nature, but it also shows the value of Rich's conclusions on the aetiology of the disease. This author had the opportunity of examining cases of periarteritis nodosa due to serum sickness. It was felt that in seven cases observed over a short period of nine months a definite connexion existed between serum sickness and periarteritis nodosa.

Among the arguments in favour of this connexion were the following: (a) In 5 out of 7 cases treated with serum the vascular lesions were definitely fresh. (b) None of the patients had had symptoms suggestive of periarteritis nodosa prior to administration of serum. (c) Following the study of Clark and Kaplan, it was felt that micro-organisms (such as the pneumococcus or influenza bacillus) cannot be regarded as responsible for vascular lesions of the type of periarteritis nodosa.

The following facts could be regarded as strongly suggestive, according to Rich, of the part played by serum sickness in causing the vascular lesions, independently of sulphonamide therapy.

"First the lesions were found in the viscera of all the four cases of serum sickness that came to necropsy during the brief period of nine months. In the second place, while the patients had also received sulphonamides, the urticaria and general glandular enlargement in one case seem rather clearly to have been due to serum, for these manifestations of serum sickness appeared seven days after the first injection of the serum and four days after the sulphonamide had been discontinued. In the third place, the lesions were found in the single fatal case of serum sickness available in our files before the advent of sulphonamide therapy."

It is also of great interest, according to Rich, to remember that necrosis of the vessels with adventitial inflammation was described in Gerlach's study of the histology of the Arthus phenomenon as long as twenty years ago. In a recent article Miller and Nelson (1945), describing a case of polyarteritis nodosa developing during antisyphilitic treatment, suggest that "the condition represents in this case an anaphylactic type of hypersensitive response to arsenicals."

Experimental evidence of the relation of anaphylaxis to periarteritis nodosa has been reported by Rich and Gregory (1943), who produced multiple lesions of the condition in rabbits by injection of normal horse serum. In order to sensitize the animals quickly they gave each of them an intravenous injection of 10 ml. horse serum per kg. of body weight; by the twelfth day afterwards intradermal injections of horse serum showed that the animals were anaphylactic to the serum, and then at varying intervals different animals were given horse serum intravenously in doses of 2 ml. or more. Periarteritis nodosa was found in different situations in each of the rabbits.

With the theory of anaphylaxis in mind, it is clear that the discovery of the responsible antigen would be of great help in the treatment of this very serious and often fatal condition.

Summary

A case of periarteritis nodosa is reported. Diagnostic difficulties are stressed and the possibility of anaphylaxis in a causative role is pointed out.

I should like to thank Dr. J. M. Alston, pathologist, Group Laboratory, Archway Hospital, for the laboratory investigations and for his help and suggestions; and Dr. S. H. G. Robinson, to whom I am indebted for the post-mortem examination.

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The Ministry of Health states that considerable economy in the use of phials and packing materials would result if a proportion of the penicillin were distributed in packs larger than the present 100,000 units. It is accordingly proposed to pack a proportion of it in phials containing 200,000 units, 1/2 mega unit, and 1 mega unit. Distribution hospitals receiving substantial amounts are being notified of the new packs and invited by the Ministry of Supply, where this can be done without wastage of the drug, to accept a proportion of their monthly allocation in the larger packs. Smaller distributing centres not approached directly by the Ministry of Supply are requested to consider whether they can take a proportion in these larger packs and to inform the Penicillin Production Control, Ministry of Supply, Portland House, Tothill Street, London, S.W.1, accordingly.

A CASE OF METASTATIC GAS GANGRENE

BY

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The following case is reported because, although gas-gangrene infection is comparatively common in war surgery, metastatic spread is very rare. So far as is known this was the only case reported from the B.L.A.

Case History

Trooper A., aged 29, was admitted to a base hospital acting as a C.C.S. at approximately 4 p.m. on April 23, 1945. He had sustained wounds in both legs from a mine at about 10 p.m. on April 22. First-aid dressings had been applied in a forward unit and he was evacuated by air transport. His general condition was good all the time. The limbs were supported on Cramer wire splints. One dose of 2½ g. of sulphanilamide had been given.

On examination there was a small linear wound in the right mid-leg, over the anterior tibial compartment, with obvious laceration of muscles; and a gross swelling and ecchymosis of the left ankle and foot, with some blisters—painful, with limitation of all movements. The diagnosis was a penetrating wound of the right leg and a simple fracture of the os calcis of the left leg.

Operation was performed at 10 p.m. on April 23. Débridement of the right leg was carried out, with removal of loose fragments of fractured fibula and some clothing from the depths of the wound, where it had penetrated the posterior compartment. The anterior tibial vessel was severed. Local penicillin-and-sulphanilamide powder was applied, covered by loose vaselined dressing. A padded Cramer wire splint was fitted above the knee. The skin of the left leg was cleansed and a light padded plaster splint applied. The case was now judged to be suitable for evacuation further back. A penicillin drip, 100,000 units daily, had been started at approximately 8 p.m.

April 24.—General condition very good.

April 26.—At 1 a.m. the patient reported pain in the right leg and complained of the splint. Movements of toes were normal; no pyrexia; pulse 100 and of good volume. Splint adjusted with relief and morphine 1/4 gr. (16 mg.) given. At 9 a.m. there was obvious spreading gas-gangrene infection of the right leg with toxæmia. Plasma transfusion was started, and at 11 a.m. amputation at the right mid-thigh was performed, because of gas and oedema up to the groin anteriorly and 3 in. (7.5 cm.) from the natal cleft posteriorly. Linear incisions were made in the skin of the stump and penicillin-sulphanilamide powder was applied, covered with vaselined gauze. Local irrigation with penicillin solution was done twice daily through rubber tubes. A course of sulphathiazole tablets by mouth was started. At 11 a.m. 45,000 units of anti-gas-gangrene serum were given. Plasma was transfused, followed by blood, of which he had five pints (2.84 litres) by the evening of the 27th.

April 27.—General condition very good (described as "too good" by the transfusion officer). The penicillin drip was increased to 400,000 units daily. In the evening the patient complained of severe pain in the left foot. At 10 p.m. operation was performed. The skin was reddened and tense on the dorsum of the foot. The plantar compartment was swollen and there was crepitus. Incisions were made (1) on the dorsum—two longitudinally; (2) in the plantar compartment—one medial plantar; (3) in the ankle—postero-lateral and postero-medial. Gas and some pus were present on the dorsum. The plantar muscles were poor in colour, but not dead—thought to be due to streptococcal myositis.

April 28.—General condition good. Penicillin reduced to 100,000 units intramuscularly daily.

April 29.—Right stump dressed; clean, so loosely sutured. Penicillin tubes removed.

April 30.—Left foot dressed. Still a smell, and anaerobic myositis of plantar muscles. Further excision. Tubes inserted for hydrogen peroxide irrigation.

May 2.—Left foot dressed. Infection still present; tubes removed and further excision done.

May 3.—Right stump dressed. Sutured further because of absence of infection.

May 4.—Infection present in left foot, so extensive excision done. Eusol dressing. Penicillin discontinued.

May 6.—Dressing left foot. Clean; but plantar muscles all absent, and posterior dislocation of body of astragalus noted. Reduction not attempted because of infection.

May 8.—It was evident that the left foot would be very poor, even if it could be saved. Reduction of the astragalus would have been dangerous in the circumstances, despite the fact that infection appeared to be under control.

May 10.—Amputation 4 in. (10 cm.) above left ankle-joint. No infection in this region, so suture, with rubber drains, was done.

The posterior tibial artery was contused and thrombosed at site of injury. Penicillin I.M. had been restarted on May 8, and was continued until the 12th at 100,000 units daily. Three pints (1.7 litres) of stored blood were transfused on May 9-10, and 1 pint (568 ml.) of fresh blood on the 11th.

May 12.—Drains removed. Healing well.

No further anxiety was felt, and the patient daily improved both physically and mentally, with open air and good diet. By May 20 both stumps were clean and almost healed, and he was evacuated to the United Kingdom.

The total dosages given were: Penicillin—2,300,000 units (April 23 to May 4, May 8 to 12); sulphathiazole—56 g. (April 26 to 30). Blood—8 pints (4.5 litres) stored, 1 pint fresh. The time intervals observed during treatment were: Wound to operation, approximately 24 hours; wound to gas gangrene, approximately 75 hours; first operation to amputation, 61 hours; gas gangrene to left-foot operation, 46 hours.

Discussion

The development of gas-gangrene infection in the wound of the right leg at the end of three days was rather remarkable in this case, despite damage to the anterior tibial artery. The length of time between wounding and the first operation was 24 hours. If there had been heavy infection one would almost certainly have seen signs at that time, but, in fact, the wound was very clean, and would have been classed as comparatively minor. It is unlikely that infection and invasion developed immediately after the first operation, because spread would have been rapid and movements of the toes restricted. During all this time the patient was having a daily dose of 100,000 units of penicillin intramuscularly. This dose is considered adequate by most authorities (McIntosh and Selbie, 1943; Cutler and Sandusky, 1944). The vaselined gauze dressing, although applied lightly, may have plugged the wound and provided conditions favourable to the development of infection. The quick spread and quick decline in general condition suggest late onset.

The interest in this case, however, is the metastatic spread to the left foot. The time at which the bacteria entered the blood stream merits consideration. If this occurred before the second operation the bacteria must have existed there for about two days despite adequate blood levels of penicillin and sulphathiazole. It may have occurred at the operation, although a tourniquet was used and the limb was removed very quickly. Invasion after the operation is unlikely, because the oedema and gas in the fascial planes settled so quickly and there was no muscle infection at the site of amputation. One is led to the conclusion that the invasion occurred either before or during the operation. The penicillin in the blood stream was bacteriostatic but not bactericidal to the organisms, and in the left foot they passed outside the power of the drug. The long interval before operation may have been a factor, and demonstrates once more the danger of delay in adequate surgery. The fact that the left plantar muscles were the site of the metastatic spread was probably due to their insufficient blood supply, resulting from damage to the posterior tibial artery at the ankle.

Clinically, the condition was very similar to streptococcal myositis (MacLennan, 1943), and so incision rather than excision was first performed. Both muscle and pus were sent for culture; *Clostridium welchii* and other anaerobic organisms were grown, but repeated examinations failed to reveal any streptococci.

The total destruction of the plantar muscles must be attributed to their poor blood supply, because the infection on the dorsum of the foot promptly subsided after incision and chemotherapy. Destruction of muscle, whatever the cause, is a favourable condition for anaerobic infection, and in such a case chemotherapy is ineffective. This was emphasized by Wood Power (1945).

Comment

This case bears out the well-known facts that early surgery is always essential, and that removal of all dead muscle is the only safe measure for preventing gas-gangrene infection or stopping its spread. In this case it would appear that the blood level of penicillin, although generally considered to be adequate, was not capable of preventing the spread of the organism by the blood stream.

I wish to thank Brig. R. J. Shaw, M.C., A.M.S., lately commanding a general hospital, for permission to publish this case. My thanks are also due to the transfusion officer, Capt. (Miss) Winterton, R.A.M.C., whose help and treatment were invaluable in this case, and to the sisters and orderlies who nursed and cared for a very good but very ill patient. Lastly, my gratitude is due to Major J. D. MacLennan, R.A.M.C., for his advice and encouragement in the preparation of this report.

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SIGNIFICANCE OF SYMPTOMS IN THE DIAGNOSIS OF PULMONARY TUBERCULOSIS

BY

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Since the introduction of mass miniature radiography in this country in 1943 considerable discussion has arisen as to the most efficient way to employ this new weapon. There has been a body of medical opinion which has decried the advantages of orthodox mass miniature radiography as at present practised. It has put forward as an alternative that it would be more productive of results and more economical of personnel to concentrate the use of mass radiography machines on the examination of those sections of the population presenting symptoms suggestive of chest disease and that general practitioners should refer for fluorography all persons who have suspicious symptoms, however slight. The present paper was prompted by these suggestions, and is an attempt to discover the relative merits of the two methods if pressed to their logical conclusion.

It is generally accepted that the number of persons found by orthodox mass radiography to have significant lesions is in the region of 1.3%. This figure can be subdivided into observation cases, 1.0%, and treatment cases, 0.3%, and it has been found (Dick, 1945) that approximately two-thirds of the first group and one-half of the second group are symptom-free.

In order to arrive at a figure for the number of the general population having such symptoms as might be indicative of disease of the chest a questionnaire was presented, and where necessary explained, to each of 5,308 persons (2,713 men and 2,595 women) passing through the Middlesex County Council Mass X-ray Unit in the month of June, 1945. The questionnaire was as follows, and the results are given in Tables I and II, where the symptoms are rearranged in order of frequency.

Questionary

1. Have you a cough of one or more months' duration?
2. Any phlegm?
3. Have you coughed up any blood recently?
4. Have you any pain in your chest?
5. Are you more short of breath than you were six months ago?
6. Are you losing weight?
7. Are you feeling off colour or tired?
8. Have you had "flu" or frequent colds recently?
9. Have you seen a doctor for any of the above complaints?

It will be seen that the predominant symptom in men was cough and in women lassitude, and that 36% of all those interviewed presented one or more of the symptoms listed in the questionnaire. This figure approximates very closely to that for the proportion of persons found by mass radiography to have significant lesions with symptoms. In other words, in cross-sections both of the general population and of persons with significant lesions the proportion of those presenting symptoms is the same.

This appears to indicate that symptoms in themselves are not likely to be of great assistance in the discovery of previously undiagnosed pulmonary tuberculosis. It is, however, recognized