direct effect of diphtheritic toxin were absent, and so were the respiratory complications which are mainly due to secondary organisms. Tracheotomy was not necessary in any of the cases, though two of them were admitted with slight suction; of course such a result could be obtained with antitoxic serum. Not a single death occurred in the present series.

The mortality rate for diphtheria at the Medical College Hospitals, Calcutta, during the five-year period from 1941 to 1945 varied from 20 to 36%. The lowest (20.3%) occurred in 1941 and 1945, and the highest (36.5%) in 1944. The average mortality was 25.6%—total admissions, 1,429; deaths, 366. In the present series the mortality was nil, but we must keep in mind that of the 27 cases 20 were mild and 7 moderately advanced. From such a small number of cases we cannot assess the value of penicillin in the treatment of diphtheria, but we feel that the subject requires further study. Penicillin cannot replace antitoxic serum in severe cases of diphtheria where immediate neutralization of toxin is imperative, but is it possible to treat early cases with penicillin alone? Diphtheria confers a good deal of immunity to the sufferers who survive. For the production of active immunity we often have recourse to injections of modified toxin such as T.A.F. and T.A.M. or A.P.T. Now if an early case of diphtheria is treated with penicillin alone the infection may be checked, and at the same time the amount of toxin absorbed in the system will be partly destroyed and partly used up as an antigen. Can this toxin act as a stimulus for the production of a better type of immunity? The answer should be "yes," as we know that the best way to acquire immunity is to suffer from the disease in a mild non-fatal form. Incidentally, it may be mentioned that prophylactic immunization is practically not done in India as a routine.

The disadvantage to a child of three-hourly injections of penicillin should be kept in mind. It is distressing to the patient, and the parents will often object. Whether this disadvantage will be overcome by the discovery of a preparation such as penicillin in beeswax and peanut oil or by the injection of a single large dose of penicillin, as has been tried successfully in some cases of gonorrhoea, is still a matter of speculation, but such possibilities cannot be disregarded. Whether penicillin in conjunction with antitoxic serum can reduce the mortality rate and the incidence of complications in severe cases of diphtheria is also a subject that needs intensive study.

The financial aspect must also be considered. We have shown that the average curative dose of penicillin is within the limit of 500,000 units. In this institution an average curative dose of antidiphtheritic serum for a similar group of cases was 50,000 to 60,000 units. When we started to use penicillin therapeutically in the middle of 1945, the drug was scarce and the price varied from Rs.20 to Rs.15 (£1 10s. to £1 2s. 6d.) for each phial of 100,000 units. At the end of 1946 the price was Rs.3/8 (5s. 3d.) for 200,000 units, and the supply was ample. The price of antidiphtheritic serum in the middle of 1945 was between Rs.6 and Rs.7 (9s. and 10s. 6d.) for 10,000 units. The present price is Rs. 7 (10s. 6d.) for 10,000 units. Thus the cost for each case treated with penicillin is Rs.8/8 (12s. 9d.) and for each case treated with antidiphtheritic serum Rs.35 to Rs.42 (£2 12s. 6d. to £3 3s.). We expect the price of penicillin to fall still further. This reduction in cost is at present possible only in an institution where there is a whole-time staff and nurses to attend to the patients. In private practice the patient will have to bear the additional cost of continuous medical attendance for three-hourly injections, careful nursing, and the storage of penicillin, particularly in tropical climates.

Summary

Twenty-seven cases of diphtheria treated with penicillin alone are reported: 16 were bacteriologically positive and 11, though bacteriologically negative, were clinically typical cases of diphtheria. Twenty were early and seven moderately severe.

All the cases recovered without developing any complications; the temperature was normal within three days, the throat swabs became negative within three to seven days, and the patches disappeared within two to five days.

The merits and demerits of penicillin in diphtheria and the possibility of future improvement are discussed. Penicillin treatment is undoubtedly more economical.

Typing of the particular strain was not ascertained. Only the clinical aspect of the cases is mentioned.

Our thanks are due to Prof. B. P. Trivedi for his ungrudging help in bacteriological matters, and to the Superintendent, Medical College Hospitals, Calcutta, for kindly allowing us to use the hospital records in preparing the article and for supplying us with penicillin.

REFERENCES

- Berman, B. B., and Spitz, S. H. (1945). *Bull. U.S. Army med. Dept.*, 4, 87.
 Christie, A. B., and Preston, J. C. (1946). *British Medical Journal*, 1, 433.
 Dodds, Richard J. (1946). *Ibid.*, 2, 8.
 Ercoli, N., Lewis, M. N., and Moench, L. J. (1945). *J. Pharmacol.*, 84, 120. (Quoted in *British Medical Journal*, 1946, 1, 656.)

A CASE OF MESENTERIC THROMBOSIS COMPLICATING MULTIPLE WOUNDS RECOVERY FOLLOWING MASSIVE RESECTION

BY

W. N. HINE, M.C., M.R.C.S.

Late Major, Surgical Specialist, R.A.M.C.

Mesenteric thrombosis is a catastrophe that seldom occurs in men of military age. The following case history has an added interest because its aetiology is difficult to dissociate from the consequence of severe shell wounds sustained nearly four months previously.

Case Report

A trooper of the Royal Tank Corps aged 32 had enjoyed excellent health until he was wounded in action on Jan. 31, 1944. Severe injuries to both lower limbs necessitated transfusion and prolonged resuscitation before wound toilet was performed on Feb. 2. Secondary haemorrhage arose from an extensive infected wound in the left thigh on Feb. 12, and was controlled by ligation of the femoral artery in Hunter's canal. He then progressed satisfactorily until March 1, when a wound in the neighbourhood of the right knee-joint was found to have caused suppurative arthritis. This demanded wide incisions and splinting with strapping extension.

The patient first came under my care at the 67th British General Hospital on May 5, 1944. His general condition was very satisfactory and no disease of heart or lungs was noted. Temperature, pulse, and respirations remained normal. The plasters were changed. The wounds of the left thigh and leg were healed and a fracture of the left tibia had united. The right knee-joint was still slightly swollen and the drainage incisions were granulating. Quadriceps exercises were performed daily.

Occurrence of Thrombosis.—At 4 a.m. on May 27 the patient was awakened by abdominal pain, and after expressing a desire to defaecate, he attempted unsuccessfully to use a bed-pan. Vomiting then occurred, and collapse was evidenced by sweating, subnormal temperature, and a rapid thready pulse. The abdomen moved with respiration and tenderness was limited to a circular area 6 in. (15 cm.) in diameter around the umbilicus. Morphine, 1/4 gr. (16 mg.), was administered, and a plasma drip was started. At 8 a.m., although the degree of

collapse was less, profound pain had greatly increased. It was spasmodic in character, causing him to cry out and to grip his abdominal wall. Generalized abdominal rigidity was noted during the attacks of pain, but in the intervals guarding was only apparent around the umbilicus, there was no visible peristalsis, and the abdomen was silent on auscultation. Lieut.-Col. W. Brindle, R.A.M.C., was called in consultation, and made a diagnosis of mesenteric thrombosis; he recommended surgical intervention. By 10 a.m., after administration of 2½ pints (1.42 l.) of plasma, the patient's general condition improved; his pulse rate was 110 and his blood pressure 98/70.

Operation.—Major Ward, R.A.M.C., induced anaesthesia with 0.5 g. of thiopentone and continued with gas-and-oxygen. In addition the tissues of the abdominal wall were infiltrated with 2% "novocain." A midline incision extending 4 in. (10 cm.) above and below the umbilicus was employed, and on incising the peritoneum much blood-stained fluid escaped. Distended coils of chocolate-coloured small intestine with oedematous haemorrhagic mesentery presented and were delivered from the wound. The peritoneal coat of the damaged gut still retained the normal sheen, but the upper and lower limits of devitalization were sharply demarcated. Bowel clamps were applied to healthy intestine 2 in. (5 cm.) above and below the involved segment and resection was rapidly performed. The mesentery was clamped and removed at its base beyond the areas of most intense haemorrhage. In all 91 in. (231 cm.) of gut was removed, and repair was effected by means of an end-to-end anastomosis. The omentum was sutured around the junction and over the mesenteric stump. The abdominal cavity was then mopped dry, and the abdominal wall was closed in layers without drainage.

Post-operative Treatment and Progress.—Continuous gastric suction was instituted, and 2 pints (1.14 l.) of whole blood was administered. Injections of morphine 1¼ gr. (16 mg.), were given four-hourly during the first 24 hours. By the following day the patient's general condition was much improved. His haemoglobin was 98%, pulse 120, temperature 100° F. (37.8° C.). Intravenous glucose-saline introducing 2 g. of sulphapyridine during each period of four hours was given by the drip method. Frequent sips of water were allowed, and although the bulk of this fluid was withdrawn by suction it helped to keep the mouth moist and relieved his thirst. The bowel acted satisfactorily four days after operation, and gastric suction was discontinued on May 31. On June 13, after an apparently smooth convalescence, he complained of pain in the right iliac fossa, and next day it was necessary to open a small abscess which had pointed in this region. Subsequently his progress was uninterrupted, and when he was evacuated to England on July 2 his condition was very satisfactory. He found no difficulty in digesting ordinary diet, and his stools were well formed and regular.

Follow-up.—On Sept. 10, 1944, I was informed by Maj.-Gen. Ogilvie, who examined the patient at a hospital in England, that no further complications had arisen, and that he appeared fit and well. He was also seen at Liverpool Hospital in 1945. He had made a full recovery and was doing light work.

I am most grateful to Lieut.-Col. W. Brindle, R.A.M.C., for his advice and help in dealing with this case, and to Col. A. Angus, M.C., late R.A.M.C., for permission to publish this paper.

The *Register of Ambulance Stations*, compiled by the Home Ambulance Service of the Order of St. John and the British Red Cross Society, gives the addresses and telephone numbers whence ambulances may be obtained throughout Great Britain. The Home Ambulance Service was set up in 1919 to provide a better means of transport for the sick and injured than those commonly available, particularly in the country, where improvised cabs and wagons often had to be used. It now has 1,000 vehicles in service. The ambulances are provided by the Order and Society, and the responsibility for running, housing, and maintaining them rests entirely with voluntary workers. Thus the smallest possible fee is charged to patients, and those who cannot afford to pay receive free transport. In 1923 the Mobile X-ray Service was started, as complement to the work undertaken by the ambulances, to bring x-ray units to the bedridden and immobile. In 1926 the work of the ambulance service was supplemented by a first-aid road service; boxes of splints and bandages were set up at the roadside and have proved invaluable to the many victims of road accidents.

Medical Memoranda

A Case of Dislocation of the Metatarso-Tarsal Joints

The following case is of interest because of the rareness of the condition and the radical form of treatment adopted.

CASE REPORT

Miss A., aged 56, was first seen on Oct. 10, 1945. She fell a short distance down a step on to her right foot, which became swollen and very painful. Tenderness was most pronounced over the base of the first metatarsal. A radiograph showed a complete

Radiograph of both feet, Oct. 10, 1945.

lateral dislocation of the metatarso-tarsal joints, with a fracture of the first cuneiform at the base of the first metatarsal. Reduction in the out-patient department failed and she was admitted under my care on Oct. 13. The following day a pin was inserted through the metatarsals, and a weight of 7 lb. (3.1 kg.), later increased to 10 lb. (4.5 kg.), was applied, the leg being bandaged to a Braun frame. This produced some distraction but no reduction and, after two days, manipulation under anaesthesia was performed with the weight in place. No real improvement was obtained. The pin was removed, and after the skin had recovered from fairly severe blistering I performed the formal operation of arthrodesis of all metatarso-tarsal and inter-metatarsal joints on Oct. 31. There was considerable fracturing of both metatarsal and tarsal bones which was not obvious in the radiograph. Plaster was applied and by March 16, 1946, the patient was discharged, with no detectable clinical abnormality. Despite the extensive arthrodesis the foot was not less mobile than its fellow.

COMMENT

This fracture is not referred to by the majority of authors, but Böhler (1935) mentions various tarso-metatarsal dislocations, of which those involving the first and fifth are the most common. He advises distraction, with a pin through the metatarsals and os calcis. This might have been successful, although I doubt it. The risk in such a method is persistent pain afterwards. If mobility is to be of great importance, as in the subtalar joint, it is a debatable question whether arthrodesis is the best treatment, but in such a case as this it seems to me the ideal treatment, as mobility is minimal at these joints and there is little risk of persistent pain if the arthrodesis is successful.

An interesting case of fracture dislocation of the mid-tarsal and cuboïdo-navicular joints was reported recently by Jaslow (1946). This produced a rather similar picture, but at a different level in the foot. His case was also treated by fixation, using a screw, with a completely satisfactory result. The very satisfactory result in my case suggests that arthrodesis as a primary measure is the best form of treatment.

W. DOUGLAS PARK, M.S., F.R.C.S.

Connaught Hospital, London, E.17.

REFERENCES

- Böhler, L. (1935). *Treatment of Fractures*, 4th ed., p. 468, Wright, Bristol.
Jaslow, I. A. (1946). *J. Bone Jt. Surg.*, 28, 386.