

An Address

ON

THE TREATMENT OF SPRAINS AND OF SOME FRACTURES.

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GENTLEMEN,—These subjects are often surrounded with difficulty and, until the advent of the Roentgen rays, it was sometimes quite impossible to give a definite opinion as to the exact nature of the injury. In the text-books the treatment of a sprain is often spoken of very briefly, but if one were to judge by the frequency of the accident and the pain and trouble which it causes to all concerned the matter should merit greater preciseness and thoroughness in its discussion.

I.—SPRAINS.

A sprain may be defined as a momentary disturbance of the normal relation which exists between opposing joint surfaces, but varying very much in degree. However slight the disturbance is, some stretching of the surrounding parts must take place, accompanied by effusion of blood and subsequently of lymph. The degrees of a sprain are very variable. In some cases the injury is so slight as to cause little more than temporary inconvenience; in others the ligaments are ruptured; and in the severest of all the pull on the ligaments is such as to tear off a small portion of bone. Mr. Callender described these last-named cases as "sprain-fractures."

Before discussing the question of treatment it is well to ask what takes place exactly when a joint is sprained, and to elucidate this point we must look briefly at the parts composing a joint, for the first fact of importance to grasp is that such an injury affects every kind of tissue entering into the composition of a joint. We have first of all the bony surfaces more or less adapted to one another, generally fitting closely and moving freely on one another through the medium of the smooth articular cartilage. The bones and the cartilage are covered by a continuation of the synovial membrane. Binding the bones in apposition are the various ligaments composed of inextensible and, so long as they are uninjured, painless fibrous tissue. The synovial membrane is reflected on the inner aspect of the ligaments, and between the endothelial surface of the synovial membrane and the ligaments is a more or less thick padding of sub-synovial tissue in which blood-vessels, lymphatics, and nerves are freely distributed. Outside the ligaments are numerous muscles and tendons by means of which the movements of the joint are governed and directed. These are quite as much a part of a joint as the ligaments and bones. Tendons frequently run in canals or tubes of fascia over the joint and are closely attached to the capsule; and around the tendon-sheaths and filling up the inequalities about the capsule is a large amount of loose connective tissue known as peri-articular tissue. When a sprain occurs each one of the structures mentioned is affected considerably. As a rule the bone is only slightly, if at all, injured. The ligaments are frequently stretched and torn; and blood and, later, lymph are poured out from the vessels of the sub-synovial and peri-articular tissues into the joint cavity and into the tendon-sheaths, amongst the muscles and into the peri-articular tissues; hence the swelling of the parts. Some of the fluid so effused is ultimately absorbed through stomata which exist on the surface of the endothelium of the joint. In this respect the joint cavity may be looked upon as a large lymphatic sac. The remainder of the fluid is taken up by the connective-tissue spaces.

The symptoms of a sprain are sufficiently well marked. At the moment of the accident there is pain, often of a sickening character. It is referable to several causes—namely, stretching and tearing of the ligaments, sudden tension of the soft parts, and effusion of blood into the joint. The pain becomes less severe shortly after the accident

and even disappears in slight cases. This is the period of quiescence. It then reappears or increases in intensity owing to the tension arising from extravasation in the joint cavity and the peri-articular tissues, and is referred to those spots where the ligaments are most extensively damaged. Coincidentally with this there is swelling which is especially noticeable at those parts of the capsule which are not supported by ligaments or by muscles. With the increase of pain and swelling the movements of the joint become limited and even lost. After a time, usually from three to four days, subcutaneous extravasations of blood can be made out and are always most marked where the damage to the ligaments and peri-articular tissue is greatest. An observation of their position and extent affords a guide as to one detail of the treatment. The pain, swelling, extravasation, and loss of movement extend over a few days to two or three or four weeks. The essential point to bear in mind is the existence of two stages as indicated by two well-defined attacks of pain. The first is that of injury associated with stretching and tearing of the parts and effusion of blood. A period of quiescence then ensues, lasting two or three hours, followed by pain due to tension and continued effusion of blood. A great deal of damage is often sustained by the patient when he attempts to use a sprained joint during the quiescent period, and the idea is often put into practice of walking off a sprain of the ankle. It will be readily recognised that the period of convalescence is much retarded and the effects of the sprain take a longer time to wear off.

It is important in severe cases to make the diagnosis as clear as possible, especially where the condition of "sprain-fracture" exists, and for that purpose the employment of the Roentgen rays is invaluable. Even when no fracture has taken place there are frequently found about the joint some tender spots. These spots are pretty constant in position. For instance, at the knee a spot is found just below and on the inner side of the patella; at the ankle, the front of the external malleolus. These spots are first noticeable during the second period of pain after the accident and they persist for some considerable time. Their presence is due in the first place to ruptured ligaments and later to the persistence of roughened, inflamed, synovial fringes, or sometimes to places where the extravasation of blood and lymph has not been absorbed. If they should persist for some weeks or months after a sprain their usual cause is the formation of bands of adhesion. It is important to remember the existence of these spots and the causes of them, since there often arises a very considerable difficulty after a sprain in getting rid of these painful places. In fact, patients often complain and feel dissatisfied that while they are able to move the joint with a fair amount of freedom their ease in locomotion is considerably interfered with by these painful spots. There are certain predisposing causes of sprains. Some abnormal conditions of the limb are distinctly blameable—for instance, ankylosis of the knee, club-foot, and genu valgum. These disabilities place an excessive strain upon parts of a joint which are not naturally adapted for meeting such a strain. Other conditions are—atrophy of the muscles, whether as the result of infantile paralysis or injury to a nerve. At the ankle the most common cause of a sprain is relaxation of muscles and ligaments associated with anæmia and similar conditions. Instead of the muscles and ligaments being so toneful that they can be immediately braced to meet any sudden call upon them they are relaxed, the joint surfaces are readily displaced and so a sprain follows. Age has also a certain influence. An injury which in a child would be sufficient to produce a severe sprain or a separation of the epiphyses will in the aged produce a fracture.

Now, as to treatment, there are two methods—that of immobility and that of mobility. By these are meant the method of rest and the method sometimes adopted of rapid forcible movement immediately after a sprain. If the method of immobility be adopted we have the following means at our disposal. The application of heat, of properly applied pressure, fixation by splints and plaster-of-Paris, friction, and the use of the constant current. These are all valuable in their places, but the true treatment for sprains consists in the appreciation of the right time to apply them. Cold applications either of ice, cold water, or evaporating lotions have of late fallen into considerable discredit. But the discredit is not deserved. It is due, not to the agent itself, but to a want of intelligence in applying it. If we revert for a moment to what happens at the time of receiving a sprain

we shall note that at the moment of injury numerous small vessels are ruptured and there is an instantaneous pouring out of a certain amount of blood and of lymph, so that effusion goes on for three or four hours after an injury. It is during these hours that the application of cold is so effective, and it seems to me that it acts in the following direction. It is a local constrictant of the vessels, lessening their size and limiting the effusion. Now, if the amount of effusion poured into and around the joint be controlled the time of healing is lessened, and the probable amount of stiffness afterwards is also decreased, so that the patient recovers sooner. It is therefore quite rational to apply cold during the first three or four hours after the accident, and, indeed, it is the best method at our command. If there be a desire to check further the amount of effusion this can be readily done by the application of pressure and placing the joint in such a position that its potential cavity is lessened. For example, the knee should be placed in extension and not flexion, the ankle at a right angle and not in full extension nor in full flexion. Pressure is usually applied by bandage, but herein there is an intelligent and a non-intelligent method. If an ordinary bandage merely be bound round the joint the chief part of the pressure is made on the prominence of bones at the joint, but pressure must be made so that it is brought to bear evenly on all parts of the capsule which can be got at. For example, in the case of the ankle-joint a bandage around the ankle merely presses on the external and internal malleoli and on the tendo Achillis behind. But, now, if three or four layers of cotton-wool be placed on the joint with a little additional amount in front of and behind the internal and external malleoli and the bandage be then applied, the cotton-wool sinks into the various hollows and effectually compresses the distended capsule. So that if the sprain be seen within the first two or three hours of its occurrence the following treatment should be carried out. Apply cold vigorously for from about ten minutes to a quarter of an hour, either by pouring cold water over the joint or by the application of ice or spirit lotion and then wrap the joint round with lint or other suitable material soaked in cold water or spirit lotion, put on the cotton-wool in the manner just indicated and place the joint in such a position that there is least potential cavity for effusion to be poured into and firmly bandage the part.

During the period of quiescence the same line of treatment should be adopted, for there is some quiet effusion still going on. But when the second attack of pain ensues and it is becoming more severe, the application of cold is not of much value, since by this time the tissues are distended with blood and with lymph and effusion has now ceased to be poured out. The right thing to do is to apply heat, as hot applications not only diminish the pain but exercise a permanent effect upon the duration and the amount of swelling in this way; when the vessels which have been injured have recovered their tone the application of hot water or of heat in other forms promotes absorption, so that the effused blood and lymph are as rapidly as possible taken up into the blood-vessels and lymph-channels. During this time the joint should be kept at rest and pressure should be maintained on it by cotton-wool and a bandage, since well-directed pressure also assists absorption.

The most vexed question in connexion with a sprain is the duration of this period of rest. How long should it be persisted in? It may be said that as a rule most joints are rested too long and that at an average of three or four days after the swelling has subsided movement of the joint should be commenced. The direction of the movement is a most important point. It has already been stated that we can ascertain by the position of the tender spots and by the distribution of extravasated blood which part of the joint has been most injured. Take, for example, injury to the external lateral ligament of the ankle, no one would be so unwise as to invert the ankle as a part of the early movements, but would flex and extend and carefully evert it so that whilst moving the joint he would be in no way interfering with the healing of strained and of ruptured ligaments. It should not be forgotten that constitutional conditions influence the question of sprains very considerably. If the patient have a tuberculous history or a gouty or a rheumatic-gouty history he should rest much longer than should a patient with an ordinary history.

When the amount of swelling is very considerable hot applications and rest are not sufficient. The best thing is properly applied friction. The object of friction is to empty

the lymphatics of a certain amount of coagulated lymph, and in rubbing the parts it is always advisable to begin to rub that part of the swelling which is most distant from the joint, thus emptying the distant lymphatics first and then those which are nearer the joint and so promote circulation of lymph from the most congested to the least congested parts. Together with rubbing, frequent application of hot water and gentle movement should be carried out. If after ten days' treatment on these lines the thickening about the joint have not disappeared and there still remain tender spots on moving the articulation and on pressure, counter-irritation by blisters is called for. As a rule, one may say that in a fortnight or three weeks with the above treatment a severe sprain will cease to give rise to trouble and inconvenience and the patient can go about with comfort. Sometimes, however, it happens that on the patient attempting to use the joint acute pain sets in. This is due to sub-acute or chronic congestion of the joint, and the only treatment for it is absolute and complete rest. It is easily effected by means of a plaster-of-Paris application, and from four to six weeks is not too long a period to keep such a joint entirely at rest. It, however, frequently occurs that after the removal of the splint the movements are necessarily somewhat stiff and awkward and are not infrequently painful. As a rule, such pain does not arise from adhesions within the joint but it is really due to the condition of the muscles. They are at this stage somewhat wasted and their tendons are more or less glued in their sheaths. There are two means of overcoming these difficulties: one is by rapid movement of the parts under an anæsthetic and the other is by more gradual methods. The former, or the more forcible method, sometimes meets with astonishing success, but at other times it is followed by disaster, especially in cases with a tuberculous inheritance. The more gradual means comprise friction, the use of the hot-air bath, and the constant current. It is essential that patience in treatment should be inculcated, and if cases are treated on the above lines there will not, as a rule, be much difficulty in bringing even severe and complicated forms of sprain to a successful issue.

Allusion has been made in an early part of the paper to the practice of treating sprained joints by the method of mobility from the first. It is one which can only be employed in very slight cases and even then with some misgiving, for in certain patients the symptoms instead of rapidly clearing away become more pronounced and permanent thickening and disability of the joint remain.

II.—THE TREATMENT OF SOME FRACTURES.

The treatment of fractures about the elbow-joint.—Of all fractures those in the neighbourhood of this joint are more difficult to diagnose and are more often followed by disastrous consequences both to the practitioner and to his patient than any other fractures, and such was more often the case formerly than now that the Roentgen rays permit of early recognition of the mischief. But it must often happen that the rays are not available. Excluding fracture of the olecranon the general practice has been to put the arm up at a right angle with the forearm in the mid-position between pronation and supination. In my opinion keeping the limb in this position for a fortnight or three weeks is the cause of most, if not all, the after-trouble. Now I am about to propound an axiom—namely, that in all injuries about the elbow-joint except fracture of the olecranon the forearm should be forcibly extended, then supinated, then acutely flexed—that is to say, the limb should be placed with the ball of the thumb of the affected limb resting against the neck on the opposite side. No splint is needed and, indeed, is harmful, for the position can easily be secured by means of a sling passing round the neck and round the wrist. For the knowledge of this axiom and for an insight into its practical value I am wholly indebted to my friend Mr. Robert Jones of Liverpool.

It is interesting to see how it works out. Taking, for instance, a case of dislocation of the elbow backwards with fracture of the coronoid process of the ulna. If the limb be put up in the usual right-angled position the dislocation does not remain perfectly reduced, while the separated coronoid process is drawn upwards by the action of the brachialis anticus and acquires a new fixation point higher up on the ulna so that it locks prematurely in the coronoid fossa of the humerus and thus limits movement. Or, again, to take those severe injuries to the lower end of the humerus in which there is an oblique fracture into the joint with frequent displacement forwards of one of the condyles, if the limb is put

up in the usual way at the right angle the displacement is not reduced, a large mass of callus is thrown out on the front of the humerus, and at the end of three or four weeks the range of movement is found to be limited to a few degrees and no efforts whether under an anæsthetic or not can increase this. If, however, as soon as possible after the accident the forearm be fully extended, and with the thumb pressure be firmly made in front of the elbow-joint and the forearm then acutely flexed and supinated and kept in apposition for the time mentioned above the result will be most satisfactory. What has happened is this. The ulnar and radial portions of the elbow-joint being in a flexed position have maintained the fractured parts of the bone in their proper position and by the pressure of the coronoid process into its fossa this depression has remained comparatively free from callus. It may be objected that there will be considerable difficulty in securing complete extension when the bones have been united, but it is a practical and therefore certain point that at the elbow after all fractures, except those of the olecranon, the difficulty arises not in obtaining extension but flexion movement, and it is this very difficulty which is obviated by the method of which I am speaking. To take one more example, a transverse fracture of the lower end of the humerus, if the right-angled position be adopted, the lower end of the upper fragment projects forwards and the lower fragment is displaced backwards. By adopting the acutely flexed position this is at once overcome. The same method is applicable to dislocations of the elbow after reduction, for if that position can be assumed there is no doubt that complete reduction has taken place. The value of the method might be exemplified in each of the many fractures in the neighbourhood of the elbow-joint, but space will not serve. Actual trial of the treatment of all doubtful injuries and fractures in the neighbourhood of this joint, except fractures of the olecranon, by fully extending, then supinating the forearm and acutely flexing it without the subsequent use of splints, pads, and bandages, and merely using a sling, will prove the truth of these statements in a most gratifying way. At the end of from three to four weeks in the case of a fracture the hand should be dropped a little, and then two or three days afterwards it should be noted whether the patient can raise the forearm to the fully flexed position. If he can, the sling may be further loosened and the process repeated. If he cannot, the forearm must be placed back where it was previously and kept at rest there for some days and the experiment then be repeated.

Separation of the lower epiphysis of the femur.—This is a rare accident but there are many interesting points in connexion with it. The separated epiphysis is usually displaced forwards and not backwards, unlike the displacement which occurs in a transverse fracture of the lower end of the femur; the displacement is backwards almost always in the latter case. Forward displacement of the lower epiphysis is accounted for by this circumstance—the epiphyseal line is directed from the front downwards and backwards so that the epiphysis more readily glides forward on to the shaft. In transverse fracture the line of fracture usually passes above the attachment of the gastrocnemius; hence the fragment is tilted backwards. Another point of interest about separation of the epiphysis of the lower end of the femur is that it is almost always due to a wheel-accident, the most common cause being that a boy riding behind a cab gets his leg caught in the wheel and the epiphysis is wrenched off. There are two difficulties in treatment—first, to reduce the epiphysis and, secondly, to maintain the reduction. This can sometimes be accomplished by division of the tendo Achillis and forcible extension, but the epiphysis is extremely liable to become displaced. To prevent this Mr. Jonathan Hutchinson, jun., and Mr. H. L. Barnard recommend that the limb should be put up with the heel touching the buttock. I have made trial with both methods and have sometimes failed with them and been compelled to open the joint and to fix the epiphysis in place with a steel nickel-plated screw, and indeed this seems to me to be the best course to adopt in doubtful cases.

NEW ISOLATION HOSPITAL.—The Gelligaer District Council have decided to erect a permanent isolation hospital to take the place of three small cottages at present used for the purpose of isolation and the resources of which have proved totally inadequate during the epidemic of typhoid fever which is at the present time affecting the small mining village of Pontlottyn.

REMARKS ON TEN CASES OF ENTERIC FEVER IN WHICH THE BLOOD WAS EXAMINED PERIODICALLY FOR AGGLUTINATIVE PROPERTIES.

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THIS investigation was undertaken mainly with the following objects: 1. To determine as far as possible whether the serum reaction is any aid to prognosis and if any connexion between the serum reaction and the presence of complications, especially relapse, can be traced. 2. To determine whether the blood of patients suffering from enteric fever reacts better to the bacillus coli communis than the blood of patients not so suffering, and, if so, to see if the cases which so react run a different clinical course to the others, and if in such cases any causal connexion can be traced between this reaction and complications or relapse. 3. As a subsidiary point, to determine whether considerable differences in clumping power exist between typhoid bacilli obtained from different sources

It is now universally accepted that the bacillus coli communis is not a separate, distinct, and invariable organism, but rather that the name covers a group of organisms, closely allied but differing among themselves in certain details, chemical, morphological, and pathological. It is therefore of importance that a number of bacilli coli obtained from different sources should be used. The bacilli coli examined were derived from the sources shown in the following table:—

TABLE I.

Race of bacillus coli.	Whence obtained.
I.	Isolated from the stools of a patient suffering from enteric fever.
II.	Isolated from the urine in a case of pure bacillus coli infection of some part of the urinary system.
III.	The stock laboratory bacillus coli culture.
IV.	Obtained from a case of pyosalpinx.
V.	„ „ an abdominal abscess.
VI.	Isolated from the mesenteric glands in a case of enteric fever.
VII.	„ „ stools of a patient suffering from enteric fever.
IX.	„ „ stools of a patient suffering from enteric fever, Case 3 of the series.
X.	„ „ stools of a patient suffering from enteric fever, Case 9 of the series.
XI.	„ „ stools of a patient suffering from enteric fever, Case 3 of the series.
XII.	„ „ stools of a patient suffering from enteric fever, Case 9 of the series.
XIII.	„ „ spleen of a patient who died from enteric fever.
XIV.	„ „ milk (obtained from a farm) suspected of causing a small outbreak of enteric fever.

All of these except Coli III. were fairly recently isolated. Coli III. had been sub-cultured for over a year in the laboratory. It will be noticed that Coli I., VI., VII., IX., X., XI., XII., and XIII. were obtained from cases of enteric fever. They differed among themselves in rate of coagulation of milk, production of indol, &c. Only the pathogenic effects of Coli III. and Coli XIV. were tested. Coli III. is quite non-pathogenic even in considerable doses. Two cubic centimetres of Coli XIV. injected intra-peritoneally into a young rabbit caused death in about, or less than, 24 hours and the bacilli were isolated from the liver, spleen, peritoneal fluid, and heart blood. A variety of Gaertner's bacillus was also used on one or two occasions.

A number of typhoid bacilli isolated from different cases were also used. They will be indicated as follows:—Ty. St. (the stock laboratory culture), Ty. S, Ty. R, Ty. M, and