in a betanaphthol solution and returned to it when the operator is not using them.

Sponges should be kept in a betanaphthol solution (or a corrosive sublimate solution) during the operation. After the blood from the wound has been sponged away, they should be put in another basin containing an antiseptic solution and must be thoroughly cleansed and sterilized anew before being used again. The antiseptic sutures and ligatures should be similarly soaked in betanaphthol solution during the progress of the operation.

No one should touch the wound but the operator and his first assistant. No one should touch the sponges but the operator, his first assistant, and the nurse having charge of them. No one should touch the already prepared ligatures or instruments except the surgeon and his first and second assistant. None but those assigned to the work are expected to handle instruments, sponges, dressings, etc., during the operation.

When any one taking part in the operation touches an object not sterilized, such as a table, a tray, or the ether towel, he should not be allowed to touch the instruments, the dressings, or the ligatures until his hands have been again sterilized. It is important that the hands of the surgeon, his assistants and nurses should not touch any part of his own or the patient's body, because infection may be carried to the wound. Rubbing the beard or head, or wiping the nose, requires immediate disinfection of the hands to be practiced.

The trailing ends of ligatures and sutures should never be allowed to touch an assistant's or surgeon's dress, or to drag upon the operating table because contact may occasionally, though not always, pick up bacteria, which may cause suppuration in the wound.

Instruments that fall upon the floor should not be again used until thoroughly disinfected. The clothing of the patient in the vicinity of the part to be operated upon, and the blankets and sheets used to keep him warm should be covered with dry sublimate towels, and all dressings should be kept safe from infection by being stored in glass jars or wrapped in dry sublimate towels.

¹ In abdominal operations it is usually not necessary, and may be unwise, to use the ordinary chemical antiseptic solutions because of their irritant qualities. When used in the abdominal and pelvic cavities such solutions must be very weak; ordinarily, water ren-

ORIGINAL ARTICLES.

THE PREVENTION OF THE SHORT LEG OF HIP DISEASE.

Read before the American Orthopaedic Association, at Boston, Mass., September 18, 1889.

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A short leg is what is commonly dreaded as the result of hip disease. The shortening is not, however, as a rule, due to the shortening of the bones. What produces the short leg of hip disease is an immobilization of the joint which prevents the reduction of flexion of the thigh, or adduction of the thigh; or which, as too often happens, prevents the reduction of both flexion and adduction. If, for instance, the patient stands with the thigh considerably adducted, we will say 22.5 degrees, and fixed at that angle, the limb cannot be made vertical without elevation of that side of the pelvis, with of course a drawing upward of the heel and an inevitable appearance of shortening; and if the thigh is flexed, for example 45 degrees, and fixed at that angle, the limb cannot be made vertical without an inclination forward, which gives an appearance of shortening to the whole figure. Thus we see, that when the patient stands, adduction means "apparent shortening." The same is true of flexion. And when we direct our attention to the deformity which attends the patient when he walks, we see that the affected side dips at every step, and that when the limb comes into a vertical position, as it does at the critical moment when it is called upon to support the weight of the body, the pelvis rocks forward or laterally, or it may be in both directions at every step; and we have the characteristic gait of hip disease.

If, on the other hand, the thigh is immovable on the pelvis in a good position, neither adducted nor flexed, when the patient stands, the limb is vertical and the pelvis is level in all directions; and when the patient walks, the pelvis without any lateral tilting, rocks to and fro with a moderate motion, enough to allow the limb to swing backward and forward, by virtue of the mobility of the vertebral joints and the hip joint of the unaffected side, in the arc appropriate for locomotion in a comparatively easy and graceful way. Walking thus performed, is attended by no dipping of the affected side, and with no shortening except what may come from shortening of the bones or "real shortening."

How to secure this good position of the limb in a hip joint ankylosed by disease, is a question of great importance, second only to the question,

dered sterile by boiling just before the operation, is the proper fluid for sponges, irrigation and instruments. The precautions as to cleansing the area of operations externally, and as to instruments, must be the same as in other operative procedures.

How can we promote resolution of the inflammation? I believe a good ultimate position of the limb can be obtained by inducing the patient to use the affected limb as much as possible in walking, of course protected from concussion by the hip crutch.

I do not mean to say that traction is useless as an agent for overcoming deformity; it will diminish extreme deformity with absolute certainty whether applied with the weight and pulley or rack and pinion; but it is less effective when the deformity is only moderate or slight. Applied, for instance, to an extreme case of flexion, it will produce extension. Indeed, traction, a few years ago, was universally called extension. But in proportion as the flexion is reduced, the power of traction to further reduce the deformity rapidly diminishes, because it is evident that a given power loses its ability to overcome resistance at the angle, as the angle becomes more obtuse. *If, for instance, we would straighten a crooked nail we may, if the nail is very much bent, say at an angle of 90° , reduce the angle by traction: but as the angle becomes more and more obtuse, the power of traction to accomplish our object lessens, and finally disappears.

This consideration is one of those which lead me to discredit traction as a means of reducing deformity. Another, is the fact, that although traction may in skilful hands overcome even slight degrees of deformity, it is only by assiduous attention and a nice adjustment of the direction in which the force is applied that this may be done. The correct position of the limb, thus brought about, is maintained while the patient is under special supervision and restraint; but when they are relaxed, the causes, whatever they may be, which produce the deviation, resume their influence. And this leads to the inquiry, What are the causes which produce the customary deformity of hip disease; what flexes and adducts the limb?

This question is quite distinct from the question, What prevents motion? We know that motion is prevented, first, by reflex contraction of the muscles, and afterward by ankylosis; but what determines the position of the limb through the months and years when muscular action holds it fixed; what forbids a good position and inclines toward adduction and flexion? If we can discover the forces which cause the limb to err, we may perhaps remove or thwart them. It has been said that effusion determines the direction of the limb, which takes that position in which the capsule can best accommodate the volume of fluid. Migration of the acetabulum and dislocation of the femoral head, have also been cited as controlling forces. Abduction has been thought to depend on spasm of the gluteal muscles followed by their paralysis, which allows their opposing muscles to produce adduction. Atrophy and attrition of the

head and acetabulum have been thought to have some effect in deciding the character of the deformity. It has also been said that the limb takes that position in which an imaginary painful spot or area on the head of the femur is furthest removed from the depth of the acetabulum, where it would receive pressure from muscular action.

In some stages, and in certain cases, each of these modes of accounting for the chosen position of the limb may, or may not, be correct; but what we want, is to recognize some cause, general in its application, and independent of such pathological conditions as have been cited, which are more or less transient and difficult to demonstrate in bone, muscle, nerve, or effused fluid. A more widely applicable theory is that which says the position is generally the attitude of minimum suffering; but pain is not always present, indeed, as a rule, it is present but a small portion of the time during which the limb is held in its selected position. Can we not find a cause which is in force in all the periods of the affection, the painless as well as the painful?

It has been said, and wisely, that the position is due to efforts made by the child and nature to secure fixation, and that the position assumed is that in which immobilization by nature reaches its maximum. This is a good explanation, and applicable to every case in all of its stages; but I do not think these words quite cover the whole ground. I would add to them a line recognizing the influence exerted on the direction of the limb by the patient's habitual attitudes and positions.

Before accepting this addition, however, it will be necessary for us to accustom ourselves to recognize the fact that the fixation or immobilization created by reflex muscular action is very far from being absolute immobility. This view is in accord with the ordinary events of practice. Cases in which fixedness is inconstant are matters of daily observation. For instance, a joint at the first moment of examination is without motion, but a few moments of delay and skilful manipulation reveal slight motion. Or, at one examination, the limb is in a position, adducted we will say, at a certain angle, which is made a matter of record, and at the next examination, a few hours or days later, the angle is widely increased or diminished. Or a patient with marked deformity is put to bed with a weight and pulley, or is treated by traction with the hip-splint, and the deformity is greatly mitigated in a few hours. In all these cases, reflex muscular action is in force, and yet it does not prohibit changes in the direction of the limb. The condition resembles that found in patients affected with a certain kind of paralysis, whose joints have been compared to a leaden pipe which retains its shape with a very positive degree of fixedness, but which can be bent by the application of a suitable degree of force.

In view of this mobility of the joint, fixed by reflex muscular action, I believe that the position assumed by the limb is determined by the patient's efforts, both voluntary and reflex, to place the limb where its fixation will be liable to the least disturbance, and where it will afford him the most convenience in his ordinary attitudes and movements.

Before considering how to avert deformity it is in order to review the typical positions of the limb in hip disease. They seem to be three in number, and arranged chronologically as follows: 1. Abduction, which is produced early in the disease, when the patient seeks to favor the limb when he stands by putting his weight on the sound limb. He assumes the attitude which follows the military order, "at rest," in which the limb is abducted with a descent of the pelvis on that side and apparent lengthening. Later in the progress of the disease, we have, 2. Adduction and flexion, caused by the patient's efforts to withdraw the affected limb from undue contact with the ground, and to make the disabled member as little an impediment as possible, while the chief work of progression is done by the sound limb. The natural rhythm of the gait is broken, the sound foot being on the ground longer than the other, and the affected limb is drawn up out of the way, when the foot is raised from the ground, by an elevation of the pelvis on that side, with of course, adduction and flexion of the thigh and apparent shortening. Finally, in the neglected and bed-ridden patient, we have, 3. Extreme flexion of the knee and thigh, and extreme adduction of the thigh, obviously the position in which the patient is most comfortable, and the joint most free from disturbance.

These changes, taking place in a typical and uninterrupted case, but illustrate the mobility of the immobilization, so to speak, which characterizes hip disease. In passing, would it not be well to agree to call this form of immobilization, "fixation," a term the status of which is not well established, leaving the longer word to be applied to absolute immobility, such as accompanies ankylosis or bony union after fracture? We could also use the term fixation to indicate what we produce in the hip-joint by traction, which is not absolute immobility, but enough immobilization to aid the natural efforts to keep the joint still and promote resolution, and yet not enough to stand in the way of desirable changes in the position of the limb.

To return to methods of averting deformity, the first position, that of abduction, seldom calls for attention in practice. It would, in some cases, be fortunate if slight abduction could be maintained as the ultimate position, because the apparent lengthening thus secured might happily compensate for whatever real shortening is entailed by the destruction or retarded growth of

the bone. The third position, extreme flexion and adduction, cannot occur with the use of the hip-splint; and as we all, I presume, adhere to treatment by this apparatus, the practical question before us concerns only the prevention of the second position, that in which the thigh is seriously but not extremely flexed and adducted. How can we then, by the use of the hip splint, keep the limb slightly flexed and free from adduction during the many months which usually intervene between the first appearance of deformity and the occurrence of ankylosis?

To recall what we have said about the cause of this deformity, it is the result of the patient's efforts to keep the affected limb off the ground while the well limb does most of the work of progression. If then, we can induce the patient to adopt a gait in which the two limbs are used equally, the cause of the deformity would vanish. The affected limb would then reach for the ground at every step when its turn came, and that would mean a descent of the pelvis and the abolition of adduction, and this would be unattended with violence to the affected joint, because the weight of the body comes on the ischiatic tuberosity resting on the perineal strap, and not on the heel. The first, or an occasional effort of this kind, would not be likely to produce any effect, but if the effort is made habitual or a matter of systematic drill, the adduction of the limb will be gently and gradually corrected, because the patient, consciously or otherwise, will incline the limb towards abduction, so that he can more readily conform to the mode of walking prescribed for him. Undue flexion is subject to similar corrective procedures. And if the naturally rhythmical action of the limbs is restored and becomes habitual, the limb fixed in a good position by reflex muscular action, becomes immobilized by ankylosis, and the patient recovers with the minimum of deformity and locomotor disability.

It may be said, by the way, that the rhythm of the human gait is a subject which has not received the attention to which it is entitled. When natural, it is very simple, the time being divided equally between the two feet; but its very simplicity makes a slight deviation very noticeable, as in the lameness of incipient hip disease in a child, in whom the ordinary motions of the joint are as yet unlimited, and whose lameness is entirely due to the fact that he violates rhythm by spending more time on the sound than on the affected limb. He accents the blow given to the ground by the well foot, which hastens to relieve the affected limb of the weight of the body. It is a point of practical importance that many people who are lame, add to their lameness by neglecting to keep correct time with their feet. Any of us can appear lame by simply giving more time to one foot than to the other, a matter of easy and immediate demonstration; and one who

is really lame can lessen the appearance of being so by simply giving natural rhythm to the action of the feet.

I have been led to the opinions¹ presented in this paper by pondering the question, Why do patients similarly affected, and treated exactly alike, recover with such different degrees of deformity? A young girl, for instance, was in the third stage, in which she nearly lost her life, before treatment was begun. She has recovered with no adduction, and almost no flexion; so that although there is real shortening of nearly two inches, there is very little lameness. I attribute this good position to the fact that her mother was very anxious about her only daughter, and was always with her, so that every step the child took with the hip splint was taken under the necessity of appearing as well as she could. Her steps were equally timed, and the affected limb became ankylosed in a useful position because it had to do, so far as was possible, half the work of locomotion. I also treated a boy who recovered from the disease, in a more moderate although purulent form; but he limps about most awkwardly with 20 degrees of adduction, and 50 degrees of flexion. I explain his bad position by the fact that the mother, one of the best of women, was busy out of the house, every day, and nearly all day, necessarily leaving at home and very much to their own devices, her family of four boys. As the patient was most of the time in excellent general health and very ambitious, he vied with his brothers in all their games, and developed his well limb enormously at the expense of the affected one, which was elevated and adducted to keep it out of the way. In another case the patient, who recovered after long-continued purulent discharges, was a girl endowed with uncommon beauty; and although she was by no means docile, and under very little restraint at home, her vanity led her to try always to appear at the best advantage, and thanks to her careful gait and studied attempts to be graceful, she now walks with very little lameness, with flexion not more than 10 degrees, adduction *nil*, and more than two inches of real shortening.

Another child, whose treatment as a hospital out-patient was finally suspended for neglect, will probably recover with the limb adducted forty-five degrees. A year before her final discharge she was made an in-patient and the deformity was entirely reduced by recumbency and the weight and pulley for seven weeks; but soon after returning to her unfortunate home, where a large family and poverty make even ordinary parental care impossible, the deformity recurred and will doubtless be permanent.

These are the more striking examples selected

from many cases, the study of which has led me to the practical conclusions above expressed. I believe that for years I made a mistake by encouraging patients, protected by the hip splint, to take part in the rough occupations of healthy children. One result was frequent chafing by the perineal straps, which at once destroys correct rhythm, because it is impossible for the patient to divide his weight equally between the well foot on the one side, and the excoriated perineum on the other. It is my practice now to advise moderation in exercise, and especial attention to the manner of walking. I insist on the patient's keeping time in his steps so far as practicable, and lead him to adopt and maintain a proud bearing, keeping his head high and behind the vertical of the centre of gravity. A girl is told to practice deportment before the looking glass, and a boy is advised to organize a juvenile military company, and to take command of it himself. The parents are informed of the importance of encouraging the child to adopt deliberate and graceful movements on all occasions. Since I have changed my practice in this regard, there has been an improvement in results, and I no longer am anxious as to the ultimate position except in those cases in which the patient is intractable, and the domestic management at fault.

It may be well to mention that, as in this method of regulating the position of the limb no account is made of the abductive power of the traction by the hip splint, the perineal strap on the sound side is dispensed with. A single strap is more convenient, and has proved sufficient both as an ischiatic crutch and an agent for making counter traction when the rack and pinion are used.

Summary.—The deformities of hip disease are caused by the patient's efforts to so place the limb that it shall be the least disturbed by, and afford him the most convenience in, his customary attitudes and movements. They are, 1. Abduction; 2. Adduction and flexion; and 3. Extreme adduction and flexion. The second position is practically by far the most important, and is the only one considered in this paper. It is caused by the patient's elevating that side of the pelvis in order to take the limb off the ground, and to keep the affected limb out of the way of the well one, which is on the ground a longer time than the affected limb, and does most of the work of progression. The limb is maintained in the chosen position by reflex muscular contraction, which does not immobilize the joint, but fixes it in such a manner that changes in its position are readily made by the application of gentle but persistent force. It is proposed therefore, to induce the patient, wearing the hip splint, which protects the joint from the violence of walking, to divide the time on the ground equally between the two feet, or rather between the foot of the sound side and

¹ Medical Record, May 21, 1887, p. 586; St. Louis Courier of Medicine, May, 1881, p. 372.

the ischiatic crutch on the affected side, with the expectation that adduction and flexion will be wholly or in part reduced, when the affected limb makes repeated efforts to reach the ground and do its share in locomotion. It is believed that the patient can be induced by precept and drill to adopt this manner of locomotion with the result indicated, a belief which is sustained by the observation that patients led by accident to walk in this way, have recovered with a good position of the limb, and by the results of the adoption in practice of this method of preventing deformity.

4 East 25th St., Madison Square, New York City.

MALIGNANT SMALL-POX; A FORM HITHERTO FATAL.

BY H. RUSSELL, M.D.,
OF SUPERIOR, WIS.

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I take the liberty of sending you a report of some cases of above form of small-pox for publication in your valuable journal, in order to expose to the notice of the medical profession a pretty accurate description thereof and its treatment, so that the disease may be diagnosed, if possible, at time of physician's first visit and thereby not permitted to spread, which state of matters occurred after the first case of it, which I saw in vicinity of Westfield, Marquette Co., Wisconsin, in the winter of 1872-73, as, although prior thereto, I had seen many cases of variola and varioloid, I totally failed to discern the least resemblance to last diseases.

My first case was that of a young man, named James Brown, whom I first visited on the 18th of January, 1873, and found in the usual febrile state, precursory to an eruptive disease, with an eruption just appearing on the forehead, which I considered as having been that of scarlatina and announced it as such to his parents, but on the following day the patches were larger than those of scarlatina, and, after having looked over the various exanthema in Aitken's "Practice," I concluded that it was a case of hybrid, described therein, and watched its progress carefully for a few days, when I told them that I did not know the name of the disease that affected their son and advised counsel, which was not obtained, and on the following Monday another physician took charge of the case and diagnosed it as black measles, and as no one was afraid of measles, many visited the patient; hence, in about two weeks thereafter there were many affected by variola, varioloid, and referred to malignant form, and, knowing that the treatment of the first two is simple, and that the character of the pustules, etc., attending them is easily detectible and recognizable by physicians and others who have, previously, seen such cases, I shall, in the follow-

ing, try to describe the appearance of the pustules in said form, its history and the treatment which I found to be of service in my last case, and the only one in which I tried it to any amount.

The pustules, if such they may be termed, in this almost hitherto, nondescript, are not cone-shaped as in variola, and varioloid, but are umbilicated in the centres, of about the size of an ordinary cowpock, are red around the bases and marginally contain a clear fluid which scarcely ever becomes opaque in the least, are mostly confined to the face and extremities, whilst the whole trunk, as far down as the umbilicus, is of a bright red color, and in no case need the attending physician expect such a patient to live more than ten or ten and one-half days after the first appearance of the eruption by using ordinary treatment; such, at least, having been my experience; but in my last case, that of a child named Hannah Smith, aged 9 years, I used tincture of iodine, of which I gave her eight drops in syrup every three hours, and am happy to state that she recovered as readily as if she had merely been affected with measles, whereas her brother and sister had succumbed to the same fatal form, the former not having taken any iodine and been treated by another physician, and the latter only having used it for the period of three or four days prior to death.

In regard to the use of iodine in this form of small-pox, I would say that I got the idea from having seen Prof. Daniel Brainard, of Chicago, successfully use it, hypodermically, on chickens, in the presence of his class for the bite of the rattlesnake, and having used in my former cases, of which I had thirteen during said winter, the different acids, etc., and hydrate of chloral (said to have been used beneficially in the German army for small-pox), without the least success, I happened to think of the iodine, and presumed that, as it had acted so well against rattlesnake poison, it might, possibly, have a good effect on small-pox poison, and hence, used it with the above happy result, and it is my opinion, that if I had used it in my former cases I would have saved all of their lives except those of two, who, during the continuance of the disease, were affected by severe intestinal hæmorrhage.

In regard to the terrible affection being a new one, I have very good reason to believe that it was in the north of Ireland about seventy-nine years since, and in other parts of Europe about one hundred and sixty-nine years ago, and wonder why a very accurate description of it is not to be found to day in every standard work on the practice of medicine, whereas it is not in any of them unless in one lately published by that talented, time-honored veteran, Prof. N. S. Davis, of Chicago, and is by all odds, more fatal than any and all of the pustular or exanthematous