containing it excised. If a stricture is actually present or suture of the opening is likely to narrow too much the lumen of jejunum or colon, an appropriate resection will be necessary.

In any case the establishment of a temporary caecostomy is of the greatest value. The sole purpose of such an opening is to prevent the accumulation of flatus in the colon above the suture line. By it the sutures are relieved from any strain and the patient is entirely spared the discomfort and danger of post-operative distension.

If the pylorus is still obstructed and it is necessary to obliterate the anastomosis, a fresh gastro-enterostomy must be done or an extensive resection of the stomach, such as described by Clairmont.

REFERENCES.

- ¹ Czerny: *Beit. z. klin. Chir.*, 39, 1903, Supplement, p. 99. ² v. Herczel: *Cong. de la Soc. Internat. de Chir.*, Brussels, 1905, p. 350. ³ Kaufmann: *Mittell. a. d. Grenzgeb. der Med. und Chir.*, 19, 6, Bd. 15, p. 151. ⁴ Gosset: *Revue de Chir.*, 1906, B. 33, S. 59. ⁵ Lion et Moreau: *Revue de Chir.*, 1909, 39, p. 887-891. ⁶ Port and Reitzenstein: *Mittell. a. d. Grenzgeb. der Med. und Chir.*, 1907, Bd. 17, S. 590. ⁷ Paterson: *Proc. Roy. Soc. Med.*, vol. II, Pt. 3, Surgical Section, p. 238. ⁸ v. Rooijen: *Arch. f. klin. Chir.*, 1910, 91, p. 380. ⁹ Polya: *Deut. Zeit. f. Chirurg.*, 121, 1913, p. 101. ¹⁰ Hamann: *Trans. Amer. Surgical Assoc.*, vol. xxxiii, 1915, p. 358. ¹¹ Barling: *British Journal of Surgery*, 1917, v. 343-349. ¹² Downes: *Annals of Surgery*, 68, July-December, 1918, p. 95. ¹³ Carnot, etc.: *Bull. et Mém. Soc. Méd. des Hôp. de Paris*, 1918, S. 3, xlii, 1173-1180. ¹⁴ Clairmont: *Wien. klin. Woch.*, 1918, xxxi, 285. ¹⁵ Clairmont: *Munch. med. Woch.*, 1918, lxxv, 1067-1071. ¹⁶ Mathiew: *Arch. de mal. de l'appar. digest.*, Paris, 1918, ix, 448, 453. ¹⁷ Urrutia: *Arch. de mal. de l'appar. digest.*, Paris, 1912, vi, 33-35, and *Rev. Chir. de Madrid*, 1911, vi, 361-365. ¹⁸ Sherrin: After our paper was written Sherrin quoted five cases in his Hunterian Lectures in February, 1920. ¹⁹ Bolton: *Journ. Path. and Bact.*, 1915, vol. xx, p. 133. ²⁰ Paterson: *Gastric Surgery*, London, 1906, p. 20. ²¹ Wilcox: *Quart. Journ. of Med.*, 1909, vol. iii, p. 93. ²² Paterson: *Proc. Roy. Soc. Med.*, vol. II, pt. 3, Surgical Sect., p. 238. ²³ Pavlov: *The Work of the Digestive Glands*, 1910.

SOME NOTES ON MILITARY ORTHOPAEDICS.

BY

R. W. SUTHERLAND, M.B., Ch.B.,

MAJOR R.A.M.C.,

LATE SURGEON SPECIALIST AND OFFICER IN CHARGE SURGICAL
DIVISION, — MILITARY HOSPITAL;

AND

J. M. CHRISTIE, M.B., Ch.B., F.R.C.S. EDIN.,

CAPTAIN R.A.M.C.,

LATE SURGEON SPECIALIST AND OFFICER IN CHARGE ORTHOPAEDIC
DEPARTMENT, — MILITARY HOSPITAL; SURGICAL SPECIALIST,
MINISTRY OF PENSIONS.

In this article, which is based upon experience gained in the orthopaedic department of a central military hospital, we desire to draw attention to certain principles which are not so widely known to the profession generally as they ought to be, and to give some few illustrative details. We do not claim to have made original discoveries, but we have had ample opportunity of applying and learning the value of those made by others, and of working out methods of treatment best suited to the multiplicity of complicated lesions with which we have had to deal.

Our work was under the ultimate supervision of Colonel Carless, C.B.E., A.M.S., Consulting Surgeon to the Eastern Command, whose kindly criticism and unsparing help, and commendation when earned, made it possible.

The accumulation in England of chronic cases showing gross deformity and loss of function, the result of severe gunshot wounds, made it necessary to collect them in centres where they could be studied in detail and collectively, and where treatment could be instituted to restore the maximum function possible.

It was early seen that an authoritative statement of military orthopaedic principles, based on an exact knowledge of anatomy, physiology, and pathology, was necessary. The principles of treatment were established, and in this matter our country has been fortunate in possessing as Director of Military Orthopaedics one who has been described in America as the greatest orthopaedic surgeon in the world—Sir Robert Jones.

It was abundantly clear to those of us responsible for surgical cases in military hospitals that no one man could carry out satisfactorily the complicated investigation and detailed treatment required. No haphazard method would suffice, but a system must be instituted. Team work in the widest sense was necessary to achieve the best results, with the greatest economy of effort.

Team Work.

Each case was examined by the various men who specialized in some branch of investigation, and when the notes were completed, with photographs, stereoscopic radiographs, pathologists' reports, reports on electrical examination, results of dental examination, etc., the case was reviewed as a whole. The sequence of treatment, operative and otherwise, was considered, with the ultimate result to be hoped for. Each specialist carried out his share, and the head of the department reviewed the cases weekly. The individuals engaged in this work, by exchange of views and discussion of cases, gained a wider knowledge and a broader view than was possible singly. We all felt that by this means we were achieving results which justified our methods.

Those of us who served in the army abroad and had to deal with the severest primary lesions, and who on pension boards are now considering the ultimate results of such cases, are astonished at the wonderful functional recoveries which come before us. When it is remembered that the country has undertaken financial responsibility for these lesions, assessed on the existing degree of disability, it at once becomes apparent how well worth while this work has been to the nation, apart from the increased productive capacity and happiness of the wounded.

In noting these results it is hardly to be wondered at that Sir Robert Jones, whose principles have formed the foundation of military orthopaedic surgery, wishes to hand on to the civilian population the benefits now conferred on the soldier. The question is a national one, and comparison of expenditure and results to be obtained will show such a plan to be a national economy through the resulting increase in productive capacity.

In no field of medicine is the necessity for exact observation and clear thinking so necessary. A limb which at first sight appears hopeless may, as investigation is carried into each detail of its function, finally give a ray of hope, which persistent treatment justifies. Again, have we not often heard of useless massage, patiently carried out, for a joint with bony ankylosis? Examples could be multiplied.

Repair: Principles and Details.

In dealing with chronic sepsis and repair, the questions of phthisis, nephritis, syphilis, dental caries, secondary anaemia, and intestinal toxæmia are of the greatest importance. In the matter of "fresh air" we were able to make an interesting experiment. Our hospital was by the sea. Our surgical wards, built for that purpose, were of brick, large and airy, and we think would have been pronounced excellent by the greatest purist; but we moved our worst cases to temporary huts by the beach, where their beds could be carried out to the sea front, and where they remained all day. The effect was excellent. As the sun and wind bronzed them, so it seemed their appetites increased, they put on weight, sepsis diminished, and wounds healed. As they watched the bathers in the sea and the children on the beach their whole outlook on life changed, their neurasthenia diminished, and they too were on holiday and wanted to be up and doing again. Employment, amusement, surroundings, fresh air, and sleep—everything helped. The diet was varied and generous, and, when possible, adapted to suit particular tastes.

Anaesthesia.

In the giving of anaesthetics we found a useful field for ether by the rectum, with morphine and atropine. This was specially valuable in head, neck, and chest cases, and in patients who had been gassed or were bronchitic. An enema was given on the day preceding operation; rectal lavage with saline on the morning of operation, and a moderate breakfast. Morphine gr. $\frac{1}{4}$ with atropine gr. $\frac{1}{10}$ was given, and half an hour later 6 oz. of ether to 2 oz. of olive oil were very slowly run into the rectum by gravitation; this took twenty minutes to administer. Absolute quiet and suggestion of sleep were employed. When the patient appeared to be sleeping soundly he was carried from the ward to the theatre. Immediately the operation was over a flatus tube was introduced and the anaesthetic evacuated. The rectum was washed out several times with saline, and 2 oz. of pure olive oil introduced. The anaesthesia was light, without post-operative shock, and we had neither sequelae nor complications.

Vaccines.

Our experience of autogenous vaccines led us to believe that they undoubtedly assisted in the combating of sepsis, and that they were a safeguard against the "flare up" of a chronic lesion when an operation had to be performed.

Operation.

We early learned the value of as perfect an aseptic technique as we could practise. An already chronically infected wound gave added reason for the avoidance of a superadded sepsis in a debilitated patient.

We placed great importance on the line of approach to the focus we proposed excising, planning our incision and operation on anatomical principles. Sinuses very frequently lie in close proximity to important structures, and the scar tissue, moreover, tends to drag those structures out of their normal position. It is therefore unwise to follow a sinus as a matter of routine. Kocher's principles regarding incisions, which carefully avoid all nerves, were our guide. When possible muscle planes were followed. The ultimate scar of the operation and any limitation of movement which it might cause had also to be considered.

We may cite an illustrative case:

An officer was admitted with a sinus in the axilla, running through a dense mass of scar tissue to the scapula at the origin of the long head of the triceps. Several attempts had been made to reach the focus without success. Finally we approached it by detaching the infraspinatus from its scapular origin, thus exposing with ease the axillary border of the scapula. A considerable sequestrum was readily removed and unhealthy bone excised. The flap was replaced and the axillary sinus healed rapidly. With the recognized after-treatment the functional result was excellent.

In the young soldier the importance of the epiphysis must not be overlooked.

An apparently minor point, but one of very great importance, is that of fascial planes, spaces, and sheaths. An impressive example of this is to be found in lesions of the hand and wrist. It is most unfortunate that the surgery of this region is generally regarded as "minor," and practised so casually; it resolves itself into that of planes.

Sepsis in Bone.

The excision of infected wounds whenever possible, which was practised in primary wounds as a routine with such success in the later days of the war, proved to be of equal value in chronic cases. The curetting of sinuses leading to infected bone was a useless procedure. Bone cavities with chronic osteo-myelitis, and with or without sequestra, called for complete excision and the removal of overhanging edges. The cavity was left wide open and packed with gauze. We believe it mattered little what antiseptic was used if the operation was properly performed, and no antiseptic could make up for an incomplete operation. In our hands dichloramine-T in eucalyptol, etc., gave the most rapid results, producing healthy red granulations in a few days. The cavity was secondarily closed or covered in by sliding, pedicle, or Thiersch grafts, each method having its own indications.

The avoidance of unnecessary trauma was of primary importance if a severe reaction was to be averted. We used stonemason's chisels, made of hardened steel with very sharp edges. The chronic discharging sinuses of many months, and even years, were securely healed, and the function of the limb could now secure undivided attention.

Reamputations.

The principle that no plastic operation may be safely performed in the presence of sepsis is universally accepted. That reamputation is a plastic operation was early forced upon us in going into the history of patients who had undergone amputation; many showed repeated reamputations and reinfections—a little bit more of the limb had been lopped off on each occasion. Ill-considered surgery had increased the disability it had set out to cure.

In several cases of short thigh stumps with the scar adherent to the end of bone, we were able to turn a muscle flap over the bone end and so secure a good stump without further shortening.

Skin-grafts.

Many patients were disabled owing to weak scars, especially if adherent to bone, muscle, or tendon. The

raising of such scars, with the introduction of fat grafts between them and the deeper structures, was not successful. The scar tissue sloughed—no doubt from interference with its blood supply. The only satisfactory procedure was to excise the scar and fill the gap, if primary suture were impossible, by a sliding graft of skin taken from over soft tissues in the neighbourhood—Thiersch grafting the denuded area, if necessary. It was important to remember that such grafts contracted, and must therefore be cut larger than at first sight appeared necessary. In some cases the condition of the limb did not permit of a sliding graft and pedicled grafts from a distant area were used. The operation was in three stages—(1) the fashioning of the pedicle; (2) the transference of the graft to the area to be filled; (3) the severance of the pedicle and its replacement. Some surgeons have reported unfavourably on this operation, but our experience was good. Possibly undue haste in performing the successive stages may account for failures. We allowed a fortnight to three weeks between each.

Muscles, Tendons, and Nerves.

The lesions of muscles, tendons, and nerves are closely associated. Our experience of muscles has been that of investigation and remedial treatment by means other than operative. The wasting, contracture, or lengthening in neglected cases was most difficult to overcome, and required patient treatment by massage, electrical stimulation, posture, contrast douching, and active exercises.

Where tendons were limited in movement by adhesions we employed a fat graft, after division of the limiting bands, with satisfactory results. At a later date, and especially in the secondary suture of severed tendons, we replaced the fat graft by a piece of aponeurosis removed from the front of the leg immediately above the ankle joint. This we wrapped round the traumatized tendon and suture line, with the deep (smooth) surface outwards (Mayer). In transplantation of tendons we made use of the minimum number consistent with fair function and the natural balance of antagonistic muscles. We realized the importance of correct alignment of the muscles and tendons and posture to approximate their origin and insertion. We found it equally important to avoid over-correction. Whenever possible, following the researches of Mayer and Biesalski, we made use of the sheath of the paralysed or damaged tendon. Every effort was made to secure implantation into bone which undoubtedly gave the best functional results.

Nerve lesions present a multiplicity of phenomena, some of an associated functional and organic syndrome which the investigations of Tinel, Dejerine, and others have done so much to elucidate. Here again we employed fat grafts after suture of divided ends when the junction lay in the midst of much fibrous tissue. In severed nerves end-to-end suture was the only method which gave favourable results in our hands. In regeneration of nerves Tinel's test of formication on percussion is undoubtedly the finest at our service.

Joints.

No lesion of joints are more common than ankylosis following injury or the injury of structures affecting them. No conditions require more careful consideration before interference. The established practice of putting a joint through its complete range of movement under an anaesthetic in cases of adhesions following disuse and certain non-pyogenic infections is rarely applicable to the conditions so frequently existing in war wounds. Massive adhesions may preclude movement by reason of the risk of fracture, or the production of considerable trauma by forcible movement may result in the same degree of limitation as before treatment. The gradual stretching of intractable adhesions by the various forms of rack splint yields much more favourable results. In many cases, especially when complicated by nerve lesions with long-standing paralysis or severe scarring with loss of muscle, it was felt best to leave the joint severely alone if in or near the optimum position.

In malposition we practised excision of the joint, in some cases with a view to ankylosis, in others—for example, the elbow—to obtain as much active movement as possible. It was surprising to find how great a range of useful movement could be secured, especially at elbow and

shoulder, after excision. It was our practice to sacrifice diseased or doubtful bone quite freely, following rigidly the subperiosteal method of Ollier. We commenced passive movements on the day following operation, and encouraged attempts at active movement as soon as the swelling or reaction had subsided. We used splints which enabled patients to get up as soon as the effects of the operation had passed off.

Bone.

We have already referred to our experience in dealing with sepsis in bone, and will only mention the subject of mal-union and non-union. In mal-union, where the conditions interfered with the function of the limb, we believed it wise to avoid the lately infected area if there had been extensive or deep sepsis, and to do an osteotomy in a healthy area. In non-union, often with a considerable gap, we employed lateral grafts or medullary pegs. We preferred the medullary peg, taking it from the tibia. This enabled a portion of healthy bone to be placed in firm contact with a vascular area in the affected bone, whereas in a sliding graft bone is being dealt with which is often rarefied by disuse or porous by previous infection. Transplantation of a massive lateral graft, including medulla, gave good results, but it was very difficult to secure a firm apposition. The medullary peg has the advantage of stability.

This paper has mainly dealt with certain points, in investigation and operative treatment, which have appealed to us. We would give a wrong impression of the work did we not mention in conclusion that the after-care of the patient occupied the bulk of our time. In the massage and electrical departments, in the gymnasium and workshops, in organized exercises, sports and amusements, the gradual re-education of function was attempted. It may be interesting to mention that little special equipment was obtained for this work; the adaptation of the material to be found in any hospital met most of our requirements.

The enthusiasm and organizing ability of Lieut.-Colonel C. R. Sylvester Bradley, R.A.M.C., overcame all difficulties, and to him we are indebted for permission to publish this article, based on the practical work in the hospital under his command.

PHYSIOPATHIC PARALYSIS OF THE HAND, AND ITS CAUSATION.

By R. G. ABERCROMBIE, M.D.,

ASSISTANT PHYSICIAN, SHEFFIELD ROYAL HOSPITAL; MEDICAL
DIRECTOR, EDGAR ALLEN INSTITUTE, SHEFFIELD.

BABINSKI,¹ who first clearly described the condition, suggested the name of "physiopathic paralysis" for certain anomalous cases of paralysis and contracture of the hand following upon wounds of the upper extremity. The cases are of special neurological interest in that their general characteristics point to a psychological origin, yet, unlike other forms of functional paralysis, they exhibit well-marked organic changes in the tissues.

Clinical Features.

A large number of cases amongst soldiers and war pensioners, recently under my care, have provided material for the following observations, which are chiefly concerned with those features which serve to elucidate the pathology.

Without apparent adequate cause, a wound of the upper limb is followed by loss of power in the hand of the affected side. Neither the situation nor character of the wound bears any relation to the grade of the subsequent paresis; none of the symptoms correspond to the territory of any particular nerve.

The short muscles of the hand and the long flexors are chiefly affected. The muscles are sometimes limp, more often spasmodically contracted, so that the hand assumes various postures; frequently the palm is hollowed and the fingers imbricated one over the other, to form the so-called "accoucheur's hand." The paralysis is usually not complete; feeble movements can be performed in a tremulous or "wagging" manner. The thumb often escapes, so that the hand can meet the needs of a hospital patient or pensioner, though inadequate for any useful purpose.

The sensory symptoms are limited to an uncertain and varying hypo-aesthesia and contortions of apparent pain

on the performance of passive movements. The patients are unduly apprehensive of pain, and are devoid of the normal impulse towards recovery.

The affected muscles waste, often extremely; they exhibit mechanical hyperexcitability; slight electrical changes occur, but the reaction of degeneration is not present. The skin, subcutaneous tissue, and bones share in the atrophy, so that the whole hand appears attenuated and smaller than its fellow. The skin is salmon-pink or cherry-red in colour, with a satin-like sheen around the roots of the nails. Trophic sores do not occur. The nails are curved and longitudinally grooved, sometimes greatly deformed; beneath their free margin a small fold of skin is often visible.

Profuse sweating of the palm is a common and striking feature; and it is of special interest that this symptom is directly influenced by emotion. If the affected hand be unexpectedly seized and examined, the palm may be found normal or slightly moist; if now the hand be made the subject of discourse to bystanders, beads of sweat form upon its palmar surface, until finally a sheet of moisture is formed over the whole palm. The palm of the opposite hand may also become moist, but not to anything like the same extent; meanwhile the rest of the body shows no abnormal sweating. Localized flushing of the affected hand may sometimes be similarly produced.

Cases are sometimes left in massage departments without adequate psychological treatment, so that the natural evolution of the symptoms is undisturbed. Such cases in process of time enter a clearly marked late or secondary stage, in which the profuse sweating, the congestion, and the idio-muscular reflex have disappeared, but the wasting and the paresis persist; the latter is often accentuated by adhesions, and in severe cases by actual distortion of the joints.

The foot may be affected, but this is rare. I have seen five such cases with well-marked trophic changes during the last year. The inverted and hollowed sole and tense tendo Achillis appear to exercise a great attraction for surgeons; three of the five cases, from different parts of the country, had been submitted to tenotomy. In each case operation rendered the condition worse.

Pathology.

Babinski has suggested that the symptoms are reflex phenomena, the peripheral wound supplying an irritative stimulus to a centre in the cord, from which centrifugal impulses pass to the affected member. This view has not, however, been widely accepted in this country; the general features, and especially the rapid and striking improvement which often follows appropriate psychological treatment, have led to the general belief that the symptoms are essentially of psychological origin. The paralysis is thus regarded as hysterical and the trophic changes as merely the result of disuse.²

This explanation, completely adequate for the motor symptoms, is quite insufficient for the trophic changes which constitute the essential distinction between these cases and those of ordinary hysteria. In the first place, many long-standing cases of hysterical paralysis of the hand occur in which the disuse causes no trophic changes at all, or at the most a slight general wasting of the muscles; whereas in physiopathic cases severe trophic changes may occur with considerable rapidity. Again, were it true that the trophic changes were merely the result of disuse, they would become more accentuated the longer the disuse lasted. But this does not occur; on the contrary, in long-standing cases, as mentioned above, the profuse sweating, congestion, and idio-muscular reflex tend to disappear, notwithstanding the persistence of the paralysis. Finally, the physiopathic condition is essentially a war phenomenon; Weir Mitchell noticed similar cases during the American Civil War.³ In civilian hysterical paralysis localized sweating sometimes occurs, and may be regarded as a minor physiopathic manifestation; but severe trophic changes are exceedingly rare.

Some additional factor must therefore be imported by the effects of war, capable of superadding trophic changes in cases of functional paralysis.

Certain general symptoms, occasionally observed in unwounded men during medical inspection behind the line, throw light on the nature of this additional factor. Excessive sweating of a truly remarkable grade was sometimes to be noticed; even in cold weather the sweat