

attributes his success to special precautions with regard to intervals between doses, etc.

Lieut.-Colonel Harrison, officer commanding Rochester Row Hospital, writes: "Jaundice occurs during treatment of syphilis with arsenical compounds in 0.6 per cent. of cases, and this symptom may last for four or five months."

In neither of the cases here reported was arsenic detected in the urine.

TOXIC JAUNDICE, WITH ATROPHY OF LIVER, FOLLOWED BY REGENERATION AND RECOVERY.

By BARBARA G. R. CRAWFORD, M.B., CH.B.

DURING the summer of 1917 I had the opportunity of seeing and treating three cases of toxic jaundice caused by trinitrotoluene. In all three there was profound illness, with jaundice, delirium, and marked diminution of liver area, and later recovery, with replacement of liver substance and function. During the course of the disease the patients were seen by one of H.M. Medical Inspectors of Factories, who confirmed the diagnosis and the diminished liver area in two of the cases (the third case, being convalescent at the date of his visit, was not fully examined), and who stated that in his opinion a fatal issue was to be expected.

The patients were workers on T.N.T. manufacturing processes, and were exposed both to fume and skin contact. C. B., male, aged 29, worked for four months in a corrugated iron building where the T.N.T. was washed, and then for eight weeks in the open air recovering T.N.T. from waste water gullies. T. M., male, aged 22, worked for three months in the T.N.T. process, and then for five weeks on the outside laundries (as the gullies are called) at the same work as C. B. B. C., female, aged 19, worked for six weeks in the T.N.T. packing house. One patient had thus been in contact with the T.N.T. for six months, and one for four months; both of these had been employed in the open air for many weeks before the onset of illness; the third had worked in T.N.T. for six weeks only, and had been free from contact for thirty-eight days before the jaundice was observed; during that time she had been attended by her own private doctor for "sore throat." The hands of all three were stained orange yellow, as is common among T.N.T. workers.

In each case the health had not been satisfactory for some weeks before the onset of jaundice, the complaints varied greatly and can hardly be regarded as definite prodromal symptoms: B. C. complained of sore throat, T. M. of faintness, C. B. of tightness of chest (and a fourth case, referred to later, of weakness of the eyes).

On investigation, however, it was ascertained in each case that the worker had felt weak, with poor appetite, slight nausea, and a tendency to headache (one case, C. B., came to the surgery asking for his discharge, as he did not feel able for his work). Cyanosis was not observed in any of these cases, and the patients had never suffered from T.N.T. dermatitis.

The first definite sign was yellowness of the conjunctivae, quickly followed by general icterus; at the beginning the patient did not appear to be seriously ill, but shortly afterwards became suddenly worse with vomiting, delirium, incontinence of urine and faeces; rigors were frequent and were associated with severe epigastric and hepatic pain; the stools were paler than normal but never entirely clay-coloured; the urine was heavily bile-stained, normal in quantity and specific gravity, acid in reaction, and containing small traces of blood and albumin (in one case tube casts and epithelial debris were present); leucine, tyrosine, and T.N.T. were absent.

In all three cases the disease ran a similar course, the patient becoming steadily worse; the liver area decreased and drowsiness and delirium persisted. In one case the patient was more or less unconscious for over three weeks, passing his evacuations under him and having to be fed by hand. In this case an inexperienced nurse placed the clinical thermometer in the patient's mouth, and a moment later recovered part of it with difficulty, the lower end having been bitten off and swallowed by the semi-conscious

man. Fortunately the thermometer end was passed later with a globule of liquid mercury in the stools.

Extreme emaciation occurred in two of the cases, the third lost weight but did not emaciate to the same extent as the others. The temperature was normal as a rule, rising occasionally for a day or less at a time to 100° F.; the pulse-rate was normal though feeble at the height of the illness. The breath was foul and had a characteristic odour; the tongue and lips were furred and bled slightly; the colour of conjunctivae and skin became dark yellow; small raised petechial spots appeared on the limbs, chest, and face; there was no itching. Vomiting was troublesome and the bowels tended to be costive; in response to an enema or an aperient slimy pale stools were passed which stained the draw-sheet pink round the edges of the soiled area; during this time no T.N.T. could be detected in the urine. Perspiration was scanty, the skin being harsh and dry.

Whenever the patient was sufficiently conscious he complained of constant pain over the liver region, and the liver dullness steadily diminished until in the two most severe cases one to one and a half inches or less could be made out in the nipple line.

The treatment was necessarily somewhat empirical, the symptoms being alleviated as far as possible as they arose. The skin was encouraged to act, the bowels kept free by a mild aperient (white mixture) and enemas; nourishment was given in small quantities at frequent intervals—milk and soda water, meat juice, thin broths, barley water, etc.; meat extracts were well tolerated, while fruit and fruit juices disagreed and caused vomiting. Injections of 6 oz. of a saturated solution of sodium bicarbonate were given by the rectum twice daily at the height of the illness, and the same salt by mouth also in a mixture and in milk to the amount of 2 drachms daily; whenever this was discontinued the patients became worse. All three cases slowly rallied, and in the fifth or sixth week of the illness began definitely to improve; delirium ceased, the vomiting and pain became less frequent, appetite better, colour less deeply jaundiced, and the stools became normal in colour and consistence; the area of the liver increased, and its function returned with remarkable rapidity; in one case (C. B.) in five weeks the liver dullness from being less than one inch increased to two and a half inches.

Convalescence, however, was slow and slight relapses frequent, the patient becoming drowsy and sick, and having recurrence of epigastric pain if allowed to do much at first, or if excited by friends or visitors. When the patients were allowed up oedema of the legs and to a less extent of the body was troublesome, and persisted for weeks after the urine was clear of albumin; the jaundice was slow in subsiding, a yellow tinge remaining after ten weeks. The liver dullness, after having almost disappeared in two of the cases and having greatly diminished in the third, returned practically to normal. The petechial spots persisted as small raised papules, with no itching, especially on the face, long after the patients had otherwise recovered and the jaundice had completely disappeared.

The three cases were eventually discharged home and returned to work, T. M. as a miner, C. B. as a sanitary worker, and B. C. on the factory traffic gang. The length of treatment in hospital averaged ten weeks, and the duration of illness until the patient was fit for work again was nearly twice that period. I have recently heard from the patients, and all report themselves well and at work at the present time, six months after recovery. In the third case, B. C., which was the least severe, blood examination revealed no pathological change, cell and haemoglobin ratios being normal. Menstruation was missed for three periods during her illness, but has occurred normally since.

In a fourth case, a girl of 18 years, who worked for four months on the outside laundries, and was seen on several occasions but not treated by me, the symptoms and course were the same—full recovery and regeneration of the liver taking place after a serious and prolonged illness of many months, in which the liver area diminished to less than half its normal size. In this case also sodium bicarbonate was given freely throughout.

The chief points of interest appear to be: (1) The regeneration of the liver after very extensive destruction. (2) The beneficial result of the exhibition of sodium bicarbonate¹ in what seemed to be hopeless cases. (3) The absence of T.N.T. in the urine when it was being excreted by the bowel.

From a series of several hundred examinations of the urine my experience has been that T.N.T. is normally present (Webster's test) when a worker is in contact with this substance, and that instead of this being a danger signal, as has been held, it is on the contrary normal and quite compatible with good health; it is not found in the urine of patients suffering from toxic jaundice.

REFERENCE.

¹ Sodium bicarbonate is recommended by Dr. W. H. Willcox for the treatment of toxic jaundice due to tetrachlorethane, BRITISH MEDICAL JOURNAL, February 26th, 1916.

ACUTE METATARSAL OVERSTRAIN (FOOT-SWELLING).

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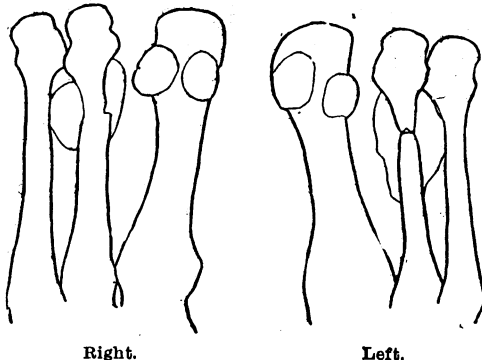
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ACUTE overstraining of the metatarsals is one of the disabilities to which the marching foot is subject, and even before the war was being increasingly recognized by the military surgeons of the large conscript armies of the Continent as a lesion to which their recruits were liable. The complaint was first described in 1855 by Breithaupt, who gave it the name of "foot-swelling," and attributed it to injury of the metatarso-phalangeal joints and tendinous sheaths. This was the accepted explanation until 1887, when the French surgeon Pauzat, in a very striking paper, suggested periostitis of the metatarsal bones as a cause. Pauzat's explanation still holds good for some cases, but with the advent of *x* rays in 1897 fracture was revealed, and in the *Revue d'Orthopédie* of September, 1898, there is an excellent skiagram by Maunoury of Chartres, showing fracture of the third metatarsal with characteristic callus formation.

The following case illustrates the typical signs and symptoms of overstrain:

W. T., aged 28, entered the army in October, 1914. During his training in England he frequently fell out on the march because of sore feet, but was never completely off duty for this trouble. On May 24th, 1916, he was sent to France, and remained a few days at a rest camp. On May 28th he marched six miles, and at the end began to feel pain in the left foot. Next day he marched another ten miles, after which the foot, being swollen, was bandaged. The following day he again marched a few miles, and both feet became swollen and painful. He was sent to a field ambulance, and thence down the line. He was admitted to the Royal National Orthopaedic Hospital on June 15th, bearing a card with the provisional diagnosis of trench feet.

The feet were swollen, and he complained of pain across the anterior part of the dorsum of each foot, particularly the left. He had distinct pes planus, but, owing to the pain, he objected to any attempt at manual inversion. He was kept in bed and the feet were massaged. At the end of ten days he was allowed up; there was a recurrence of the pain, which he persisted in



An outline drawing of a skiagram showing the three inner metatarsals of a soldier's feet. There is a marching fracture of each second metatarsal with characteristic callus formation.

localizing at the anterior part of each foot. An *x*-ray picture, an outline drawing from which is here reproduced, showed a fracture of each second metatarsal bone just behind the head, with considerable surrounding callus, that on the left being the more exuberant and therefore possibly explaining the greater tenderness on this side. The patient was kept off his feet completely for one month, and during this time was given massage and hot air. He was then by easy stages allowed to get up, and six weeks after admission he could walk with comfort. To prevent relapse it was thought advisable to add a transverse

"football" bar across the sole of each boot, well behind the position occupied by the heads of the metatarsals, to take the weight for the time being off these heads, and for the planus a valgus wedge and prolonged heel were added. He was then transferred to a convalescent hospital.

It is very seldom that marching fractures occur in both feet as in this case. Of 575 cases collected by Nion in two only were both the second metatarsals affected, in one both the third, and in one the second and third. Rarely are there two fractures in the same foot; in the same series four times only were the second and third metatarsals broken and once the second and fourth. Acute metatarsal overstrain is practically confined to the three middle metatarsals. I can find no recorded instance of fracture of the first metatarsal due to marching, and fractures of the fifth are commonly the result of accident due to sudden throwing of the body weight upon the inverted foot. Usually one foot only is affected and usually only one bone; Nion gives the proportions of 112:98:17 for the second, third, and fourth metatarsals respectively. That some bones are more frequently involved than others is due to their anatomical disposition and the relative parts they play in bearing the body weight. The great diversity in the strength and projection of the metatarsal bones is readily apparent on examination of a large number of skiagrams. It seems that the head of the fifth always projects least and the fourth next, but that the projection of the heads of the three inner bones is subject to much variation. The third head may reach the same level as, but never exceeds, that of the second, and either or both of these bones may extend beyond or fall short of the first. The second metatarsal bone is more subject to variation than any other; it may be the strongest, next to the first metatarsal, or it may be the weakest. On the other hand, the third metatarsal is always a weak bone. The metatarsals as a whole are so arranged as to complete the anterior portions of the longitudinal and transverse arches of the foot, the second and third occupying the highest plane. At their bases they all unite with the tarsus, but the first has the widest range of movement, the fifth next, and the fourth next, whereas with the second and third, as Hepburn points out, "an extremely powerful interlocking of parts is provided which places any marked independent movement of these metatarsal bones entirely out of the question." Again, in the *x*-ray picture of a normal foot it will be seen that the second and third metatarsals are practically parallel, and run in a strictly antero-posterior direction, whereas the others radiate obliquely forward.

This disposition of the bones provides for the transmission of the body weight by the astragalus along a line passing through the second metatarsal head.

When standing the weight is borne by the two feet, the chief points of support in each foot being the os calcis, the shaft and head of the fifth metatarsal, and the head of the first metatarsal. During ordinary walking, however, the main points of contact with the ground are continually changing. First the heel is brought down, then the sole, and then the body is levered forward on the metatarsal heads. During this last part of the step the four inner metatarsals and their toes are the chief points of contact, with the second and third forming the most direct anterior supports of the longitudinal arch of the foot, and consequently subject to very direct pressure. That this is so is shown by the boots of people with normal feet, from which it appears that the sole is most worn about the middle, at a point corresponding with the heads of the second and third metatarsal bones. Frequently there is also a callosity in the corresponding position on the sole of the foot. It is during the successive weighting of the metatarsal heads that overstrain is produced. The feet of the vast majority of recruits quickly accommodate themselves to the rigours of route marching, but occasionally there is a breakdown, either in the direction of flat-foot or metatarsal overstrain, or both. In these the extra loading due to the pack, the fatigue induced in the small muscles of the foot, and the roughness of the ground traversed are cardinal causes. With every unevenness of the ground the sole of the boot becomes slanting, and the tendency is for the mid-metatarsus to become more heavily weighted, and occasionally one bone more burdened than the others. This is further promoted by the lessened co-ordination between the metatarsal bones as the result of tired muscles and the generally diminished sensibility of the foot induced