treated systematically without delay by accepted methods. The Wassermann reaction is positive in the blood; apparently no secondaries develop. In less than two months the reaction is negative, and the patient feels perfectly well. Almost exactly three months after infection he suddenly begins to suffer from severe headaches, and in the course of a few days develops the characteristic symptoms of acute meningitis. The case is diagnosed as cerebro-spinal meningitis, and is treated for a week with antimeningococcal serum in full doses. Doubts are cast on the diagnosis by the course the disease pursues and by the cytological findings in the fluid, as well as by a consideration of the history of the case. On the eighth day after admission syphilitic meningitis is diagnosed and the fluid subjected to the Wassermann test, which is, however, reported as negative. A fortnight later both in blood and fluid the Wassermann test is found to be strongly positive, and by energetic treatment with mercurialized serum and mercurial inunction the patient makes uninterrupted progress to complete recovery. He is discharged cured not quite four months after admission.

A case of this description presents several features of interest.

1. On clinical grounds a suspicion of the inaccuracy of the original diagnosis was not long in crossing our minds. There was not at any time any pyrexia; there was no vomiting till quite late in the course of the case; sphincter troubles were conspicuously absent; no rash was observed. Further, in the average case of cerebro-spinal fever the patient either sinks into coma with comparative rapidity, or becomes quickly cheerful as he improves; in other words, by the close of the first week there is usually adequate indication of the course the case is going to take. Yet in ours the patient remained for some weeks practically in the same state as on admission. He had neither restlessness nor delirium, except for a few hours at a late stage, and was perfectly rational throughout. Where cerebro-spinal meningitis becomes chronic the meningeal signs—retraction, rigidity, etc.—are as a rule very marked; emaciation is pronounced and incontinence of common occurrence. None of these phenomena was present in our case.

It may be regarded as certain, then, that the clinical aspect of the case was from the outset felt to be anomalous for cerebro-spinal meningitis.

There is a conflict of opinion as to the possibility of differentiating acute syphilitic meningitis clinically from other varieties. Desnos¹⁴ thinks it is not to be distinguished; Bronstein says the ordinary meningeal symptoms are less developed and less marked; little change in pulse or respiration occurs; the evolution is irregular, with exacerbations and remissions. De Coudé declares the symptoms are those of an ordinary diffuse meningitis, resembling tuberculous meningitis. We have already commented on the features of the case here recorded, which in our opinion separate it clinically both from cerebro-spinal and tuberculous meningitis; whether these are pathognomonic or not, whether they are exceptional in acute syphilitic meningitis or not, whether they were conceivably modified or not by the first week's treatment with antimeningococcal serum, we are not able to determine.

2. The findings in the fluid call next for remark. In none of the many examinations were cocci ever found; on the first occasion there was an unmistakable excess of lymphocytes, with a few "polymorphs." It has been shown that thereafter the fluid varied, becoming predominantly polymorphonuclear, and later again markedly mononuclear. In this connexion it is of interest to note that in Claisse and Joltrain's case the fluid was at first typically lymphocytic, after two intraspinal injections of colloidal mercury it became polymorphonuclear, and subsequently lymphocytic again. The question thus arises whether the injections of antimeningococcal serum exercised a modifying influence on the cytological content of the fluid, notwithstanding their non-specific action in this case. It is our opinion that the polymorphonuclear character of the exudate was due to the administration of antimeningococcal serum, as in our experience every case in which, owing to the suspicion of cerebro-spinal fever, this serum has been administered, has shown this polymorph reaction even when the suspicion has subsequently proved to be groundless.

The lymphocytosis is not of itself different from what is

found in the tuberculous variety. De Coudé holds that in cases where the acute form of syphilitic meningitis occurs as an exacerbation from the chronic invasion of syphilis a lymphocytic finding may change to polymorphonuclear. Di Porto¹⁵ says the fibrin reticulum constantly found in tuberculous meningitis is not got in the acute syphilitic type, but we have no information on this point.

When the Wassermann test was first done in the fluid on November 19th, the result was negative; a fortnight later it was strongly positive. The sole comment we feel justified in making is that owing to unavoidable exigencies the examinations were made by different pathologists.

As far as treatment is concerned we desire to record the satisfactory results of the use of Mulford's mercurialized serum by the intraspinal route.

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THE TREATMENT OF WOUNDS INFECTED WITH *BACILLUS PYOCYANEUS*.

BY

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INFECTION of wounds by the *Bacillus pyocyaneus* is comparatively common. Sometimes the patients arrive with the wounds already infected; on the other hand, the infection often develops some time after admission. Infection may be from some previously infected wound, or it may arise from the use of infected instruments or apparatus, especially arm baths. There is also reason to suspect that some wounds are already infected with this bacillus, but owing to the presence of other organisms its growth is impeded and the characteristic appearances of the pus are not present until the local conditions of the wound become favourable for its free growth. The virulence of the organism appears to vary considerably.

Characters of an Infected Wound and Condition of Patient.

1. The suppuration is profuse, and it has a characteristic bluish-green colour which varies considerably in shade, and which stains the dressings and also very often the patient's skin.
 2. There is a characteristic offensive, musty odour.
 3. When this infection appears it tends to extend to other wounds in the same ward, although careful precautions are taken.
 4. When it has once appeared in a wound it is very difficult to eradicate, and the healing of the wound is often greatly impeded.
 5. There may be an intractable diarrhoea due to infection of the intestinal tract, presumably of septicæmic origin, and in one case recently *B. pyocyaneus* has been isolated from the blood.
 6. As a result of the prolonged suppuration there may be considerable weakness and anaemia.
- Owing to the above facts wounds infected with this organism have been in some hospitals isolated and treated in separate wards. The infection is not dangerous to life, and as a rule eventually the cases do well. Indeed it would appear in most cases that the wound must be granulating and showing signs of repair before the organism can grow sufficiently freely to produce the characteristic pus. Many cases in which routine bacteriological examination of pus shows *B. pyocyaneus* without clinical signs of infection have later quite suddenly discharged pus of characteristic colour and odour. Hence the infection frequently appears in wounds that are regarded

as doing well, but in which the local condition is favourable for the growth of the *B. pyocyaneus*.

Treatment of Wounds infected by Bacillus pyocyaneus.

In the autumn of 1915 cases of "blue pus" were isolated at the hospital in which we are serving, and in September there were between thirty and forty. Eusol had just been generally adopted as an antiseptic, and was used systematically in the form of baths, soaks, and for syringing in these patients. The results were disappointing; eusol appeared to have no more effect than hypertonic saline, carbolic, and other lotions previously employed.

In June, 1916, I was led to try hot eusol fomentations owing to some successful cases in which a very foul odour had been overcome in this way.

The first case on which this treatment was employed was a case of gunshot wound of the thigh and compound fracture of femur. This man, wounded June 5th, admitted June 9th, was doing very well when, on June 18th, marked and characteristic signs of infection by *B. pyocyaneus* appeared. With four-hourly eusol fomentations the colour and odour had completely gone in twenty-four hours, and the suppuration was very much less profuse. Eusol soaks were then substituted, with the result that on June 26th a faint coloration again appeared; twenty-four hours' treatment with hot eusol fomentations caused this to disappear, and it never recurred. No cultivation was taken before the eusol fomentations were started, but several were taken afterwards, and no *B. pyocyaneus* was ever found.

The second case was a patient admitted on June 3rd to the same ward with a perforating wound of the right shoulder fracturing the acromion and head of the humerus and opening the shoulder-joint. He also was doing very well when, on June 17th (suggesting infection from the preceding case), a marked and characteristic colour and odour of the pus suddenly appeared and a bacteriological examination showed a profuse growth of the bacillus. Here also with eusol fomentations the colour and odour completely disappeared in twenty-four hours and the discharge was much less profuse, but in spite of the absence of clinical signs cultivations still showed a slight growth of the bacillus. The fomentations were continued for a week when a return to eusol soaks led to a reappearance of the characteristic signs, so fomentations were resumed, with immediate disappearance of colour. The pus remained of a creamy colour until the man left hospital, but the organism, as shown by bacteriological investigation, was not completely eradicated.

Since these two cases every case of a wound infected by *B. pyocyaneus* has been promptly treated in this way without isolation. There were not altogether more than about twenty-five cases in the succeeding five months, and never more than two cases at the same time in any ward until recently, when in a small ward containing five wounded German prisoners four cases appeared practically simultaneously. Of these, when treated with eusol fomentations, two rapidly cleared up, one cleared up but recurred slightly on omitting the fomentations, while the fourth, a deep penetrating wound of the knee-joint, though very much improved still showed pus tinged with a slight blue-green colour.

The two cases first mentioned in some detail were both in a ward containing forty-two beds, at the time all occupied by wounded men, and no further cases appeared while they were in hospital. Hence it would seem that when the infection is promptly recognized and treated in this way the tendency to spread is very much diminished.

Clinical Conclusions.

The results of the treatment of these cases by hot eusol fomentations may be summed up as follows:

1. In many cases, especially in superficial wounds and where drainage is free, all clinical signs of infection by the *B. pyocyaneus* disappear within twenty-four hours or even less.

2. In a considerable number of cases a faint coloration of the pus persists for some time, often to such a slight extent that if the wound was not known to have been infected the presence of the organism would not be suspected.

3. In either of the above groups, if the colour should reappear after the fomentations have been omitted, they should be at once recommenced. In any case the fomentations should be continued for some days after all characteristic signs of *B. pyocyaneus* infection have disappeared.

4. Complete disappearance of the clinical signs and eradication of the bacillus is more likely in superficial and widely open wounds. A faint coloration of the pus is more

likely to persist in deep and sinus-like wounds, such as compound fractures; in these complete eradication of the bacillus will be more difficult or impossible.

5. It would certainly appear that the tendency of the infection to spread is very much diminished. This is the case even when a slight tinge of colour persists or when cultivation still shows the presence of the organism.

6. It is quite safe to treat these cases in an ordinary ward with other infected wounds provided that ordinary precautions, such as dressing these cases after other cases, are taken.

The question now arises as to whether the action of hot eusol is merely a bleaching action simply decolorizing the pus, or whether it really has any action in hindering the growth of, or actually destroying, the organism. That it has a bleaching action on the colour is certain, and is easily proved. It is only necessary to take a cultivation in the laboratory, and add a small quantity of eusol which has been heated nearly to boiling point. In a few seconds the colour, except in the deeper parts of the medium to which the eusol takes time to penetrate, completely disappears. Cold eusol does not have this effect. That it has some effect in destroying or diminishing its growth and virulence appears certain from the clinical facts noted above.

The treatment with hot eusol fomentations of wounds infected by *B. pyocyaneus* has a marked effect on the virulence of the organism in question. One point which has been noticed is the difficulty experienced in obtaining any pigmentation of the medium in a culture derived from a discharge of a wound which is receiving hot eusol treatment. Numerous subcultivations are necessary to restore the colour-forming properties of the organism, and one is not always successful in bringing back this characteristic feature of *B. pyocyaneus*.

Another point is that the actual growth of the organism itself is not so profuse after hot eusol treatment as it is after treatment with saline or other dressings, and also that after the former treatment one has sometimes noticed a certain tendency of the organism to die out on cultivation.

Summary of Bacteriological Results.

The results of a large number of bacteriological investigations may be summed up as follows:

1. In some cases the pus may have a bluish-green colour and an offensive odour, and yet no *B. pyocyaneus* can be found even after repeated cultivations. In these cases diphtheroid organisms are found, and it is possible that these are responsible for the colour and odour of the pus. On the other hand, it is very likely that the *B. pyocyaneus* is present but that its cultivation and recognition are prevented by the other organisms present. These cases clear up rapidly when treated with hot eusol fomentations.

2. In many cases the *B. pyocyaneus* has been found on bacteriological examination of a wound which shows no clinical signs whatever of the infection and in which its presence was unsuspected. On one occasion the pus from a wound of the foot had a bright orange colour; a cultivation was taken to ascertain the nature of the infection, and the result showed a profuse growth of *B. pyocyaneus*. This supports the view that many wounds may be infected, but that a certain stage of healing or other local condition may be necessary for the profuse growth of the organism and the production of the ordinary clinical signs.

3. If cultivations are taken from infected wounds while the treatment with hot eusol fomentations is in progress there is an evidence of decreased virulence, as shown by slower growth and by diminished and slower production of colour.

4. In some cases if cultivations are taken every two days the organism may entirely disappear. This is more likely to be the case in shallow and superficial wounds, and may occur in two or three days or after a slightly longer interval. In deep and sinus-like wounds a faint growth may persist for a very long time, and is usually associated with a faint greenish tinge in the pus. It may also persist in the entire absence of all clinical signs.

5. Complete eradication from deep wounds is difficult. A cultivation may be negative, and even though the treatment is continued and clinical signs absent, later cultivation may give a positive result.

6. Clinical and bacteriological evidence combined show that virulence of the organism varies considerably, and

that a cultivation may show its presence in the absence of clinical signs. Under these circumstances it is practically non-infective, and does not harm other patients or the wound. It is when the clinical signs are present that the pus is infective, and the organism is likely to spread to other patients and seriously to retard the process of healing.

Method.

1. As soon as a wound is suspected to be infected a specimen of the pus is sent to the pathological laboratory for examination. If the clinical signs are definite, treatment by hot eusol fomentations is commenced at once. In a doubtful case the result of the examination may be awaited.

2. The fomentations must be of sufficient thickness and size; they must be as hot as the patient can stand, and must be changed four-hourly. A 5 per cent. solution of eusol heated to boiling point is employed. The wringer should be of canvas or strong calico, since ordinary wringers of linen or flannel are rapidly destroyed.

3. When the wound is deep or sinus-like, or when a slight coloration persists, the wound may be syringed twice daily with eusol as hot as the patient can bear, or packs of eupad powder wrapped in gauze and moistened with hot eusol may be employed in addition to the fomentations. The latter is often very effective.

4. Frequently the odour and colour will completely disappear in twenty-four hours or less, but the fomentations should always be continued for at least three or four days after the disappearance of the clinical signs.

5. When the fomentations are omitted, eusol or saline soaks may be used; but if there is a return of colour and odour, treatment by fomentations must be resumed.

6. A bacteriological examination of the pus should be made every two or three days as a guide to treatment. Cases in which the clinical signs of the infection are absent but the organism is found on bacteriological examination are probably harmless, but it is wise in these cases to continue the eusol fomentations for a long period.

NOTES ON IONIC MEDICATION AND THE METHOD OF ADMINISTRATION.

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LEWIS JONES, in the preface to his handy little book on ionic medication, laid it down that we need not greatly concern ourselves as to whether there is effective penetration of ions or not, but that the procedures he describes have been followed by results of value. From the incontestably satisfactory results obtained by ionization as compared with simple electrolysis, I think it is impossible to doubt that such penetration does take place.

My experience in the treatment of ear disease, for instance, has given me results that I could certainly have obtained by no other method. None of the authorities on middle and inner ear troubles make more than the most cursory mention of electricity as an aid in treatment, and ionization is barely suggested as feasible at all, yet I have found it of infinite value in arresting some of the gravest symptoms in these cases.

Resolution of inflammation, release of adhesions, and general bactericidal action are the things to be aimed at in dealing with the ear. Galvanism has done some good, but the great value of ionization lies in its sclerolytic effect. This can be secured by no perfunctory use, however, and I think the absence of satisfactory results contributed so far is somewhat due to the insufficiency of the technique employed. For instance, it is recommended to ionize the tympanum by the use of a probe tipped with cotton-wool soaked in the fluid to be employed. This is futile; the cotton-wool cannot hold enough from which to derive sufficient ions to be effective. The proper method is to lay the patient's head sideways on the table, and to fill the external meatus with the solution employed, then the current is passed through it, thus ensuring a constant supply of the required ions. A small probe insulated to its tip will carry the current into the solution.

Great relief may be obtained in all classes of middle-ear catarrh in this way by the use of a solution of zinc iodide (30 per cent.) with 3 to 4 milliampères of current.

Zinc iodide is a colourless and stable compound made by boiling zinc and iodine together in water in the proper proportions. It is non-irritative, and soothing in action. Iodine being an anion and zinc a cation the current must occasionally be reversed to get the benefit of both the elements, removing the anode during reversal to avoid the shock. In acute cases the current may be kept on for five to ten minutes, in chronic for twenty.

The relief of pain in the acute cases is very marked after the current has run for a few minutes. In the more recent cases the relief comes speedily, perhaps half a dozen applications suffice; in those of long duration weeks, and even months, are called for, and it is not justifiable to cry off without prolonged trial in the most apparently hopeless cases. Tests with the forks may any day reveal some little amelioration encouraging one to persevere.

A man had been stone deaf for twenty years from labyrinthine trouble in one ear and middle-ear disease in the other, with fixation of the ossicles. I ionized the latter for nearly three months without a sign of improvement, occasionally inflating with compressed air at 20 lb. pressure. Just as he wanted to give up and I was beginning to despair, eighty-five days from the beginning of treatment, he told me he had heard the clock ticking, and on testing I found he had slight aerial audition with the C² fork. At the end of six months he could plainly hear loud conversation, and I sent him back to the bush, as that was the most that could be attained, but it made life worth living.

In the functional deafness caused often by nerve exhaustion, the result of mental trouble, ionization gives much relief, acting in some cases like magic. A man who has great business and family troubles comes to me periodically for an "ear pick-me-up," and goes away hearing and refreshed after two or three ionizations of zinc and iodine *plus* a little faradic.

Many mastoid cases, I am convinced, if taken at a reasonably early stage, can be arrested and operation avoided by ionization with an absorbefacient bactericide. Mercuric iodide (HgI₂·2KI) presents such a compound, and can be administered in 1 in 500 solution for periods of half an hour morning and evening with 5 milliampère current.

A young woman came to me with all the usual symptoms of fairly advanced mastoiditis and I applied this treatment. The pain left her after the second application but returned in the night. That morning I kept her under for an hour and a half; all pain had then gone and she had no return of it during the progress of the case. The swelling and tenderness were very great when she came first, but subsided from the second day; the tinnitus disappeared on the first evening, and, though there was very marked sagging of the posterior wall she recovered entirely within three weeks. She would not allow me to puncture the tympanum. She has no impairment of hearing now, a year after the treatment, and transillumination through the meatus shows no dark area.

The current here, to my mind, clearly carried the ions direct into the mastoid. In purulent otorrhoea this germicidal action is manifested in the rapid diminution of the leucocytes and lymphocytes under ionization by zinc and iodine.

Ionization with a 2 per cent. solution of alum is useful in relaxation of the tympanum. I have used arsenic ions in two cases of tuberculous middle-ear trouble; in one instance without result, in the other with very marked benefit.

The aural vertigo so often indicative of labyrinthine loss of couple, is generally, but slowly, relieved by the mixed continuous ionization and mild faradic current. Labyrinthine tinnitus can also be greatly relieved and often removed by iodine ionization. The positive pad should be placed behind the mastoid, and the current (5 milliampères) sustained for half an hour on alternate days for a week or so. If pain is at any time urgent immediate relief can be given by ionization with cocaine. Morphine will act similarly, but more slowly.

Goitre has been tackled with varying success by radium and x-ray therapy. It yields to ionization in a satisfactory manner, but the treatment is long and tedious.

In a girl of 17 with marked enlargement of both lobes of two years' standing, I got complete recovery after four months' application on alternate days. I used an aluminium anode 6 in. long, 1½ in. wide, curved to fit the neck, covered with four thicknesses of lint kept saturated with 5 per cent. solution of zinc iodide, with 15 milliampères of current for an hour at a sitting.

In another case of many years' standing I have reduced the enlargement by half after twelve months' work, and, as it is slowly but steadily decreasing all the time, I hope to get it down entirely.