Conclusions.

1. The average of both the systolic and diastolic blood pressures on the days after injection is generally lower than before injection, the fall in the systolic being slightly more marked than in the diastolic pressure. This fall, however, is very probably not a direct result of the action of neo-salvarsan, and, in part at least, may be due to rest in bed.

2. The blood pressure seven hours after the intravenous injection of neo-salvarsan is usually lower than it was before. The fall in the diastolic pressure is slightly less than that of the systolic pressure. The fall cannot be explained as due to fever.

3. As compared with the blood pressure taken seven hours after the intravenous injection of neo-salvarsan, the average of the blood pressure estimations on subsequent days is usually lower. This is more marked in the diastolic than in the systolic blood pressure.

4. During the actual intravenous injection of neo-salvarsan both the systolic and diastolic pressures are nearly always higher than on other occasions. This appears to be due to excitement. During the operation the pressures may vary considerably, the systolic blood pressure being more affected than the diastolic.

5. The blood pressure before the first injection of neo-salvarsan is nearly always higher than the blood pressure before the second injection of neo-salvarsan, but here again mental excitement may be responsible.

6. Finally, the general effect of intravenous injections of neo-salvarsan is rather to lower, certainly not to increase, the arterial blood pressure.

NOTES ON THE TYPHUS EPIDEMIC IN SERBIA, 1915.

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From March 1st to the end of April, 1915, about 1,800 cases of typhus passed through our hands. It is impossible to form anything like a correct estimate of percentages with regard to deaths and sequelae, for the hospital was seriously handicapped by reason of the dearth both of nurses and medical attendants. So far as hospitals were concerned, the epidemic was almost entirely neglected during the first three weeks. So great was the mortality among the native doctors that the few who could be induced to take charge of the General Fever Hospital had to leave the supervision and treatment of patients almost entirely in the hands of the orderlies.

Hospital Organization.

When the Sixth Reserve Hospital was taken over for the purpose of isolation and treatment of these cases it was considered unjustifiable to detach nurses from the existing units, inasmuch as most of these nurses were surgical nurses whose services were required elsewhere. It thus happened that during the earlier days at the Sixth Reserve Hospital the nursing was left in the hands of three volunteers from the surgical unit. Two only of these were fully qualified nurses; the third was a probationer. These three nurses, together with one doctor, were left to cope with the typhus outbreak.

With such a staff it was, of course, impossible to provide adequate treatment, and so it was necessary to enlist in the work some Serbian soldier orderlies and a number of Austrian prisoners, and as a necessary precaution only orderlies and prisoners who had had typhus were selected. The wards one by one were emptied, scrubbed and washed with disinfectants, and the ceilings, walls, and floors were afterwards brushed with petrol. This cleaning was done twice weekly afterwards throughout the entire hospital buildings. The Austrian and Serbian attendants were, with a few exceptions, thoroughly washed, bathed in disinfectant, and given clean clothes. They were then isolated and not allowed to come into contact with anybody, save those in authority or patients under supervision. It was hoped in this way to avoid all contamination, and we found that only one case during the first few weeks became reinfected by vermin. A certain number of the orderlies were not disinfected, and these were given the charge of the admission of patients to the wards. To them was left the duty of unclothing the patients, shaving their heads, and passing them through the bath of disinfectant. From the bath of disinfectant the patients passed directly to the clean orderlies, who wiped them down and gave them clean night things. They were then sent to clean beds. We invariably carried out this method of handling new arrivals. As soon as we had a sufficiency of the requisite combination garment (to which reference will be made later) to distribute throughout the hospital staff, all the orderlies were disinfected, as they were enabled to maintain their cleanliness by discarding their clothes after each admission.

In the early days the conditions under which all the foregoing was performed were extremely primitive. The patients were disrobed on the steps of the pavilion in the open air, and passed into the hall—the antechamber to the wards—where they were immersed in a disinfectant bath, after which the "disinfected orderlies" took them at once into the wards. Later on, when the colony included two excellent cadet schools, we were able to take over the outside offices—kitchens, baths, and wash-houses—and here, in these outbuildings, the patients received the same treatment as above, but under much more favourable conditions.

It is unnecessary to dwell upon all the difficulties that we encountered in this procedure, such as shortage of water, and occasionally the inability of the Serbian authorities to give anything like proper notice of arrivals. The staff in the earlier days was driven to distraction by the difficulty of trying to uphold the ideal of scrupulous cleanliness as regards patients admitted. Realizing all these difficulties and how gravely we were understaffed, it is not surprising that during the first three weeks we could not perform any autopsies or bacteriological investigations. It was only later, when we obtained the services of Dr. Bellingham Smith and Dr. Daylell, and an efficient staff, that we were able to undertake this work. With our full staff—two doctors and Dr. Daylell, the bacteriologist, and twenty-six nurses—we were able to introduce order and provide adequate treatment.

To prevent lice getting into underwear it was necessary to improvise suitable garments—not such an easy matter, since the necessary tailoring was not to be had. At first we tried a jacket fitting high in the neck, long sleeves to button securely over the wrist, trousers fastening round the waist with string, and the legs tucked into high rubber boots. Finally I decided upon a sort of combination suit which answered admirably to all requirements, and was especially welcome in the hot weather. It was made in one piece, fastening at the neck like a bathing suit—that is, by two buttons on the shoulders, the trousers ended in feet which were slipped into sandals. To protect the hands, rubber gloves (previously boiled) came up well over the wrists. We made it a rule that all the staff should wear this outfit. Changing-rooms were provided, the combination suit being put on before going into the wards, and removed when going off duty.

Symptoms and Course.

As is always the case when one meets with diseases with which one is unfamiliar, one is inclined to dogmatize on the first few cases, but in reviewing to-day all the cases which passed under our notice, one finds it extremely difficult to give anything like a clear-cut picture of this fever. For instance, one hesitates now to conclude that the gravity of the case was indicated by the severity of the exanthem, or to presume that if the first fortnight passed without incident the prognosis was good. Inferences such as these were in course of time corrected. So far as possible one ought to abstract from the many cases, and give a typical example.

The incubation varies from five to fourteen days, but usually it is a period of twelve days—an onset of two days and a fever of sixteen days resolving in lysis. At the onset the patient shows no more discomfort than he does with an ordinary common cold. He may feel slight headache, a little pain in the back; he may lose his appetite, but for two days he does not show anything very suggestive. It is only on review that he remembers that he was somewhat out-of-sorts. On the third day these symptoms become aggravated, and he may now begin to suggest the typhus facies. He is not yet feeling sufficiently

unwell to take to his bed, but he has no inclination whatsoever for work, and by the following day, probably, definitely takes to his bed. Now the typhus facies is almost universal. If asked to distinguish it from the facies which goes with a common cold, one might say that it differs only in the respect that the secretions, instead of being excessive, are suppressed, and that as a consequence the nose and lips do not present the slightly swollen appearance they have in the common cold; otherwise the face is flushed slightly and the eyes are unquestionably congested, the vessels being decidedly injected. It is, perhaps, this absence of swelling of the nose and lips and the presence of the congestion elsewhere that makes all those who come in contact with typhus expert in distinguishing it by these features alone. The pulse is the only other feature which is at all distinctive. Its rate is slightly increased, it remains rhythmic and regular; with a large amplitude to the wave, its tension is low.

The skin looks slightly reddened all over, and frequently shows a kind of watercourse appearance, red channels running in every direction, confluent and often so diffused as (when not closely examined) to give merely an appearance of erythema. The urine is unchanged, there is no great increase in urates, and no albumin at this period. The bowels are slightly inactive and the appetite is poor. The thirst is from the first excessive. There are no physical signs to help one at this stage. The spleen is not enlarged. On the fourth or fifth day there appear for the first time some rose spots, widely separated and located variously over the abdomen, the lower part of the chest, and on the anterior surface of the shoulder. The patient is now beginning to look seriously ill. He is lethargic, his movements are sluggish, and he is almost comatose. From this time onwards his mouth is the greatest source of trouble. Sordes appear, and unless the mouth is carefully washed its foul condition is the beginning of various sequelae—parotitis, laryngitis, and otitis media. At the very best there is always a certain hoarseness and a certain amount of deafness. It is common at this stage also to find the urine suppressed for two or three days and then afterwards to find the urine displaying albumin and casts. For seven to ten days this condition goes on practically without change. The patient remains lethargic, seems dull and stupid, and almost comatose. He becomes markedly constipated, frequently wets his bed, and his mouth throughout the whole of this time requires constant attention. After this the patient begins slowly to recover, and at the end of the fourteenth day frequently shows a crisis which turns out to be a remission, the fever running up again for two or three days to decline afterwards in lysis. From this point onwards the patient again slowly recovers, and may, at the end of another week, begin to show a healthy and voracious appetite, a clear mind, and a considerable contentment. He is, however, distressingly weak; all his muscles are flaccid and his heart is readily upset.

Severe Types.

The two morbid types which we found to defeat all treatment were, first, those we called fulminating, and secondly, those exhibiting circulatory stasis.

Fulminating Cases.

Beginning in the ordinary way, the great difference between these and the normal cases took place about the second or third day after a rise of temperature had set in. It is from the observation of these cases that one is well advised to take the deposition of all patients before they lose consciousness, since these fulminating cases never recover consciousness. The patient passes into a deep coma. He displays very marked and exaggerated twitchings—subsultus tendinum. He mutters, picks at the bedclothes, his face is markedly congested, and his eyes are frequently nystagmic with a squint. He has no control whatever over his sphincters, and usually within three days or so he dies.

Cases exhibiting Circulatory Stasis.

The next class of cases, in which the mortality is, perhaps, as great, is infinitely more disappointing. Patients in this class seem to pass through the whole fever without incident, so that one is justified in presuming that everything is well, when there begins, about the twentieth day or so, typical circulatory stasis. The feet frequently become blue, the pulse small and thready; sometimes gangrene sets in, and the patient dies as if from asthenia.

These two types are the two morbid types. If one might venture to generalize, one might say the full plethoric individual is the more liable to the fulminating attack; the second is the type which affects and causes a great mortality among the older men, and, curiously enough, chiefly among the Austrians. It suggests inability of tissue recuperation, through senility of tissue in the older men; in the Austrian prisoner, devitalization of tissue through exposure, want, and depression. The impression that these cases leave with us is that the toxin is overwhelmingly potent, and affects all the tissues equally. There does not seem to be usually a selection or a nidus, except in the fulminating cases, where the toxin undoubtedly appears chiefly to irritate the cerebral cortex—in fact, the whole appearance of the patient makes one feel that he is of essentially low vitality, that all his tissues are depressed, particularly his musculature. As evidence of this he betrays hardly a movement. The tongue, for instance, which in health is constantly undergoing movement, lies in the mouth as if dead. It is no wonder that in such a septic cavity as the mouth, when the secretions are suppressed, there is such extensive vegetable formation to account for the sordes which is always present.

Concurrent Disturbances.

Now, as regards the variety of coincident troubles that may develop in the course of this fever. In early days, when we were unable to provide individual treatment, we found that a large number—probably between 20 and 40 per cent. — displayed either parotitis, otitis, conjunctivitis, or laryngitis. One, some, or all together. On examining the patients the absence of spots did not permit us to exclude typhus—it was enough to find a patient unable to speak, almost deaf, or with a swollen gland or discharging ear, to make one suspicious that the disease was due to typhus. These symptoms alone were sufficient to justify us in placing the man under observation.

The Exanthem.

The spots usually described as typical of typhus were not characteristic in the majority of our cases; a minority of cases showed the typical form—that is, a rose spot about 1 mm. in diameter with indefinite edges, sometimes raised, sometimes impalpable. This rose spot occasionally became purplish, and was then definitely haemorrhagic, no longer disappearing on pressure. A careful look-out for the first appearance of the exanthema will reveal the fact that it is first found on the upper segment of the abdomen, just as in typhoid; at a later stage only is it found extending up the chest and on to the shoulders. The majority of cases are protean. Very few of the spots become petechial; the majority vanish before that stage. This is the rule. Then, again, the time of persistence of the rash varies extraordinarily. Some spots behave in the orthodox manner, but they may be so evanescent as to elude observation altogether. It might be only that the case presented other distinctive symptoms that one was able to decide on the diagnosis at all. Again, the exanthem is by no means invariably a spotted rash; it presents occasionally a kind of watercourse appearance (already described), or a general erythema. Only in about two or three cases did we see a definite spotted rash extending over the entire body, with the exception of the face, the palms of the hands, and the soles of the feet. These cases were, it is true, unusually severe—in fact, fulminating cases; but there were fulminating cases without this extensive rash, so that one must not be led to the conclusion that the extensiveness of the rash was in proportion to the severity of the toxaemia. On the contrary, we found that the toxaemia was equally profound in evanescent rashes, so that it would be unwise to lay down rules with regard to the prognostic value of the rash.

One may say with regard to the concurrent disturbances associated with typhus that these may be removed to a great extent by careful nursing. One of the points which we insisted on was that the mouth should be most rigorously attended to. The mouth was washed out with

some solution, such as permanganate—the only disinfectant we had in any quantity in the earlier days; later, when we had supplies, hydrogen peroxide was substituted, and, as a result, parotitis, otitis, and other naso-pharyngeal disturbances disappeared. Constantly swabbing the back of the throat considerably ameliorated the condition of deafness. Patients who were able were taught to gargle periodically throughout the day, and as a result the laryngeal trouble was improved.

Circulatory Disturbances.

Another condition which caused us much anxiety, and which occurred frequently in asthenic cases, was the circulatory trouble. For a considerable time we were unable to account for this. All that we noticed to begin with was that the feet and hands became blue and cold, and the pulse small and thready, indicating a general cardiac failure. But, apart from this, we found that we had to deal with local degenerative troubles. Patches of redness usually appeared on the feet, active congestion evidently occurring there, and later this was followed by patches of gangrene. Sometimes the toes would be symmetrically affected, would disorganize and fall off. We had two cases in which the nose was affected. The fingers, though frequently showing the earlier signs, never, in cases under my observation, went on to gangrene, but, in fact, completely recovered.

The general plan adopted in these cases was that, when the feet showed coldness and blueness, hot-water bottles were at once applied, and a supporting treatment was also adopted. Strychnine and digitalis were frequently injected, brandy occasionally administered, and, when possible, massage was given. If the condition of the extremities did not improve under this treatment but proceeded to redness, then evaporating lotions were applied, and these measures met with a fair amount of success.

If one were to form a surmise one might venture to say that the extremities were the parts most likely to become morbid, in view of the fact that they were the parts exposed to the detrimental action of frost and cold in the trenches, and that in all cases it might be said there was a previous degenerative disturbance due to long exposure to cold. It is well known, for instance, that a frost-bite, once obtained, leads to a tendency to recurrence under conditions which would not otherwise produce a frost-bite, and so in this condition we have such a grave circulatory disturbance that with the acute toxaemia of the disease and the preceding history of frost-bite there was a sufficient local disturbance to bring about a further depression of the circulation and a condition of gangrene.

Temperature.

On the second or third day of the onset of malaise the temperature gradually rises, until it reaches 103° on the fourth or fifth day. This temperature is continuous, occasionally rising to 104°, until it ends in lysis. In some cases the temperature is remittent, and these, together with the fulminating cases, are the types which give the most anxiety. The cases with remittent temperatures caused the greatest anxiety after the subsidence; they were probably due to the associated cardiac disturbance—the failure of the cardiac muscle to respond to the toxins. The fulminating cases usually displayed continuous temperatures.

Pulse: Respiration.

The pulse was never very rapid and was usually associated with the temperature. The respiration was, however, frequently entirely disassociated with the temperature and pulse, and in some cases, until we gained larger experience, this disassociation with the temperature and pulse caused us grave anxiety. We felt it represented a definite local toxaemia of the medulla and to be the prelude to dissolution. Fortunately, however, with a wider experience we found that this disassociation was not a grave matter. A pulse of 98 and a temperature of 101° was occasionally combined with a respiration of 45. There never was the least sign of pulmonary stasis, and this is one of the most remarkable features of the typhus epidemic, considering the amazing depression of all the tissues together with the cardiac asthenia, that congestion and oedema of the lungs was not more frequently met with. In very few cases indeed did we know of any lung trouble at all, and these were only due, it was said, to secondary invasion. In only one case under my observation did we get a bronchopneumonia, which is usually considered a frequent sequel, a result of the extension of the infection of the organism from the mouth down the larynx into the bronchi.

TREATMENT.

Finally with regard to treatment. A supporting diet, which usually included soups, Benger's food, Horlick's milk, and so on, was administered for the first fortnight. Occasionally brandy was given, but not often. There is a great prejudice in the Balkans against the use of brandy for typhus. One must acknowledge the right of the local opinion in this matter because of the considerable experience they have of the local form of typhus; they declare, and we think with good reason, that alcohol in any form aggravates the cerebral symptoms, which are such grave and important indications of brain toxaemia.

It must be remarked, therefore, that the next point in treatment which they always insist upon, and which is a corollary of the above, is the application of ice to the head. Ice was placed on the head from the onset, and maintained there until the subsidence of fever, and, if one can generalize at all, one may say with the greatest benefit. As has been stated, the mouth was attended to every half-hour throughout the day. In some cases sordes collected almost as quickly as it was wiped away. The patient was always moved very carefully, and turned from side to side to avoid bedsores, which occurred with amazing frequency considering the short duration of the decubitus. The extremities were kept warm. There was of course the greatest insistence on fresh air, and the window frames in the wards were removed. This appeared to the majority of patients to be, of all things, their greatest hardship when the icy winds of March were blowing through. In fact, patients of all classes in the Balkans always cover their heads when going off to sleep, and it was the duty of the nurse to see that their heads were uncovered, and that breathing was free and comfortable. At one time we thought that if we were to insist sufficiently on the principles of fresh air we should do much to diminish the virulence of the toxaemia, but we are unable to say that it had that profound effect we anticipated. The tradition of typhus is that it is associated with filth, overcrowding, and the absence of fresh air, and of course it was believed that if one could provide cleanliness, space, and fresh air, one would do much to diminish the virulence of the fever. But our experiences went to show that here fresh air was not apparently the potent factor that it is advertised to be, though naturally fresh air in all disease is a *sine quâ non*.

ARTIFICIAL PNEUMOTHORAX IN THE TREATMENT OF PULMONARY TUBERCULOSIS.

A CLINICAL STUDY OF EIGHTEEN CASES.

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THE object of this paper is to give a brief account of our clinical experience at Tranquille in the treatment of pulmonary tuberculosis by compression of the lung with artificial pneumothorax in a series of 18 cases. The literature on this subject during the past two years has been very extensive, and the selection of cases, results obtained, and obstacles to be overcome in the use of artificial pneumothorax are still too much in the formative stage for any one to be too dogmatic. It is through correlating the experience of many independent observers in different circumstances that we can hope to ascertain the true place of this procedure.

Artificial pneumothorax was first used by us at Tranquille in December, 1913, and since that date we have tried to give 18 patients this treatment. The apparatus used was a modification of the Floyd-Robinson.[1] We were forced to make our own apparatus as a matter of economy, and have found it to work quite satisfactorily. At first we used nitrogen gas obtained by abstracting the oxygen from the air by pyrogallic acid and potash solution. After reading the research work of Webb and others[2] we came to the conclusion that sterile air would be quite as good and less troublesome, and for some months past we have been using