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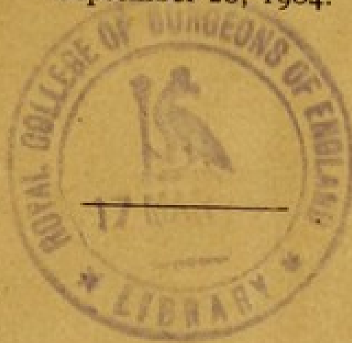
By DeFOREST WILLARD, M. D.,
Professor of Orthopaedic Surgery, University of Pennsylvania; Surgeon, Presbyterian Hospital, Philadelphia.

Read at the meeting of the Medical Society of the State of Pennsylvania, September 28, 1904.



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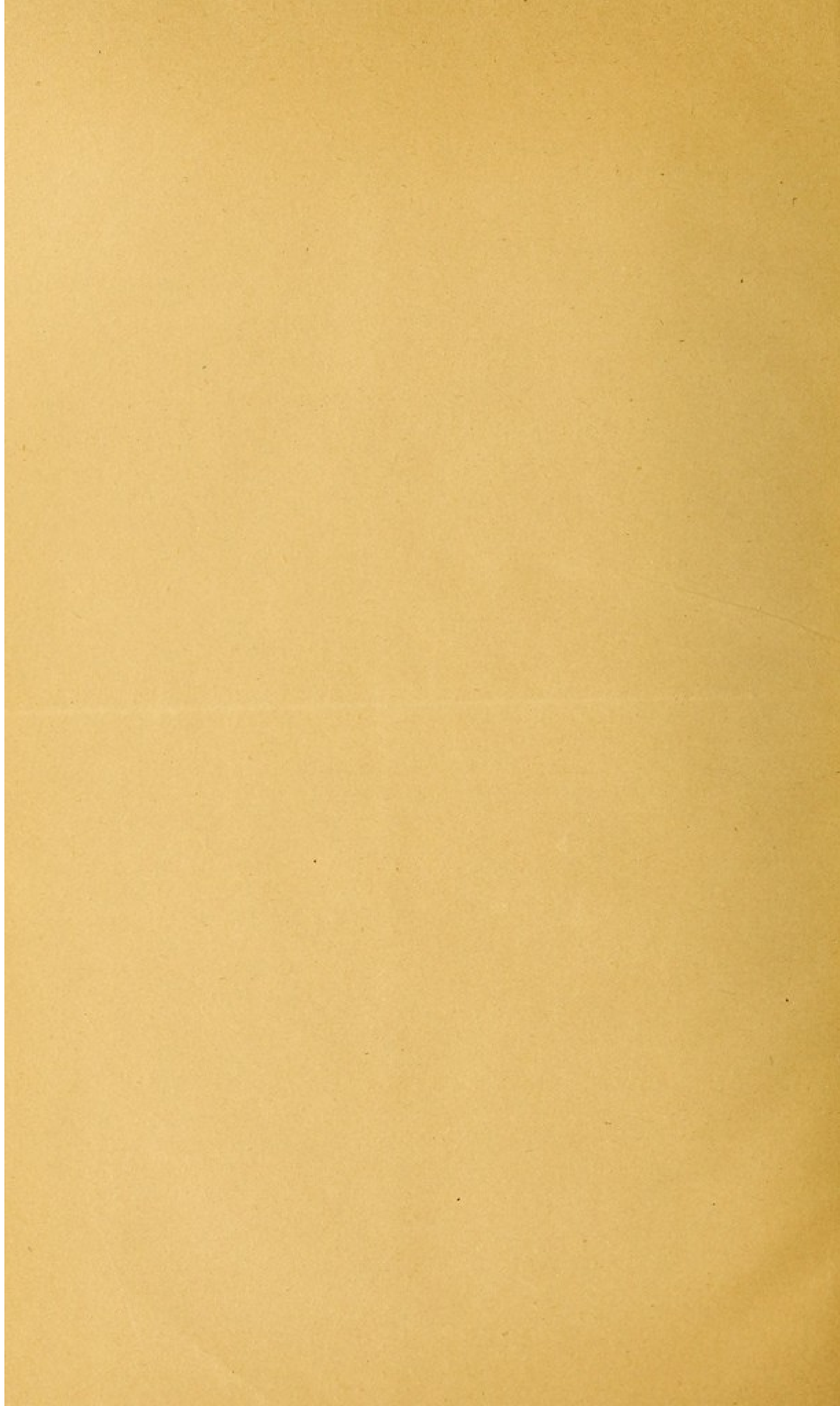

Knee Ankylosis.

By **DeFOREST WILLARD, M. D.,**
Professor of Orthopaedic Surgery, University of Pennsylvania; Surgeon, Presbyterian Hospital, Philadelphia.

It is impossible in the ten minutes allotted to this subject to more than touch upon a few of the methods of relief for ankylosis of the knee. The discussion presupposes that the acute or chronic process has passed and that partial or complete fixation is an accomplished fact.

Ankylosis is a condition, a result of disease and not a disease. It is the result of so many different pathological conditions that it is difficult in any single article to more than outline the course of a few of the more important ones. The amount of fixation may vary all the way from a slight limitation of motion up to a complete and bony continuance of the femur with the tibia. There are but few conditions in surgery in which a course of treatment to be pursued is more puzzling at first examination. Positive rules for action are very difficult to formulate since so many varying causal conditions are to be considered. The cause of the ankylosis, the nature of the pathological process, the past and present history of the case must all be weighed. Added to these considerations must be the palpation of the joint, the gauging of the amount of swelling or induration, the degree of fixation, the presence or absence of suppuration, the amount of destruction of the cartilage and bone, the age and condition of the patient, etc. A slight effusion of synovial fluid; a moderate degree of deposit; a slipped cartilage; a plastic exudate; a synovial or cartilage destruction; a traumatism; a tubercular degeneration; a gonorrheal or septic infection—any one of these conditions may result in slight or in complete fibrous or bony ankylosis. There are few conditions that require a closer observation or more accurate differentiation as to cause, progress and results. To the clinical examination should usually be added the *x*-ray picture. From all these considerations final judgment must be made.

Two cases that presented themselves to me on the same day will serve as an illustration of the elements that should enter into the question of advisability of interference. The one was a man with slightly tubercular tendencies who after an injury, presented an apparently perfectly ankylosed knee without much thickening or induration, and there had been for many months an entire absence of any active process. The other presented much thickening about the knee, with general doughiness, enlargement and tenderness. The skiagraph of the joint in the first case showed that there had been no destruction of the bone and the cartilage was apparently in a fair condition. In the second case the skiagraph showed marked erosion of both cartilage and bone. I decided, therefore, in the first case to attempt to restore motion to the joint. In the second case I advised that a permanent ankylosis was the safest and best result that could be expected, which was accomplished without operation and without suppuration, by placing the patient upon a splint and crutches for a year. In the first case it was especially important that an effort be

made to relieve the ankylosis, as the man was six feet eight and one-half inches in height; his legs were nearly four feet in length, and a stiff knee rendered his condition exceedingly awkward as it was impossible to ride with comfort in the trolley or in the steam cars, or to sleep in a Pullman or in an ordinary bed. Frequent etherizations and careful, forcible flexions resulted in restoration of movements to within five degrees of the normal and the patient has been able to use his limb most satisfactorily for ten years without recurrence of the trouble.

Sensitive Joint. Nice and accurate discrimination is also necessary in deciding as to the time when the primarily and very properly prescribed rest of a joint should cease and when motion should be coaxed or enforced. Rest should be the rule in all joint inflammations during the acute stage, but rest may be too long continued with the result of a sensitive and apparently ankylosed joint, which is really only a condition of disuse. Many a patient comes to me with such a joint, where crutches have been used for months or a year and yet no evidence of disease is present. A practical surgeon at once recognizes that a serious tubercular or septic arthritis would not have continued for that length of time without showing positive results—rigidity, induration and flexion. The patient will probably be in a nervous, hysterical condition and will shrink from the slightest movement of the joint. In such an articulation, hyperemia and sensitiveness will continue indefinitely until normal joint action is restored. Gentle but positive movements under ether, followed by massage, and passive and active movements in a proper, orthopaedic gymnasium together with locomotion, will save such an individual from the miserable life of an hysterical pervert.

Inflammatory Results. A fixed joint with moderate effusion following a synovitis after slight injury or contusion or a slipping cartilage or a loose body, usually has a definite history. It will ordinarily be benefited by both active and passive movements of the joint, at first under ether, then in a properly regulated gymnasium with massage and hot air treatment.

Gonorrheal Infection. The plastic nature of the exudate in this form of infection quickly fastens the knee in the position which it has been allowed to maintain during the acute stage. Early and gentle persistent movements are essential to the restoration of the joint but several anesthetizations may be necessary. I am speaking now only of the cases that come to the surgeon late, after ankylosis has become fixed. In the earlier stage, of course, the joint should be opened, thoroughly washed, and all infecting elements thoroughly cleaned out with bichlorid or formalin solution, with drainage by gauze or tube if the fluid shows evidence of purulent degeneration.

Septic Infection. Septic arthritis is often mistaken for typhoid fever, or is said to follow typhoid fever; the probability is that the cause was septic from the inception. All septic infections should be, of course, thoroughly washed and drained early. If however, the joint has become osseously ankylosed in bad position, it is better not to disturb the degenerated cartilages but to do an osteotomy of the femur above the knee, together with tenotomies of the hamstring tendon if necessary, and to place the leg in good walking position, even though there should be a rather unsightly curve in the lower end of the femur. If suppuration still exists, an open erasion operation will be necessary.

Tubercular. The treatment of the ankylosis following tubercular disease is an exceedingly important subject and requires very careful consideration. The great danger lies in the reawakening of the pathological process. If the disease is still

progressive, with marked flexion and partial ankylosis, especially in children, the hamstring tendons should be divided, the knee brought to nearly the straight position and there fixed with gypsum. Roentgen or Finsen sun rays, or direct sun rays may be used with advantage. When ankylosis is complete in a flexed position and the tubercular suppurative process has subsided for a year, an osteotomy above the condyles will give the best results and is the safest; in fact, it is free from danger of suppuration. In former times I frequently made a V-shaped excision of the ends of the femur and tibia, but found that the danger of reawakening the disease through the disturbance of caseous foci with their ptomains, was a positive risk. The bend in the femur remaining after osteotomy is not serious, gives a good walking leg and is easily concealed by the dress of either man or woman. When ankylosis with suppuration is present, the open operation is indicated. The question of an erasion or an excision can be best determined after the joint is laid open. Amputation may be necessary in adults, when other means of relief are impossible.

Osteo-arthritis and Rheumatoid Arthritis. The amount of benefit that can be obtained in ankylosis associated with the bony deposits occasioned by either of these conditions is small, yet it is sometimes very desirable to divide the hamstring tendons and to bring the knee into proper position for locomotion. These patients are much better if permitted to walk about even when the pain is considerable.

Rheumatism. It will be noted that I have purposely left out rheumatism as a cause of ankylosis until the last, because I wish to emphasize the fact that the majority of cases of so-called rheumatism are really not rheumatism at all. There are, of course, cases of adhesions from inflammatory rheumatism, but other conditions far exceed them in number. The ordinary physician, and even the surgeon covers up so many of his delinquincies in care or in knowledge, by calling the disease rheumatism, that it is necessary constantly to keep in mind the fact that rheumatism has definite and positive symptoms which are plainly diagnostic from the tubercular, septic, gonorrheal, and other forms of arthritis. Recent rheumatic adhesions in a joint can usually be broken up without other operation than repeated etherization and the exertion of a moderate amount of force, followed by hot air and persistent active and passive manipulations.

The technic of the various operative procedures may be for a few moments considered. In forcible straightening, or brisement force, it is very essential that the force be applied with judgment, patience and with good anatomical and surgical knowledge. Slow and persistent pressure will frequently restore motion to a joint that at first may seem hopelessly fixed. The long leverage available by the length of the tibia, renders it easily possible for a strong man to tear off an epiphysis, to dislocate a knee posteriorly, to tear the capsular ligament or to fracture a bone. These accidents are not uncommon, and are usually the result of falsely applied force. In my judgment, it is never wise to add to tibial leverage the powerful steel levers that are sometimes recommended. With such an instrument it would be possible for an ordinary surgeon to tear a leg from the thigh, or to displace a tibia backwards in spite of the safeguards provided to avert this accident. Intelligent hand manipulations are sufficient, especially if a sand-bag fulcrum is employed and division of the hamstrings is primarily performed. In such division it is always wise to perform an open operation of the biceps tendon, as the close proximity of the peroneal nerve renders subcutaneous tenotomy unsafe. The bands of contracted fascia, which are present in most of these cases of long standing, will seriously interfere with the straightening pro-

cess. These may be divided by prolongation of the biceps incision toward the median line. The popliteal artery, vein and nerve are not far distant, especially in cases where the tibia has been displaced backwards. It is usually inadvisable to endeavor to secure full motion at the first operation, lest inflammatory results occur; several etherizations are better, especially in cases of gonorrheal arthritis and of inflammatory adhesions. Every attempt to restore motion in such a joint requires patience and persistence on the part of both patient and surgeon.

Inflammatory Symptoms. The question of the application of a splint after forcible correction, will depend upon the decision at the time of the operation as to whether an attempt is to be made to restore the mobility of the joint, or whether it shall be permitted to ankylose permanently. If the former, a splint of binder's board or tin, or wood, plaster or silicate should be applied only for a few days to relieve pain and prevent violent inflammatory symptoms. Local applications of witch-hazel or other sedative will give comfort. After a day or two the patient should be encouraged to move the joint, and passive flexions and extension should also be instituted, followed by massage and gymnastic movements increased day by day. If permanent ankylosis is deemed advisable, fixed dressings will, of course, be employed for a long time.

Excision. For the excision of a destroyed or suppurating joint my preference is for the U-shaped incision, convexity downward; it gives thorough access to the articulation and subsequent union of the sutured tendon gives a stronger limb than is secured by sawing the patella or by the upward convex cut. An H-shaped incision is no better. Two lateral incisions are all right for drainage and for washings, but do not give the proper exposure for larger operative work. The question between an erasion and excision is best determined after the joint is opened. In young subjects the former is the better operation if it offers at all the hope of relief; even large tubercular foci can be removed without serious interference with the epiphyseal line and the question of continued growth of the limb is a very important one. Unfortunately, the interference of this epiphyseal line at one condyle more than the other may produce subsequent in-knee or out-knee, but as this is corrigible by subsequent osteotomy, even such an erasion is better than excision, which might more seriously intercept growth. I have practically abandoned the wiring or nailing of the bones after excision, as equally good results are secured by the use of plaster-of-Paris or other fixation splints. A bracketed splint, if properly applied with plaster-of-Paris above and below, is convenient for dressings, but a gypsum anterior and posterior trough, one-half of which can be removed at a time during the dressing, answers every purpose for the fixation. If zinc strips are laid down either side to permit of section into two halves before the plaster is thoroughly dried, these troughs are easily formed.

Osteotomy. The osteotome should be very sharp—a bone knife—not a chisel with a beveled edge.

The operation is one so simple if cleanly done, that suppuration should never occur, and the case becomes one of simple fracture. The incisions should be no larger than the instrument itself, not as I have recently seen, a cut of four inches long. I prefer a wide instrument, to make as few bone sections as possible, as all unnecessary manipulations of the part are undesirable. A square sand-bag makes the best of all anvils. Great care should be used after fracture that the fragments shall not be displaced. Correction should be made so as to bring the leg almost, but not quite in line with the thigh.

Plastic Operation. In an open operation or ankylosis, where there is danger of a recurrence of the union in the joint surfaces, the interposition of a flap of fascia may prevent adhesions and give an approximately normal tissue substitute.

Amputation. The thigh is too frequently amputated for knee ankylosis. Removal is, of course, a simple operation and is adopted by many surgeons as the quickest and easiest course out of the difficulty. Certainly it is the easiest plan, but it is frequently not the best procedure for the patient. An amputation is always an acknowledgement of defeat upon the part of the surgeon and should not be employed, especially in children, so long as there are other measures which promise hope of relieving the condition and saving the patient's life. Repeated erasions in children will often secure a good walking member and in the young the question of time is not an important one. An artificial limb adapted above the knee, while a fairly good assistant in locomotion, is a heavy and undesirable substitute; a stiffened knee in fairly straight position which is not painful, is much to be preferred.

Dangers and Accidents. I have never yet been unfortunate enough to so injure a knee joint during restoration of function as to require immediate amputation, but this is an accident that has not infrequently occurred and is quite possible at any time. I have, however, in one instance torn the popliteal artery by hyperextension to such an extent that a false sac occurred. The case, however, was cured without amputation by laying open and ligating above and below; the patient made a good recovery. By the use of extreme care, I have avoided fracture except in a single case, so far as I can remember. This fracture occurred in a case of old rheumatoid arthritis and was rather a crushing of the condyle. These cases of rheumatoid arthritis ankylosis in old people are rather prone to be followed by serious or fatal consequences if great violence is inflicted at one operation. A complete posterior dislocation, I have never produced, but where the ligaments are destroyed there is in many cases a tendency to displacement which must be carefully avoided during the exercise of straightening.

I have made no attempt in this paper to discuss thoroughly the conditions causing knee ankylosis, but diagnosis of the primal cause is of the greatest importance. In this discussion I have presumed that the violence of the original disease has spent its force, that inflammatory symptoms and phenomena have largely disappeared and that the surgeon has to deal either with a false or a bony fixation of the joint. As I have already stated, it is exceedingly difficult to formulate any definite plan of procedure in a condition that is the result of so many pathological causes. The proper line of treatment can only be decided by a most thorough consideration of the cause of the disease, its course and the present condition. There are few instances in surgery in which a nicer discrimination of individual judgment is necessary.

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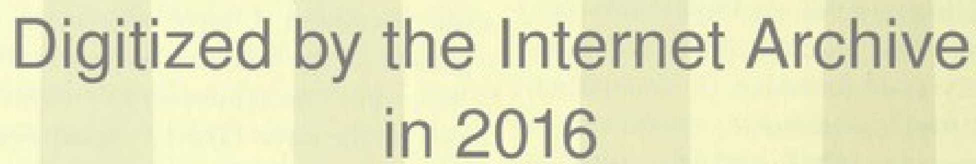

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