From 1 to 2 drachms of the dilute acid (*British Pharmacopoeia*) are given in 5 to 10 ounces of water, to which the juice and pulp of an orange have been added. As in these residual cases the secretion of pepsin is generally reduced, a saltspoonful should be added to the mixture. The first dose should be taken fasting before breakfast, when its antiseptic action is not impaired by partial neutralization with alkaline food. The second is given as a beverage with lunch, and the third with dinner. Patients rapidly get accustomed to it, and should rarely have any difficulty in taking it regularly for the rest of their lives.

Conclusion

Thirty years ago Professor Knud Faber of Copenhagen came to the conclusion that achlorhydria is always secondary to gastritis, and he has maintained it ever since. When shortly after the war I first became interested in the subject I was so impressed with the constitutional factor that I was inclined to doubt whether gastritis was of any importance at all. I now realize that gastritis and constitutional factors are of equal importance. Without gastritis there is no achlorhydria, but gastritis does not cause achlorhydria unless the patient is predisposed by having the hyposthenic gastric constitution. Gastritis in the presence of the hypersthenic gastric constitution may lead to duodenal ulcer and gastric ulcer, and a gastric ulcer may become malignant, but achlorhydria does not develop. It is the conjunction of the apparently trivial causes of gastritis with the hyposthenic gastric constitution which leads to achlorhydria, and the conjunction of these with the constitutional predisposition to cancer which leads to carcinoma of the stomach.

I expect that this is the last time there will be a discussion on achlorhydria, for the problem has shifted, and we must in future discuss gastritis, its causation, early diagnosis, treatment, and prophylaxis, just as we discuss nephritis rather than albuminuria. It is gastritis which causes achlorhydria, and gastritis, not achlorhydria, which causes Addison's anaemia and subacute combined degeneration of the cord and predisposes to carcinoma of the stomach. The prophylaxis of gastritis is the prophylaxis of these diseases. We may therefore look forward to the time when the prevention of gastritis, and, when prevention fails, its early recognition and adequate treatment, will lead to the disappearance of cancer of the stomach, which every day of the year claims over forty victims in Great Britain.

BIBLIOGRAPHY

- Beaumont: *Experiments and Observations on the Gastric Juice*, Plattsburgh, 1833.
 Bonis: *Zeit. f. klin. Med.*, 1930, cxiii, 610.
 Borovanská-Felklová: *Folia Haemat.*, 1930, xl, 178.
 Camps: *Guy's Hospital Reports*, 1933, lxiii, 123.
 Castle et al.: *Amer. Journ. Med. Sci.*, 1929, clxxviii, 748 and 764; *ibid.*, 1930, clxxx, 305; *ibid.*, 1931, clxxxii, 741.
 Conner: *Journ. Amer. Med. Assoc.*, 1930, xciv, 606.
 Cramer: *Lancet*, 1934, i, 1.
 Dyke and Harvey: *Ibid.*, 1933, ii, 59.
 Faber: *Zeit. f. klin. Med.*, 1908, lxxi, 53; *Berl. klin. Woch.*, 1913, i, 598; *Lancet*, 1927, ii, 901.
 Hartfall: *Guy's Hospital Reports*, 1932, lxxxii, 13.
 Hartman: *Amer. Journ. Med. Sci.*, 1921, clxii, 201.
 Hurst: *Lancet*, 1929, ii, 1023; *Guy's Hospital Reports*, 1932, lxxxii, 396; *British Medical Journal*, 1933, ii, 89.
 Knott: *Guy's Hospital Reports*, 1927, lxxvii, 1.
 Löhr: *Deut. Zeit. f. Chir.*, 1924, clxxxvii, 289.
 Meulengracht: *Acta Med. Scand.*, 1934, lxxxii, 352.
 Orator: *Virchows Archiv*, 1925, ccvii, 202.
 Panton and Tidy: *Quart. Journ. Med.*, 1910, iv, 449.
 Passey: *Guy's Hospital Reports*, 1922, lxxii, 172.
 Plummer and Simpson: *Ibid.*, 1931, lxxxi, 407.
 Pollard and Bloomfield: *Bull. Johns Hopkins Hosp.*, 1931, xlv, 307.
 Salus: *Klin. Woch.*, 1932, xi, 237.
 Salus and Reimann: *Ibid.*, 1934, xiii, 986.
 Shaw: *Guy's Hospital Reports*, 1926, lxxvi, 294.
 Stewart: *British Medical Journal*, 1929, ii, 567; *Lancet*, 1931, ii, 617.
 Walters: *Journ. Amer. Med. Assoc.*, 1933, c, 804.
 Wilkinson and Brockbank: *Quart. Journ. Med.*, 1931, xxiv, 219.
 Wilkinson and Klein: *Lancet*, 1933, ii, 629.

ACUTE AND CHRONIC SPRAINS*

BY

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I think the Section is wise to have selected for discussion "Acute and Chronic Sprains," so common in occurrence, but so little discussed, that it is well for us to review our ideas and be sure that they are based on sound principles. These conditions and their treatment did not attract us in our student days; they were not big enough. Who ever heard of an out-patient dresser, or even a house-surgeon, who was really interested in a sprained ankle? And yet when the doctor starts in practice it is the minor injury, far more than major surgery, which forms the bulk of the surgical side of his practice. His reputation as a good doctor will be made not by his knowledge and management of cerebral tumours, but by his handling of the sprained wrist and the Colles fracture. I would focus your attention on what passes as minor surgery, and would remind you that it is only "minor" within the shelter of the hospital walls, and assumes very different proportions when we are faced with the same problem in after-life.

We will consider the acute sprain and its management, and then pass on to the consideration of those sprains which fail to clear up and become chronic. But, before entering into a discussion on the diagnosis and treatment, certain points in the anatomy and physiology of joints must be recalled in order to be sure that our treatment is based on a clear appreciation of the underlying principles.

Physiology of Joint Movements

The essential factor to recognize is the importance of the muscles. Many complex structures go to form a joint—bones, cartilage, ligaments, and so on—but for any real understanding of the pathology of joints the role of the muscles must be emphasized.

Muscle is the first line of defence of a joint against injury, and protects it all the time against the repeated though small injuries which are met with in everyday life. If a false step is taken in walking and the balance momentarily lost, it is muscle action which prevents a strain or sprain of the ankle- or knee-joint if we are to avoid injury. If the force is too great, or is applied for too long a time, the muscle gives way; it can no longer protect the joint, and the force then falls on the second line of defence—namely, the ligaments. Here once again consequences depend on the degree of force. If the latter is slight, the ligament may withstand strain, and no ill effect will follow. If it is moderate, some fibres of the ligament will tear, generally from one or other attachment, and a sprained joint results. If the force be severe, a ligament may tear in its entirety, perhaps taking with it a small flake of bone from the point of its insertion or tearing away from its periosteal attachment, and a sprained joint results. Finally, if the force be very severe or prolonged, first the muscle, then the ligament, and finally the bone itself yields, resulting in a fracture.

This conception must be remembered, and we must guard against thinking of a fracture as a broken bone, or of a sprain as a torn ligament; we must not forget the all-important fact that it is on muscle that the first strain falls. Indeed, the fracture is often the least important part of the injury—that is, when considered from the point of view of solution of continuity in the bone. For example, a sprained back with fracture of the transverse

* Read in opening a discussion in the Section of Orthopaedics at the Annual Meeting of the British Medical Association, Bournemouth, 1934.

process of a vertebra is, academically speaking, a fracture, but it is the muscle injury, the tearing of muscle attachment, the haematoma, and the effect on soft parts which should take precedence in determining the appropriate treatment.

Partial rupture of a ligament, the tearing of a few fibres, is far more common than a complete rupture. The determination of the degree of injury is essential to a rational treatment of that injury. A complete tearing away of the attachment of the internal lateral ligament of the knee—in my experience a rare event—will necessitate at least prolonged fixation and protection, or even operative repair. The far more common tearing of a few fibres at the femoral attachment of this ligament is ill suited to such prolonged fixation, and recovers more quickly if appropriate means are taken to aid and encourage early functional use of the joint.

Diagnosis

The diagnosis of the acute sprain is self-evident, and in practice it is only necessary to exclude fracture. Careful case-taking or history is of importance, and the clinical examination must be thorough. The ultimate diagnosis of fracture will be decided by *x*-ray examination, but the clinician should be able to form a fair idea whether the sprain is uncomplicated or whether a fracture without displacement coexists. The site of maximum tenderness on pressure will generally give the clue. Tenderness over a ligamentous attachment is strong presumptive evidence of sprain; localized tenderness over the bone, at some other point, suggests fracture.

It cannot be emphasized too strongly or repeated too often that *x*-ray examination is an essential part of the clinical investigation of every patient in whom the symptoms complained of follow injury. Failure to observe this rule may lead the practitioner into all kinds of trouble. It will not help him to say that the fracture found at some later examination is trivial, and that its earlier discovery would not have altered his treatment. He must foresee in every injury the possibility of a medico-legal action, and he must safeguard himself as well as his patient. The case in which an injury to the back has resulted in a crush fracture of the spine is within the experience of most of us. How often does this injury pass unrecognized, with what disastrous results, and yet how simple is the *x*-ray diagnosis. The split fracture of the fibula without displacement and the fracture of the carpal scaphoid are common examples of bone injury frequently undiagnosed because of the failure to have an *x*-ray examination.

A further word of warning is needed. An *x*-ray plate in itself will not suffice. The *x*-ray examination must be thorough. The radiographs must be taken in two planes, or, if need be, stereoscopically. In certain situations a radiograph of the equivalent joint on the uninjured side should be taken for comparison; this is useful in young patients in whom the epiphyses are still unjoined—for example, the child's elbow. And the *x*-ray plates must be interpreted by someone accustomed and experienced in such interpretation. He may be a radiologist or a surgeon; he must know what he is looking for, so that he reads neither too little nor too much in the picture.

Treatment of Acute Sprains

The line of treatment on which most of us were brought up in our hospital days leaves much to be desired and is rightly criticized. Hot lead lotion, evaporating lotion, a bandage, and rest sufficed for the bulk of patients in our casualty departments, and formed the recognized treatment of the textbooks. If we excluded a fracture by *x*-ray examination, we were content to let these patients work out their own salvation on these or similar lines.

The more general introduction of massage and physical treatment in our hospitals improved matters, but unfortunately these departments do not seem to attract the average medical student, who may well pass through his whole career without any very clear idea of what they accomplish, because he does not take the trouble to attend. Those of us who are called upon to lecture or to demonstrate to post-graduates must be struck by the interest and the eagerness to learn the modern treatment of these simple injuries which is shown by the practising doctor.

Now what should be the treatment of an acute sprain? As an example, let us imagine an acute inversion sprain of the ankle seen an hour or two after the injury. The region of the ankle is swollen and painful, and there is tenderness on pressure in front and to the outer side of the joint. The anterior fasciculus of the external lateral ligament is partly torn from its attachment. The principles of treatment can be described under three headings: (1) pressure to limit the swelling; (2) protection to limit and prevent further damage; and (3) encouragement of function to promote recovery.

PRESSURE

Pressure can be applied by firm bandaging over layers of cotton-wool, and in the example chosen the bandage should include the heel. The more usually applied figure-of-eight bandage omitting the heel is insufficient and fails to give support just where it is most needed. This pressure bandage, if applied early, limits the amount of the swelling; if the ankle is already swollen, it is useful in getting rid of such swelling.

PROTECTION

The firm bandaging protects for the first thirty-six hours, and then, if necessary, this should be replaced by adhesive plaster strapping. The strapping starts above the ankle on the inner side, passes down under the heel, and up on the outer side. The foot is held slightly everted to take strain off the injured ligament while this support is being applied. Many layers, each superimposing the other by about one-third, are used. The strapping does not interfere with function, but protects the early stages of repair from undue strain and further damage and gives the patient a sense of comfort and security.

If the sprain be only slight strapping may be dispensed with, and the support of the compression bandage will in itself suffice. It is all a question of degree. While a very slight strain will not need protection because the muscle recovery is rapid, the moderate or severe one will recover more quickly with support; the latter does not hamper movement, which is physiological and to be encouraged. Further protection may be provided by what is called "wedging the heel" and floating it out. This is seldom needed unless the sprain is a frequently recurring one, such as I see occasionally, generally in school-girls. These recurrent sprains may manifest other features, as will be described under chronic sprains, but they can be guarded against by a simple device—namely, raising the outer side of the heel some three-sixteenths of an inch and sometimes "floating out the heel" in addition.

ENCOURAGEMENT OF FUNCTION

By this term I mean that early use of the affected limb should be allowed. In the example we are considering—inversion sprain of the ankle—the patient is allowed to put weight on the limb and need not lay up. He is encouraged to use the foot. This does not mean that he is told to go for a five-mile walk. I should not play a round of golf if I had recently sprained my ankle and it was painful, but with some support and the muscles

appropriately treated I should expect to be able to walk about and do my work from the first.

At this point we must recall what has been already said about the all-important part that muscle plays in controlling joint function, since we must concentrate on restoring muscle tone and encouraging the muscle to recover. Faradic stimulation—a method which has been described as graduated contraction—is of the greatest service. This method, as I have already stated more than once, I learned from Mr. Morton Smart in 1910, and I have used it and advised it continually since then. Essentially it consists in making muscle contract by an electrical stimulus, and both the degree and the rate of contraction are controlled by varying the stimulus. I will not enter into details of the treatment, but would emphasize its importance. Concurrently with electrical treatment massage is useful. This aids in the removal of swelling, mechanically getting rid of oedema, and improving the circulation. We generally combine electrical stimulation and massage; the one complements the other, even though the alternate contraction and relaxation, which is electrically controlled, produces what one may term auto-massage. Massage should never cause pain; it should be gentle and sedative in effect, and the small area, the site of maximum tenderness over the ruptured fibres, can be avoided.

Treated in this way, but depending on the degree of severity, a simple uncomplicated sprain should rapidly improve. The muscle quickly recovers tone, the torn structures unite, the swelling disappears, and the all-too-common sequence, the chronic sprain, is prevented.

Rotation Sprain of the Knee

There are sprains, however, which take a long time to clear up; they cannot be hurried. The commonest example is rotation sprain of the knee, such as is caused in a ski-ing accident. These severe sprains of the knee are often mistaken for torn and displaced semilunar cartilages, largely from the fact that a protective muscle spasm limits movement some 10 degrees short of full extension. The same principles should guide us in our treatment, and we must be confident of our diagnosis, for these sprains take many weeks, or even months, to recover. Unless we are familiar with this syndrome, and are true to our principles, we shall have difficulty in persuading the patient that the long period of partial incapacity is unavoidable, and forced movements or operation may be advised under a mistaken conception of the pathology.

Chronic Sprains

A simple sprain which is neglected or inefficiently treated may clear up if the injury is only trivial, but if the degree of damage is more severe symptoms will persist or will recur, and a condition that may be called a chronic sprain follow. The most common sequelae of sprains are: (1) persistent pain; (2) muscle atrophy; (3) limitation of joint movement; and (4) recurrent synovitis.

If the acute sprain be correctly treated these sequelae will be avoided. We must remember the importance of the time factor, which has been emphasized in considering the rotation sprain of the knee. The chronic sprain has supplied the main field of work for the bone-setter and the osteopath, and, to a large extent, continues to do so, both in this country and in America. One is often asked what the irregular practitioner accomplishes; what it is he really does when he claims that "he is putting a bone back in place." It is clear that unless we believe in the occult, there must be some fairly simple explanation, and it is not, I think, far to seek. He forces joint movement; he breaks down adhesions; and, if he is

successful, restores the normal range. Any medical man can do the same thing, as well or better. It is not essential to be ignorant of anatomy in order to be able to put a joint through its full range, although it is necessary to be ignorant of both anatomy and physiology if one is to say with conviction that a small bone is "out" in a wrist or an ankle which is the site of pain caused by adhesions.

The position was admirably summarized by Sir Robert Jones when, in his Cavendish Lecture, he said:

"Let me emphasize the statement that there is nothing which the manipulator does which cannot be more safely undertaken by any practitioner who possesses a knowledge of the pathology and elementary anatomy of the joints. Let it be fully realized that there are no hidden or mystic rites in the art of bone-setting."

Adhesions

The direct effect of the injury—the tearing of fibres in the ligament or joint capsule—is an outpouring of blood and lymph about the site of the tear, followed by organization of the clot, and the formation of fibrous tissue. The fibrous tissue may form a band anchoring certain folds in the capsule or preventing normal mobility of the joint. The diminution of range may be great, as shown commonly in a shoulder which is stiff as the result of enforced rest following a dislocation, or it may be small as in the inferior radio-ulnar joint or the wrist. When the patient uses such a joint and attempts to perform an ordinary everyday action, the result is pain and a feeling of weakness, or, in a weight-bearing joint, of insecurity, because of the pull on this adventitious band.

The differential diagnosis between a joint stiff as the result of inflammation and one stiff as the result of limiting adhesions is often easy but sometimes difficult. The most useful clinical test is one which we owe to Robert Jones, who used to teach that a joint stiff because of inflammation had limitation of movement in all directions, but that adhesions limited movement in certain directions only.

Adhesions limit movement very commonly, and may give rise to considerable pain and disability even when the excursion of the joint is almost, but not quite, full. It is not uncommon to see a patient complaining of disability of the knee, and on examination to make out full mobility, except that external rotation in flexion is just limited and gives rise to pain. Any gross loss of movement is easy to see, but we must bear in mind that very slight limitation caused by an adventitious band, an adhesion, may cripple the patient. Indeed, we may fail to make out any loss of movement, any diminution in the normal range, in a joint which fails to recover following injury. If we can exclude disease, inflammatory or neoplastic, and the skiagram is normal, it often repays us, empirically, to move such a joint through its full range under anaesthesia. With a clear history I should not hesitate to advise or practise manipulation, even though I could not be sure that movement was limited. One may well break down an adhesion in a joint in which the diminished range was too small to be detected with certainty on clinical examination.

The principles, then, on which we rely in undertaking the treatment of the chronic sprain are:

1. To overcome limitation of movement by forcing movement, either gradually by exercises and repeated forcible manipulation up to the patient's tolerance, or by forcible manipulation under anaesthesia.

2. To build up the musculature. It is true that active exercise is the greatest stimulus to the building up of muscle, but it is here again that the treatment by graduated faradic stimulation is of great service.

When one member of a group of muscles—for example, vastus internus—is markedly atrophied, there is no exercise that I know which rebuilds it, makes it catch up with the remaining members of the quadriceps group, so well as graduated exercise electrically provoked. The same is true in the adductor strains, caused by small tears in the muscle, the so-called “riders’ strain.” In the early stages it is far easier and the result is obtained more rapidly by this electrical method than by exercises. In the later stages of recovery active exercise against resistance supplements and then supplants the electrical method.

Technique of Breaking Down Adhesions

This technique, which has been given the grand name “manipulative surgery,” is easily acquired. The bone-setter of the old days, who had to work without anaesthesia, developed a technique for overcoming the resistance of the antagonistic muscles and catching them off their guard. He combined rotation with the movements of flexion and extension. Hutton used to say: “The twist is the thing.” But the practitioner has no need to possess any superlative or supernatural skill. Under anaesthesia he can put any joint through its full range, and, remembering that the range differs in different individuals, he can always compare it with that of the sound joint of the opposite side. Experience is of value, as, indeed, it is in all treatment, but it is not beyond the power of the ordinary doctor to acquire a working knowledge of the technique.

After-Treatment

The necessary after-treatment is to keep the parts moving, to restore function, and to prevent the re-formation of the limiting bands. The treatment conforms to that advised for the acute sprain, but the co-operation of the patient is needed. He must be encouraged to try and use the joint, assisted by the masseuse. Faradic stimulation is again a most useful part of treatment; some of us consider it an essential part.

Chronic Sprains Complicated by Sepsis or Disordered Body Chemistry

It is a fact that sprains and allied injuries in the young adult or the adolescent tend to recover more quickly than similar injuries in later life. There is, then, a second factor to bear in mind besides the injury. If a sprain in a man of 40 fails to get well we should be on the look out for a predisposing cause—for example, sepsis or disordered metabolism. There may be some apical infection about the root of a dead tooth, a septic tonsil, or there may be some chronic constipation or failure of elimination which is playing a part.

The physician should bear this in mind and examine the patient, and not focus his attention only on the injured joint. The knee which will stand ordinary use but shows signs of irritation on over-use is an instance, and, although not truly to be classed as a chronic strain, becomes painful and remains painful as the result of active use, and the trouble not infrequently clears up on removal of the underlying cause.

Sprains of Muscle and Muscle Attachments

There are certain occupational injuries which are classed as chronic sprains. The so-called “tennis-elbow” is one; this is an example of the over-use of a muscle group, and some tearing or periostitis about the attachment of the tendon into its bony insertion. The tearing of fibres in the adductors of the thigh, either in the substance of the muscle or at its attachment to the pubic ramus—the so-called riders’ strain—and the tearing of fibres in the calf

of the leg—~~leg—erroneously~~ described as a ruptured plantaris, but in fact caused probably by the rupture of some of the deep fibres of the soleus—are others. It is worthy of mention that the plantaris tendon is usually found intact when we are called upon to operate for suture of a ruptured tendo Achillis, so that it is unlikely that it ruptures in the lesser injury. The detailed methods used in the treatment of these injuries of muscle will vary, but the same underlying principles will guide us in our efforts to restore function.

Conclusion

In conclusion, I would urge that these minor injuries should be given a rather more prominent place than they at present occupy in the teaching of the medical student. An effort is being made in certain directions and in some medical schools to improve the teaching on fractures, and it would be wise if we could improve our teaching on the handling of sprains and allied injuries of muscles and joints at the same time. I know how fully occupied the medical student is, how his time is taken up, and how intensive the course has become, but still I would urge that we must attend to his teaching in these simple injuries, and must insist on his having some idea of what is being done in the physical treatment departments. He does not need to be a skilled masseur, but he should know something of massage and its possibilities for good and harm that he may know when it is to be advised. He should at least see the electrical methods in use, that he may know what we are talking of when we speak of faradic stimulation of muscles. He should realize the value of a properly applied bandage; he should appreciate that a supporting bandage to assist in stabilizing a wrist should be put on round the joint itself, and not half-way up the forearm; and that for a sprained ankle the bandage must include the heel.

It is by attention, or lack of it, to diagnosis and treatment in these minor injuries that many reputations have been made or lost.

Nosokomeion is the official organ of the International Hospital Association, and is published quarterly by W. Kohlhammer of Stuttgart (annual subscription R.M. 12, plus postage). It is of special value to all who are interested in hospitals, and the international character of its contents allows a comparative view to be taken on all branches of hospital activities. The articles are printed in English, French, or German, and are individually summarized in each language. No. 1 for 1934 was a special number on the small hospital of 100 to 300 beds, and contained eleven articles, of which the following are representative: G. von Deschwanden, “Was muss der leitende Arzt eines mittelgrossen Krankenhauses wissen?”; Raphael Jackson, “The Possibilities for Administration, Management, and Accounting of the Smaller and Rural Hospitals”; Ernst Balser, “The Small Hospital of the Future capable of being Enlarged”; Gustav Birch-Lindgren, “Some Points of View on Small Hospitals”; and Marcel Labbé, “L’Organisation du Service de Diététique dans un Hôpital de 300 Lits.” No. 2 contained the programme of the Fourth International Hospital Congress, to be held in Rome in May, 1935, and reports from national hospital associations and representatives of twelve nations. Other interesting articles were: B. Albert, “Fehler im Krankenhausbau” and E. M. Bluestone, “On Medical Organization in Hospitals.” No. 3 contains eleven papers from this year’s international post-graduate course on hospital technique, including: P. Manz, “Organisation, Technik und Einrichtung im Krankenhaus”; A. Rollier, “L’Organisation de la Cure de Travail dans la Clinique manufacture internationale de Leysin”; and Letitia Fairfield, “Ante-natal Care and Hospitals.”