for some days. The absence of citron forms, etc., must not be regarded as evidence that *Vibrio septique* is not present in the wound. *Vibrio septique* appearing in a wound showing an active condition of gas gangrene should be considered as a serious finding, whether accompanied by *B. welchii* or alone.

SUMMARY.

1. *Vibrio septique* is a saccharolytic organism clotting milk in three to seven days, without putrefactive or digestive reaction on meat or inspissated serum. It is a strict anaërobe.

2. Spores are readily formed upon all media. They are oval in shape, and central or subterminal in position.

3. The organism is pathogenic for man. It is also pathogenic for laboratory animals (rabbits, mice, pigeons, and guinea-pigs) both in pure culture and when mixed with other anaërobics.

4. In the animal body the lesions are a blood-stained oedema and deep red colour of the infected muscles. The organism also infects the blood stream.

5. Characteristic morphological types of the organism are found in the muscles; these are "citrons," club and bulb-shaped forms, as depicted in Figs. 2-4, and 6. On the peritoneal surface of the liver long snake-like filaments and chains are formed; these are specific to the *Vibrio septique* type among the pathogenic anaërobics at present known.

6. The citrons and also the deeply staining oval or bulb types may be met with in muscle tissue and in the fluid from haemorrhagic blisters in man in cases of active infection with this organism. This affords an immediate and valuable diagnosis, but a failure to find these types does not constitute evidence that the case is free from an active infection with *Vibrio septique*.

APPENDIX.

*Casein Digest Medium.*¹

To a 2-litre flask containing 1 litre of tap-water add 20 grams of anhydrous sodium carbonate. Transfer the flask when boiling to a water-bath and add 200 grams of casein, dusting this in gradually to avoid the formation of lumps; then place the mixture in a large Winchester quart bottle, allow to cool down, and add 3 grams of pancreatin with 15 c.cm. of chloroform. Incubate at 37° C. for five days, shaking vigorously from day to day to break up the crusts that have formed, then add 3 more grams of pancreatin and incubate for ten days longer. After fifteen days' digestion in all the mixture is treated with 400 c.cm. of N/1 HCl, steamed for thirty minutes to drive off the chloroform, and then filtered. The filtrate is treated with 120 c.cm. of N/1 NaOH, and its reaction is adjusted to PH = 7.3, using either the hydrogen electrode or phenol-sulphonaphthalein as an indicator in a Marriott scale. The resulting stock broth is diluted with two parts of 0.5 per cent. NaCl in tap-water before use, the reaction being again adjusted if necessary.

The sugars required can be added to this.

*Serum Agar Sugar Medium.*²

Ordinary agar 75 c.cm., sterile serum 25 c.cm., litmus solution 5 c.cm., to which 1 gram of the required sugar has been added and sterilized by steaming. The medium is made up as for ordinary serum agar.

REFERENCES.

¹ Henry: *Journ. of Path. and Bact.*, vol. xxi, 1917. ² MacIntosh: Special report No. 12, Medical Research Committee.

TREATMENT AND PROPHYLAXIS OF MALARIA.

BY

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A good many articles on the subject of the treatment of malaria have appeared recently in medical journals,¹ evidently because many men suffering from this disease have been invalidated to Europe as the result of the war. A certain amount of apprehension must be felt as to the after-effects of some of the lines of treatment advocated. Time and experience can alone settle the questions raised, but, as a contribution to the subject, I desire to draw attention to a memorandum I wrote for the P.M.O., H.M. Forces in India, in 1901, on the use of hypodermic

injections of quinine in malaria. The method (which was described in a review of the memorandum published in the BRITISH MEDICAL JOURNAL of March 29th, 1902, p. 793) has stood the test of time and experience. Since writing that memorandum (about seventeen years ago) I have had no reason to deviate one iota from the dicta I then laid down. Other medical men who have made independent observations on these statements of mine have corroborated them.

As I have had uniformly good results from this treatment, I think it will be useful to give a summary of it, for it seems to have dropped out of mind. I must in the first place strongly insist that the technique for the hypodermic injection must be carried out as laid down, otherwise grave results may occur. It must not be thought that quinine injections can be given hypodermically in the same free and easy way as a hypodermic injection of morphine. In the second place, I wish to make it clear that I do not recommend intramuscular injections, but hypodermic, that is, below the *cutis vera*, and above the fascia of the muscles.

Requirements.

1. An all glass 20 m hypodermic syringe with stout needles, thoroughly sterilized.
2. Saline solution 0.5 per cent., sterilized.
3. A wide-mouthed test tube about 3 in. long, sterilized.
4. Carbolic oil 5 per cent. and some cotton-wool.
5. Pure quinine bisulphate 4 grains.
6. Spirit lamp.

Method of Subcutaneous Injection.

Prepare the patient's flank between the iliac crest and the last true rib by cleansing with soap and water, and then smearing with carbolic oil on wool (I do not like tincture of iodine if it can be avoided).

(a) Put the 4 grains of quinine bisulphate into the sterilized test tube.

(b) Fill the syringe with the 0.5 per cent. saline solution; squirt this into the sterilized test tube to dissolve the quinine powder.

(c) Heat the quinine solution in the spirit flame till it comes to the boiling point.

(d) Fill the syringe with this boiled quinine solution.

(e) Dip the needle into the carbolic oil.

(f) When the solution cools down to about 100° F., pick up between finger and thumb of left hand (with carbolized cotton-wool intervening) a good lump of the *cutis vera* in the flank; plunge the needle in up to the hilt (eyelet downwards) into the subcutaneous tissue; sweep the point of the needle from side to side through the connective tissue, describing the arc of a circle, thus breaking down any small trabeculae, and freeing the point of the needle from any fat globule it may be in, and then inject all the solution into the space thus formed; withdraw the needle quickly; massage the flank with the carbolized cotton-wool to disseminate the fluid as much as possible.

If the above directions are carried out properly, I guarantee that the patient does not feel the uncomfortable sensation of burning or pain; and, strange as it may appear, many of my patients never know when the injection has begun or when ended; in fact, the only remark they make is that they felt me pinching up their skin!

The injection is to be given—the method described being strictly observed on each occasion—once daily for five consecutive days in alternate flanks. In addition, $\frac{1}{2}$ grain arsenious acid should be taken by the mouth, and also 5 grains (only) of quinine well diluted, in the early morning daily; the arsenious acid and the quinine should be continued for a month.

The treatment described is all that is required for an uncomplicated case of malaria, but the complications of malaria may be manifold, such as congested liver and disordered action of stomach and bowels, with loss of appetite and constipation. Measures for the treatment of these conditions on ordinary lines should be taken, but must be regarded as adjuncts to what I call the specific treatment by hypodermic injections of bisulphate of quinine.

For chronic relapsing cases of malaria, with enlarged spleen and liver, the same specific treatment is undertaken, but the five hypodermic injections are repeated every fortnight (together with local treatment of the "ague cake" spleen, by counter irritation producing a mild splenitis, etc.) till the spleen or liver becomes normal.

An important point to which I wish to draw attention is not to overdose the patient with quinine by the mouth, thereby upsetting the digestion and ruining any benefit he

derives from assimilation of his food, which gives him a chance of building up his natural resistance to infections generally, whether malarial or other. It should be remembered that the malarial patient has been robbed of a good deal of his haemoglobin by the parasite, and this has to be replaced by his own metabolism; therefore his *primae viae*—liver and other organs—should be given a chance of doing their duty, and his digestive system should not be upset by heroic doses of quinine by the mouth. It serves no useful purpose, but only intoxicates the patient and every tissue of his body, and does not produce the full parasitocidal action of quinine, weight for weight, against the malaria protozoon.

For the information of general practitioners and accoucheurs I may state that quinine given by this hypodermic method can be safely administered to pregnant women—at least that is my personal experience of many cases, and I have never heard of any untoward event in such cases in the hands of any medical man who has used it in India.

I have never advocated the intramuscular injection of quinine, for the big doses used produce local necroses (so-called cold abscesses) in the muscle; this statement has recently been verified by Major MacGilchrist, I.M.S.,² by a *post-mortem* examination of a case fatal thirty-six hours after such an injection (11 grains of quinine bihydrochloride) into the gluteal muscle. This case serves as an object lesson to those who advocate the administration of quinine by intramuscular injection.

I saw many cases of cerebral malaria in the German East African campaign in the field far remote from the base hospitals (some of them mistaken for cerebro-spinal meningitis), and most of these cases recovered when treated on the lines recommended by me, by hypodermic injections. I have no doubt the intravenous method, as recommended by Sir Leonard Rogers, would produce just as good results, but it is not practicable for sections of field ambulances to carry about the more elaborate equipment for intravenous saline injections, in preference to the simpler and safer equipment for hypodermic administration, especially in the bush of Africa and similar terrain.

Prophylaxis.

As regards the prophylaxis of malaria, I hold, as do many other medical men, that the daily dose of quinine is not a prophylaxis against malaria; recent investigations and experiments on this question by Lieut.-Colonel Anderson, I.M.S.,³ on gael populations, showed that quinine as a prophylactic was useless and a distinct waste of public money, for the price now of quinine is enormous.

From a scientific point of view I ask this question: "If you state you are sterilizing a medium (that is, cinchonizing the patient's blood) in order to prohibit the growth of a parasite by daily dosing with quinine, and then find that, after all, this parasite does develop in this medium (through some specially enlisted resistance on the part of the parasite to its environments or any other explanation you like), how are you now going to kill (sterilize) by medication this parasite that has learnt to grow in this cinchonized medium? Are you going to increase the cinchonization of the medium by adding more quinine, and thereby teach the parasite to resist further and remain dormant in this medium till such time as he can regenerate?" Obviously the answer is in the negative. Then why do it? For this is the cause of chronic and relapsing malaria, in my opinion; so the only option apparently left to the physician to cure the case is to poison both patient and parasite by heroic doses of quinine and develop in him some other chronic ailment the result of quinine poisoning, the commonest of which is permanent deafness.

Of course it is understood that occasionally cases of malaria gravidarum occur which have to be tackled heroically to save life, but such cases are not now being considered.

The views here stated will, I know, be criticized by those who advocate doses of gr. xv to xx once weekly on Saturdays, or bi-weekly, on the grounds that they have not thereby "cinchonized the media," but have by this means caught the young parasites already there which would ultimately fulminate into a recognized attack if they were not killed. If this theory is right, and really represents what has actually occurred, then of course the answer is that the

dose of quinine given has been not a prophylactic but a curative dose, and if no malarial outburst occurs an actual infection of the parasite in the medium (blood) has been inadvertently sterilized. But prohibition of the infection, which is prophylaxis, has not been accomplished. Moreover this method (gr. xx once a week) has not kept people immune against malaria, and has therefore failed as a prophylactic.

A further criticism I have heard is contained in the theory that although quinine given prophylactically does not actually immunize the patient against an attack, yet it modifies the toxic action of the parasitic infection, so that only a mild attack is produced—as an anti-typhoid injection acts as a prophylactic. Against this theory I advance my practical experience in the East African campaign. I have never seen so many cases of cerebral malaria, haemoglobinuria (blackwater fever), in all my twenty-eight years' experience in the tropics as I saw in East Africa, yet every one who could was taking quinine prophylactically.

Finally, the only prophylactic medication against malaria for armies in the field, in my opinion and experience, on the ground of practical politics, is arsenious acid $\frac{1}{2}$ grain daily, thereby keeping up the natural resistance of the body generally against many ills, not only malaria. There need be no fear of the cumulative action of arsenic, for the troops very often do not get access to the drug, and a break from the drug can always be arranged for one week every month if necessary. It is easier to stop issuing a drug than to supply it regularly.

A golden rule for tackling the question of malaria for the armies in the field is "arsenic as a prophylactic and quinine as a curative only." Yet this is no new precept, for the Italians have done this years ago.

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¹ BRITISH MEDICAL JOURNAL, September 22nd, 1917, March 23rd, 1918, May 11th, 1918; and articles in the *Indian Medical Gazette*. ² Necrosis produced by intramuscular injections of strong solutions of quinine salts, *Indian Medical Gazette*, December, 1917, p. 426. ³ Quinine in malaria prophylaxis, *Ibid.*, 1918, p. 48.

EPIDEMIC POLIOENCEPHALITIS.

(SO-CALLED EPIDEMIC BOTULISM.)

BY

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PART II.

IN considering the nature and cause of the present epidemic of cases, many of them presenting paralysis of cranial nerves, which in a recent contribution to this JOURNAL I have designated as polioencephalitis, it is well to bear in mind—in view of the fact that they have been so widely referred to as cases of botulism—that somewhat similar symptoms may occasionally be the result of diverse causes. In both botulism and polioencephalitis paralysees of cranial nerves are features in common, and Van Ermengem, in his classical paper on the outbreak of botulism in Ellezelles, lays stress upon this point. He states that "in the absence of the previous history" (of poisoning having occurred), "it is impossible to distinguish with certainty cases of botulism from bulbar paralysis (Erb's syndrome), subacute polioencephalo-myelitis, and certain ophthalmoplegias."

Polioencephalitis.

Everybody who has paid attention to the subject now recognizes that there exists an acute primary specific disease affecting the grey matter of the brain, of which sporadic cases are not uncommon. This malady, known as cephalitis or polioencephalitis, was first described by Strümpell in 1884, and, in the form which not uncommonly leads to the development of spastic hemiplegia in young children, is fairly familiar. It is comparable with acute anterior poliomyelitis (infantile paralysis), and, like that disease, often occurs in children, is of acute onset and tends towards recovery. It may or may not be associated with such general symptoms as fever, convulsions, headache, stupor or loss of consciousness, or pronounced irritability. The special symptoms produced by the disease depend, of course, upon the particular region of the grey