CONTRACTURES OF THE HAND AFTER WOUNDS OF THE UPPER LIMB.

BY
W. M. MACDONALD, M.D. EDIN., B.Sc. NEW ZEALAND,
MÉDECIN-TRAITANT, NEUROLOGICAL CENTRE, LE MANS.

DURING the early period of the war contractures occurring in the limbs after wounds, without electrical changes in the muscles, were looked on as hysterical, and were treated by disciplinary measures, which, however, failed in a large percentage of cases. Then some doubt arose in the minds of neurologists as to the correctness of this opinion, and Sicard, Meige, M^{me}. Benisty, Claude, and others published cases which they could not class as hysterical. Recently Babinski¹ has published an article

CASE I.—D. A. Sprained wrist from fall, June 25th, 1915. Contracture one month later (accoucheur's hand). Contracture of trapezius and slight atrophy of deltoid on same side. Severe pain in neck and shoulder for eight days after the accident. Anaesthesia in the territories of spinal roots C VI, C VII, and D I, light hypoaesthesia of C VIII.

in which he frankly describes these cases as reflex, and speaks of an exaltation of the anterior cornual cells. He says, further, that as these cases are organic in nature they should not be submitted to certain disciplinary procedures which are justified in hysterical cases. But this explanation appears merely to replace one difficulty by another. In the case of a group of muscles which remain firmly contracted during six, twelve, or eighteen months and which contract anew in twenty-four hours after having been straightened and kept in plaster for four weeks, is our curiosity appeased by the substitution of "reflex" for "psychic," and by the transfer of the unknown quantity from the cortical cells to those of the anterior cornua? Careful search for the organic factor ought to be made in all these cases.

CASE II.—D. S. Bullet wound of left arm, September 25th, 1915. Immediate contracture of the fingers (accoucheur's hand). Thumb contracted some weeks later. Spinal root anaesthesia (C IV, C V, C VIII, and D I). Pressure on Erb's point causes tingling in the little and ring fingers.

In the neurological service at Le Mans we have at present some 450 cases under treatment, amongst which are 25 of pure contracture of the hand. Others are complicated by fibrous retraction of the muscles, by neuritis *a frigore*, or by destruction of muscle and tendon. Several cases of contracture of the elbow and shoulder have not been included in the present series. The contractures have followed on wounds, which were mostly slight, of the arm (8), forearm (9), wrist (3), and hand (4), while in one case the original injury consisted merely of a sprained

wrist. In no fewer than 16 cases the patient states that his hand contracted immediately or very shortly after the infliction of the wound; in 4 cases the contracture occurred in two to four weeks, while in the remainder it took some months to become fully established.

A detailed examination of these cases revealed the interesting fact that in all of them there was evidence of a neuritis, such as localized anaesthesia and trophic changes, tenderness of nerve and muscles, atrophy, etc. There was anaesthesia in the territory of the ulnar nerve in 10 cases, of the ulnar and median in 1, and in the median and musculo-spiral in 1. In 5, or possibly 6, cases the anaesthesia was of the spinal root type, and in several of the ulnar cases it mounted much higher in the arm than the classical territory of the nerve, suggesting that these

cases were possibly due to lesions of the first dorsal root. In 3 cases there was anaesthesia of the hysterical type mounting respectively to the mid-forearm, the elbow, and the shoulder. In the cases with hysterical anaesthesia and also in the spinal root cases the nerve

CASE III.—C. R. Bullet wound of left wrist, with fracture of fourth metacarpal, September 7th, 1914. Contracture set in very shortly after—accoucheur's hand, with adduction of thumb and little finger and slight flexion of wrist; third and fourth fingers in hyperextension at the first interphalangeal joint; reduction difficult and painful. Brachial plexus hypoaesthesia (D I).

trunks were tender and the trophic changes were practically the same as in the other cases. In 4 other cases the anaesthesia was of an indefinite character, chiefly affecting the hand and not possessing an anatomical distribution. These were probably cases in which partial regeneration had taken place, as was observed in several during the course of treatment, the anaesthesia changing to paraesthesia and the affected zones diminishing at the periphery. In 8 cases the nerves were tender above the wound, and in 10 prolonged suppuration had occurred, so that an ascending infective neuritis is often responsible at least for the persistence of the contracture. In other cases the nerve is injured either directly by the projectile or indirectly by the shock of its passage. In the spinal root cases the brachial plexus is stretched or jarred. In one of these the patient stated that his arm was projected violently backwards when he received the wound.

As will be seen by the diagrams the anaesthesia, or rather hypoaesthesia—for it is rarely complete, pin-prick being felt as a light touch—does not conform in all cases to the classic type. The line of demarcation between the normal and hypoaesthetic areas is usually abrupt, and there is an absence of the transitional zones commonly found after section of a nerve. In 5 of the 11 ulnar cases, the hypoaesthesia mounted more than halfway to the elbow and the digital distribution varied from 1½ to 3 fingers, the palmar and dorsal surfaces being equally affected in each case. Most forms of sensation were usually affected; thus light touch was not felt, pressure was felt as light touch, pin-prick as touch, the recognition of heat and cold was diminished and the

CASE IV.—G. N. Bullet wound of right hand with fracture of third metacarpal, June 17th, 1915. Contracture two months later (accoucheur's hand); marked hypertrichosis, myotonia of ulnar and hypothenar eminences, ulnar hypoaesthesia and tenderness of nerve.

circles of Weber were enlarged. Spontaneous pains occurred in 9 cases, and in nearly all pressure on the affected nerve in the arm or forearm caused distal tingling in its cutaneous territory.

The muscles most commonly affected were the interossei

CASE V.—G. M. Bullet wound of right arm near shoulder, April 9th, 1915. Arm contracted immediately against the chest, elbow at a right angle, and fingers in extension. Later the little finger became strongly adducted. Thumb remained free, but shows trophic changes. Ulnar hypoaesthesia.

with slight flexion at the metacarpo-phalangeal, and extension at the interphalangeal joints. Frequently the little finger was strongly adducted towards the mid-line of the hand, and lay in front of the others. Sometimes the forefinger and thumb were also adducted (accoucheur's hand). Less commonly the superficial flexors of the ring and little fingers or of all four fingers were affected, producing flexion of the fingers into the palm, and in one case

CASE VI.—D. F. Shell wound of right forearm, September 23rd, 1915. Two weeks later contracture of third, fourth, and fifth fingers in extension, with slight flexion on the metacarpals; fifth finger in forced adduction. Anaesthesia of the three fingers affected and the ulnar region of the hand. Tingling in the fourth and fifth fingers when the ulnar nerve is compressed at the elbow.

the flexor profundus of the middle and ring fingers was contracted, giving rise to a curious deformity (Case XI). The flexor carpi ulnaris and palmaris muscles were also sometimes affected. Although the adductor pollicis is the most powerful of the interosseous muscles, the thumb was included only in eight cases, the explanation being that the thumb is necessary for eating and cigarette-rolling, and so it was not allowed to remain contracted. The

CASE VII.—B. L. Bullet wound of left forearm, February 1st, 1915; suppurated four months. Hand firmly closed the same day, and has remained contracted ever since with flexion into the palm of all four fingers and adduction of thumb. Ulnar nerve tender in the arm; pressure on it in all its course causes tingling in the little and ring fingers. Ulnar hypoaesthesia.

myotonia with slightly delayed contraction. In eight cases there was atrophy of the hypothenar, and to a lesser degree of the thenar, eminences.

All cases showed trophic changes, and in most they were well marked. The hand is cold and blue or marbled. The

patient complains that it is too cold in cold weather and too hot in hot. Babinski has noted a difference of 7° or 8° C. between the two hands. There is excessive perspiration in the area of the nerve affected, and in some cases it is extremely fetid. The fingers are atrophied and pointed. The skin is smooth and is attached firmly over the interphalangeal joints, the folds of which are effaced. The nails are rigid, brittle, waxy in tint, incurved, and rounded. The nail in its rapid growth drags the skin with it so as to form a pad under its free end. The phalanges may show rarefaction under the x rays, and there is a tendency in some cases to ankylosing arthritis with ulnar deviation of the fingers. Most of these trophic changes are commonly present, but they are not all found in each case.

CASE VIII.—S. M. Bullet wound of right arm, June 20th, 1915. Contracture of fingers in flexion one week later, thumb remaining free; easily reduced until August 23rd, when an operation for liberation of the ulnar nerve was performed, after which reduction became very difficult. Marked retraction of the palmar fascia as seen in sketch. Ulnar anaesthesia and tenderness of nerve.

The tendon reflexes, which are usually altered in reflex nervous troubles, are rarely exaggerated, but Babinski has found that patellar clonus occurs under chloroform in some cases of contracture of the lower limb, and he takes this as definite evidence of the reflex origin of the contracture from irritation of the anterior cornual cells. He further develops this line of argument by assigning a similar causation to all other pithiatic cases of contracture or flaccid paralysis without reaction of degeneration, on the ground that in every other respect they are similar to the cases that do possess this pathognomonic sign of reflex spinal action. By pithiatic he means irresponsible to oracular suggestion or psychotherapy.

He suggests further that the reflex action may affect chiefly the thermic control of the limb and in this way produce the trophic and other changes. But, in those cases at least in which definite evidence of reflex action has not been induced by chloroform narcosis, it is more probable that these changes are directly due to a neuritis, as disturbance of the heat-regulating mechanism of a limb could not account for peripheral nerve and spinal root anaesthesia, and it is much

CASE IX.—M. D. Shrapnel wound of right wrist, September 8th, 1914; fourth and fifth fingers contracted in flexion three days after; reduction easy. Ulnar hypoaesthesia mounting almost to the elbow.

more simple to attribute the thermal changes to a neuritis, of which we have definite proof in the tenderness of the nerve, localized anaesthesia, etc. It is perhaps possible that the neuritis and all the other changes may be due to a vasomotor reflex affecting the nutrition of the nerves and muscles, similar to that which produces atrophy of the rectus femoris very shortly after injuries near the knee-joint, and even near the ankle.

This condition is exceedingly common, sets in very rapidly and is accompanied by diminished faradic and galvanic excitability without polar change.

CASE XI.—B. A. Bullet wound of right arm, June 29th, 1915. Contracture of the deep flexors and interossei of the third and fourth fingers a few days later. Hyperextension at the first and second interphalangeal joints. Reduction easy but accompanied by a marked click as if the fingers worked on springs. Ulnar anaesthesia mounting two-thirds of the way to the elbow. Trophic changes limited to slight cyanosis and excessive sweating.

Then again in pthisis we have a reflex atrophy of the trapezius, rhomboids and pectorals. But on the whole it seems more rational to attribute all the sensory, motor, and trophic phenomena to the neuritis.

It is obvious, however, that Babinski is right in removing these cases from the hysterical class. Yet one cannot lightly dismiss the mental factor, nor is it wise to discard entirely disciplinary measures in dealing with them. They rarely occur in civilians. One soldier with a contracture of the thumb alleged that it began three years ago. One of the present series of cases (No. IX) was a civilian who came to the hospital for consultation with a contracture of the fourth and fifth fingers of twenty years' standing which had supervened on paralysis of the arm following a lightning stroke. But these are cases of extreme rarity and are not commonly found in civil practice. Again, contractures do not occur in officers and rarely in non-commissioned officers. They develop after slight and rarely after severe wounds as with all functional conditions. The thumb is rarely affected. They occur more commonly in men who come from certain districts, and, lastly, they are specially prone to occur in certain hospitals where the atmosphere is suited to the culture of functional troubles.

On the other hand, they often fail to respond to psychotherapy, they persist both in natural and in drunken sleep, they yield only to deep chloroform anaesthesia, and, as Babinski has pointed out, they return along with or even before the tendon reflexes after anaesthetization. It is evident, therefore, that we have to deal with both an organic and a mental condition.

In discarding the purely hysterical hypothesis, however, it is not necessary to invoke the assistance of reflex action

when we have evidence of neuritis. Contracture of this intensity is not an ordinary feature of neuritis, but military contracture is not an ordinary condition. What probably happens is that immediately or shortly after the wound the muscles contract from irritation of the nerve. This is probably very common and is in most cases overcome either by the patient or his attendant. Dr. Clunet, of the *Provence*, in the very interesting account that he gave at the Paris Neuro-

CASE XII.—V. H. Forefinger amputated at the second phalanx by a bullet, September 9th, 1914. Fingers began to contract the same day. Contracture established in eight days with the fingers hyperextended and widely separated, wrist in acute flexion, hand very rigid, reduction impossible. Well marked atrophy of the long supinator, radials, extensors and flexors, and to a lesser degree of the triceps; faradic hypoexcitability of all these muscles. Muscles of the hand not atrophied. General anaesthesia of the upper limb mounting to the shoulder. Ulnar and radial nerves sensitive.

logical Congress of the events which followed on the torpedoing of the vessel, stated that next day he found some of the survivors from the rafts half-dazed

and with all four limbs firmly contracted in flexion. He cured them all by flagellation, but there is no doubt that if they had been taken then and there under the wing of Red Cross ladies some of them at least would have remained contracted for months. An interesting case is that of a French surgeon who was shot through the lower jaw, and who found that by firmly contracting his masseters he could keep the fragments in position without a bandage. The contracture was well established in several hours. A month later, when he wished to decontracture himself, he found that he could not do so, and it took him two months of hard work before he could open his jaws freely. In the case of the common soldier with perhaps an inherited nervous disability, and with the call of the trenches setting up a negative chemio-taxis, there is an incentive for the patient not to make the effort at decontracture, with the result that the spasm persists. The irritation of the neuritis supplies the thorn which probably exists in all functional motor troubles, and which prevents the perverted mentality from resuming its normal tenor.

It is interesting to note that two patients with contracted hands succeeded in adding thereto a slight contracture of the knee after a mild synovitis. In several

CASE XIII.—B. N. Shell wound of left forearm, September 18th, 1915. Contracture of the hand and fingers in forced extension two weeks later. Brachial plexus hypoaesthesia (C V, C VI, C VIII, and partly C IV and C VII).

cases of disturbance of the gait after slight wounds, of false shortening of the lower limb, of knees and hips which work as if on springs, of contracted club-foot following slight sprains, I have found bands of anaesthesia, most commonly in the territory of the external popliteal. All

these cases, which are a speciality of military practice, are interesting as helping to throw some light on the origin of ordinary hysterical paralysis and contracture.

CASE XIV.—S. N. Bullet wound of the left forearm, April 30th, 1915. Contracture, two weeks later, of the wrist and elbow in flexion and extreme pronation; fingers flexed on hand with all the phalanges in extension; thumb free; marked hypertrichosis; pressure on ulnar nerve in all its course from axilla to wrist causes tingling in the little and ring fingers. Irregular ulnar anaesthesia (possibly C VII and D I); hypoaesthesia of the fingers very marked.

Treatment is disappointing, but the best results are obtained by strong hot faradic baths (with metronome), followed by massage, manipulation, and re-education, by

frequent stimulation of the hypoaesthetic areas with a strong coil and metal brush, and by strictly limiting leave until some improvement is shown. It is not wise to keep them too long in plaster, as they develop a contracture of the opposing muscles.

For the sketches of the hands I am indebted to M. Arouy, orderly in the electrical service. A few typical diagrams of the alterations in sensibility have been added.

REFERENCE.

¹ *La Presse Médicale*, February 24th, 1916.

NOTE ON THE DISTANT EFFECTS OF RIFLE BULLETS; WITH SPECIAL REFERENCE TO THE SPINAL CORD.

By JUDSON S. BURY, M.D.LOND., F.R.C.P.,
MAJOR R.A.M.C.(T.).

EXPERIENCE of gunshot wounds in the present war teaches that the effects of a high velocity bullet with rapid rotatory spin are rarely limited to the parts through which it passes; as a rule there is evidence either of indirect or of secondary lesions and sometimes of remote lesions. Thus, haemothorax may be caused by a bullet passing through the muscles of the chest without injury to the pleura; haemorrhage into the abdominal cavity, or even rupture of a viscus, by a bullet passing through the abdominal wall without penetration of the peritoneum. The passage of a bullet through the scalp which strikes but does not fracture the cranium may be followed by symptoms of an intracranial lesion; indeed, the effects of such concussion are sometimes quickly fatal owing to inhibition of the respiratory and cardiac centres in the medulla.

Paralysis, and anaesthesia of parts supplied by one of the nerves to a limb, may be set up by the passage of a bullet through the limb at some distance from the nerve which becomes affected—for example, the functions of the sciatic nerve are often affected by gunshot wounds of the thigh when it seems unlikely, from the position of the wound, that the nerve could have been directly injured. Under the heading "*sciaticques télétrésiques*" (τέλῃ, distant; τρώεις, act of wounding), Lortat-Jacob, Sézary, and Ferrand¹ describe eight cases of traumatic sciatica produced by a projectile penetrating either the lower limb or the ileo-lumbar region without directly implicating either the sciatic nerve or the lumbosacral plexus. Such sciaticas may present the most diverse clinical types, from simple neuralgia to severe neuritis, characterized by paralysis, sensory disturbance, and loss of the knee-jerk. The symptomatology does not differ from that which is observed in cases in which the nerve is directly injured. In one of their cases which was operated on, the nerve was yellow and indurated, although it had not been in contact with the bullet and was not involved in scar tissue. The authors believe that a definite lesion of the nerve may be produced by the vibrations set up in adjacent tissues by the passage through them of a swift rotating bullet.

Of particular interest are the effects on the spinal cord of the passage of bullets in its immediate vicinity, in cases in which there is no evidence of direct injury to the cord. In some instances there was an impact of the bullet upon some portion of a vertebra; in others, however, it was probable that the bullet did not strike the bone, but passed through the tissues outside it. In both conditions the damage to the cord may be either severe or slight. Records of such damage are to be found in the Goulstonian Lectures recently delivered by Gordon Holmes,² and in the address by James Collier.³

In the first of the two following cases some of the dorsal spinal roots were severely injured; the spinal cord was also implicated, and it is probable that the bone was injured. In the second case the soft tissues were probably alone involved.

CASE I.

Lance-Corporal S. was admitted to the Stepping Hill Hospital, Stockport, on June 1st, 1915. He stated that on April 26th he was struck by a bullet which entered the back near the top of the left shoulder, and came out on the right side of the spine. He was unconscious for two or three days, could not hold his water for about a fortnight, and has suffered from severe pains in the back and sides since the injury. On examination the scars of the bullet wounds were observed, the scar of entrance

being just above the spine of the left scapula, that of exit about two inches to the right of the tenth and eleventh dorsal spinous processes. The whole of the dorsal spine below the third vertebra was very tender to pressure, the greatest pain being produced by touching the sixth spinous process. The hyperaesthesia extended over the ribs on both sides, the area included between the fifth and eighth ribs being most affected. Partial anaesthesia to cotton-wool and pin-prick was detected over the back on the right side, between the seventh and the tenth ribs, and in front on both sides, from the fourth to the eighth rib. During inspiration the action of the lower intercostal muscles seemed to be impaired. The right leg was weak, and the dorsiflexors of the right ankle were nearly completely paralysed. The abdominal reflexes were normal. The knee-jerks were slightly exaggerated, the right jerk being the greater of the two. Slight ankle clonus and Babinski's reflex were obtained on the right side.

During the two months that the patient was in hospital the pains in the back and the sides and the hyperaesthesia persisted, though gradually lessening in intensity. The anaesthesia on the left side disappeared in a fortnight, that on the right side in about six weeks. The weakness of the dorsiflexors of the right ankle persisted. On August 24th the patient was transferred to the Calgarth Park Auxiliary Hospital, Windermere, and was under the care of Dr. John Mason, who has kindly kept me informed as to his condition. The patient still suffers from pain to the right of the spine and in the back of the right thigh. He is able to walk a mile, and is able to work a few hours daily in an office. The right knee-jerk is exaggerated, though less so than formerly. The right leg is weak, and the foot tends to drag along the ground.

The main points of interest in this case are: (1) The temporary incontinence of urine; (2) the implication of some of the dorsal roots; (3) the signs of a lesion of the right pyramidal tract, the fibres which convey impulses to the dorsiflexors of the ankle being chiefly affected.

CASE II.

Private G., aged 19, was admitted to St. George's Hospital, Stockport, on December 31st, 1915. He was shot in the back on December 1st, the bullet going in over the posterior border of the left scapula at the level of the sixth dorsal spine and out over the middle of the right scapula at the level of a line between the fourth and fifth dorsal spines. At the time he was shot he was standing on a firing step in a trench; he fell backwards, his feet remaining on the step and his back resting against the wall of the trench. He did not lose consciousness; suddenly he felt severe pain in the upper part of the abdomen, which lasted for a few days. He was laid down at the bottom of the trench where he remained for three hours before being conveyed to the dressing station. He was unable to move his legs; when they were touched a curious painful sensation went right through him from the legs to the back. For two or three weeks after the injury his legs were completely paralysed and sensation was lost as high as the middle of the body. During this time his urine had to be removed by a catheter; strong medicine was required to move his bowels; he had no sensation in the bowel during defaecation. Power and sensation gradually returned to the legs, and thirty days after the injury when I examined him I was unable to detect any paralysis in the movements of his lower limbs. The knee-jerks were much exaggerated and ankle clonus and Babinski's reflex were present on both sides. The presence of the superficial epigastric reflex was doubtful, the abdominal was absent and the cremasteric was normal. There was no anaesthesia. The man still suffered from pains in the abdomen. He was unable to hold his water for more than an hour. There was incontinence of faeces, and sensation in the rectum was impaired. The condition of the bladder and rectum gradually improved, and on April 19th, when he left the hospital, the action of these viscera was almost normal; the knee-jerks were still exaggerated and ankle clonus was present, but the plantar reflex was of flexor type.

In the group of "spastic paralyses," cases are not uncommon in which no paralysis can be detected, the lesions of the upper neurones being represented clinically only by exaggeration of the deep reflexes; such a condition one has often observed in cases of early disseminated sclerosis. The explanation is difficult. It may be that a lesion too slight to produce paralysis, or at least paralysis that can be detected, is sufficient to cut off cerebral impulses which are inhibitory to muscular tonus, when there will be overaction of the spinal centres which is probably the result of the unopposed action of the cerebellum.

REFERENCES.

¹ *Rev. de méd.*, August, 1914; November, 1915. ² *BRITISH MEDICAL JOURNAL*, November 27th, December 4th and 11th, 1915. ³ *Lancet*, April 1st, 1916.

ON account of the epidemic of infantile paralysis in the United States, the military authorities of Cuba have ordered that children arriving from American ports who have an abnormal temperature shall be isolated until the cause of the condition can be diagnosed. Children in normal health will be kept under supervision till any danger has passed.