

levodopa, third between methyldopa and methyldopa with levodopa and fourth between levodopa and levodopa with methyldopa. These four comparisons were not made simultaneously.

There was no effect on lying blood pressure from these drugs either singly or in combination. Methyldopa alone produced a slight fall in standing diastolic blood pressure, levodopa and methyldopa together produced a fall in standing systolic and standing diastolic blood pressure. The three patients on the higher dose of levodopa (mean dose 2 g) who received 500 mg methyldopa showed the same blood pressure changes as before.

Discussion

Our trial did not confirm the findings of Calne (1970) who found that with levodopa alone a fall occurred in the mean systolic pressure of 19.3 mm Hg when standing. However, we did not use maximally tolerated doses of the drug.

The hypotensive effect of these two drugs in combination is likely to be that of potentiation rather than synergism but too few patients were studied to be certain of this. In Fermaglich and O'Doherty's (1971) investigation no change in the blood pressure was noted but special studies of the blood pressure would be needed in order to show slight change. Hunter *et al.* (1970) found that for a hypertensive patient on guanethidine the dose of this drug had to be substantially reduced if the patient was put on levodopa. The results show that methyldopa and levodopa together lowered the blood pressure in doses which, given singly, did not affect it significantly.

Parkinsonism was unaffected by the administration of

methyldopa, but our patients were given the drug for only a few days. There are reports, however, of Parkinsonism induced by methyldopa (Peaston, 1964; Vaidya *et al.*, 1970) in people who had no Parkinsonism symptoms before they took methyldopa. In another report by Groden (1963) Parkinsonism returned to a patient when he was given methyldopa, his previous Parkinsonism having occurred when on reserpine. Methyldopa crosses the blood brain barrier in animals and therefore theoretically it could be interacting with levodopa in the extrapyramidal system.

Levodopa like methyldopa may produce a state of autoimmunity with a positive Coombs test (Cotzias, 1969), but no cases of haemolytic anaemia have been reported. In our series haemolytic anaemia did not occur, although a Coombs test was not done regularly.

It is reasonable to consider giving methyldopa to hypertensive patients on levodopa. This should be attempted only in a hospital, where the blood pressure can be carefully monitored and the dosage of the drug slowly increased.

References

- Barbeau, A. (1969). *Science*, **165**, 291.
 Calne, D. B. (1969). *British Journal of Pharmacology and Chemotherapy*, **37**, 57.
 Calne, D. B. (1970). *British Medical Journal*, **1**, 474.
 Cotzias, G. C. (1969). *Journal of the American Medical Association*, **207**, 1353.
 Duvoisin, R. C. (1970). *British Medical Journal*, **3**, 47.
 Fermaglich, J., and O'Doherty, D. S. (1971). *Neurology*, **21**, 408.
 Groden, B. M. (1963). *British Medical Journal*, **1**, 1001.
 Hunter, K. R., Stern, G. M., and Lawrence, D. R. (1970). *Lancet*, **2**, 1283.
 McDowell, F. H., and Lee, J. E. (1970). *Annals of Internal Medicine*, **72**, 751.
 Peaston, M. J. T. (1964). *British Medical Journal*, **2**, 168.
 Vaidya, R. A., Vaidya, A. B., Van Woert, M. H., and Kass, N. G. (1970). *Metabolism: Clinical and Experimental*, **19**, 1069.

MEDICAL MEMORANDA

Clostridium welchii Infection: An Unusual Case

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Clostridium welchii infection is a recognized complication of open injuries sustained in road accidents. The infection usually originates in an inadequately excised wound containing ischaemic tissue. We report a case of gas gangrene occurring in the apparently normal leg of a road traffic accident victim with a compound fracture of the opposite leg.

Case History

A 24-year-old man was involved in a road accident in which he sustained a compound fracture of the shaft of the left tibia and fibula, and minor abrasions over the right greater trochanter and

the left anterior chest wall. He was admitted to hospital and the wound in the left leg was excised and sutured under general anaesthesia. The limb was then immobilized in plaster. Next day he was well, but complained of a little pain in his right thigh. The pain gradually became more severe. Two days after injury the right thigh was noticeably swollen and tender. A radiograph showed a small quantity of gas in the muscle planes. Within the next couple of hours the thigh rapidly increased in size and crepitus became detectable. A diagnosis of gas gangrene was made. Under general anaesthetic the whole right lower limb was carefully examined for evidence of a wound and none found. There was trivial bruising over the right greater trochanter and a number of injection sites were noted in the right buttock where tetanus vaccine 0.5 ml had been injected shortly after the injury.

An incision was then made from the anterior superior iliac spine to the lateral border of the patella. A large quantity of gas escaped both when the superficial fascia and when the deep fascia were opened. The rectus femoris muscle was found to be necrotic from end to end. It was excised completely. The other muscles of the anterior compartment of the thigh were examined and appeared healthy, normally coloured, and contractile despite the presence of gas in the tissue planes. The wound was left open.

C. welchii was identified on the smear and later cultured anaerobically as a pure growth of type A. No other organism was grown. Despite a history of an allergy to penicillin he was given two megaunits intramuscularly, blood transfusion was started, and he was given sodium bicarbonate intravenously (250 ml of 4.2%). He was promptly transferred to the hyperbaric oxygen unit at the department of surgery, University of Aberdeen.

There the thigh wound was treated by continuous hydrogen peroxide irrigation (hydrogen peroxide solution B.P. "20 volume"). He was given 2,000 ml of blood during the first 24 hours and he received 5 megaunits of penicillin intravenously 6-hourly together with 1 g probenecid daily. Hyperbaric oxygen therapy at three

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atmospheres pressure was also given, the first treatment being started shortly after his admission in Aberdeen and each session lasted two hours.

On the morning after his transfer to the unit, he was pyrexial, pale, and slightly jaundiced. Inspection of the wound showed a small area of necrosis in the vastus lateralis and pale oedematous areas in the vastus medialis and the anterior part of the tensor fascia lata. These parts of the muscles did not respond to mechanical stimulation, and they were therefore excised under general anaesthesia. The haemoglobin now was 66% (9.6 g/100 ml) despite the transfusion of 2,000 ml of blood. The serum bilirubin level was 2.5 mg/100 ml. The serum aspartate level was 51 IU and the aspartate transferase level 102 R.F. units. The excised muscle was examined bacteriologically and showed profuse numbers of Gram-positive rods confirmed by culture to be *C. welchii* with a high concentration of alpha toxin production.

After a further five periods of hyperbaric oxygen treatment and three days later the patient was much improved clinically with a steady haemoglobin level, absence of jaundice, and a near normal temperature. The wound showed no further evidence of extension of the infection and there was only scanty growth from one of three swabs taken from the wound. This was now dressed daily with Furacin (0.2% nitrofurazone in water-miscible vehicle). He improved rapidly and the wound showed healthy granulation tissue appearing throughout. His further course was uncomplicated.

Comment

Gas gangrene, although well known, is a fairly rare complication in surgical practice. It has been estimated by Altemeier and Furste (1948) that the incidence after major open wounds is less than 2%, although the same writers found clostridial contamination to be present in up to 39% of bacteriologically cultured accidental wounds. There is also evidence from the Korean war that clostridial contamination of war wounds was present in 88% of cases. Infection usually starts at the site of injury or operation. Nevertheless, there are a few cases reported where the infection occurred in a tissue distant from the site of injury. Brummelkamp (1966) in a series of 55 patients reported one patient who developed gas gangrene in a leg after cholecystectomy. MacLennan (1962) on examining the world literature found a number of reports of non-traumatic infections in which *C. welchii* was identified. In this connexion it should be remembered that clostridial spores can remain dormant in scar tissue for years after the original injury.

In the present case it is difficult to explain the course of events. Close questioning of the patient revealed that he had had pain in his right thigh since a horse-riding accident one week before the car accident. He also admitted to have

injected himself with drugs, but never in the thigh and not during the preceding 12 months. He maintained he had knocked the right thigh in the car accident and he did complain of pain, but nothing was found on the initial clinical examination.

If we accept that the patient never gave himself hypodermic injections of drugs in the thigh, there seems only two possible explanations. The incubation period of gas gangrene is usually less than three days but infection may start from one hour to six weeks after the injury (MacLennan, 1962). It is possible that the infection started when the patient fell off a horse a week before the car accident, the site of entry of organisms being either a minor abrasion or from the gastrointestinal tract (MacLennan, 1962). The more likely explanation, however, is that the patient had a bacteraemia of *C. welchii* as a consequence of the open fracture of the left leg and that there existed anoxaemic tissues in the form of injured muscle or a recent or an old haematoma in the right thigh which afforded the anaerobic conditions in which *C. welchii* could grow producing clostridial myositis.

The place of hyperbaric oxygen treatment in patients with gas gangrene infection has been frequently debated and it is not the purpose of this communication to argue for or against its beneficial effect. Suffice it to say that we believe the mainstay of gas gangrene treatment is surgery combined with a high dosage of an antibiotic, preferably penicillin. Hyperbaric oxygen should be regarded as an ancillary measure in the treatment of gas gangrene (Irvin et al., 1968), although Roding *et al.*, (1972) claim that hyperbaric oxygen is the treatment of choice in gas gangrene infection.

At this time when road traffic accidents are becoming a more frequent cause for admission of patients to hospital, gas gangrene is likely to increase in frequency. We feel that this case history is a reminder to the profession that it may occur at sites distant from the sites of injury.

References

- Altemeier, W. A., and Furste, W. L. (1948). In *Advances in Military Medicine*. Washington D.C., Office of Scientific Research and Development in World War II.
- Brummelkamp, W. H. (1966). In *Proceedings of Third Conference of Hyperbaric Medicine*, ed. I. W. Brown and B. G. Cox, p. 492. Washington, International Academy of Science.
- MacLennan, J. D. (1962). *Bacteriological Review*, 26, 177.
- Irvin, T. T., Moir, E. R. S., and Smith, G. (1968). *Surgery, Gynecology and Obstetrics*, 127, 1058.
- Roding, B., Groeneweld, P. H. A., and Boerema, I. (1972). *Surgery, Gynecology and Obstetrics*, 134, 579.

Syndrome Resembling Kwashiorkor after Partial Gastrectomy

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A patient who developed protein-calorie malnutrition 20 years after a partial gastrectomy complicated by depression and a diet grossly deficient in protein is reported. This syndrome, which closely resembles kwashiorkor, has rarely

been reported in the Western world and usually follows gastric surgery complicated by other factors.

Case History

The patient, a man of 54, was admitted to another hospital where his wife gave the history of abdominal swelling with dyspnoea increasing for several months. Before admission he had become increasingly slow and confused. Over several years there had been progressive loss of appetite and he became apathetic and thin. In 1948 he had a Polya partial gastrectomy for duodenal ulcer, followed by a vagotomy a year later for recurrence of symptoms. He had not suffered from indigestion since. He drank four pints (2 l.) of beer daily and some spirits. He had broken his false teeth six months before admission and failed to obtain a new set.

At the referring hospital he was confused, irritable and slow. There was leg oedema and some ascites, but the jugular venous pressure was not raised. There were no stigmata of cirrhosis and the spleen was not felt, but the liver was enlarged. The cranial nerves were normal, but the limbs were wasted and weak with brisk

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