citrate solution, in the proportion of 2 ounces for a pint of blood (1:10). This gives finally a citrate percentage of just under 0.5 per cent., which we found gives a safe but not excessive margin against clotting. It is essential to ensure adequate admixture of citrate with blood either by stirring or by agitation of the contents of the vessel. It was found convenient to stock this citrate solution ready autoclaved in 2 oz. (60 c.cm.) quantities, ready for use. If a hollow needle be used the internal diameter should be from 2 to 2.5 mm., and the length about 4 cm., and it is absolutely essential to have the needle very carefully and recently sharpened; an incision through the skin is an advantage before inserting the needle. Should there be any doubt about the sharpness of the needle, or if the donor's vein is not well swollen, time is saved by exposing the vein and inserting the glass cannula; it was not found necessary to line either cannula or needle with paraffin. Care is needed in adjusting pressure to donor's upper arm, sufficiently but not too strongly, so that a brisk stream of blood is ensured. This is readily accomplished by the use of a blood-pressure armlet adjusted to about 50 mm. pressure.

The citrated blood, kept warm at 40° C., was then run into recipient's vein by means of a simple funnel, tube, and glass cannula as used for saline infusions.

The apparatus required is quickly prepared for use, and the method is at least as free from pitfalls as any other we have tried.

It was found that donors felt little ill effect from the loss of a pint of blood, but that further withdrawal soon disturbed them. In view of the large number of donors utilized it was felt undesirable to take much beyond this quantity as a rule; in order to increase the blood pressure rather more, we adopted latterly the practice of adding to the pint of blood a pint of other fluid, preferably gum solution. This was done from motives of economy in donors solely, and would only be advised when the degree of blood loss was not extreme. In such cases two pints of blood would be indicated, and two donors of the same group might well be used.

In a few very severe cases a second blood transfusion was given later after operation with very beneficial effect.

From a review of this collection of cases it can only be deduced that blood transfusion has a distinct advantage over gum infusion. Analysis of both pre-operative and post-operative cases gives this impression, and previous independent experience of one of us (R. C.) with forty blood transfusions, and the other with a similar number of gum infusions, also favoured the former method. At the same time it is recognized that no two cases are alike in respect of their wounds, their powers of resistance, and the circumstances of exposure and infection.

There is certainly a class of case which derives sufficient benefit from gum infusion; on the other hand, some patients who when treated with gum infusion failed to improve showed great benefit from a subsequent blood transfusion. Our experience in such cases points to the necessity in these severer cases of haemorrhage for proceeding without delay to a blood transfusion. Some cases of pure shock without loss of much blood seem to derive no benefit, unfortunately, from either method.

In abdominal cases, where haemorrhage was the important factor, blood given after operation—or, if more urgently needed, during the operation—undoubtedly saved lives; formerly this type of case after operation failed to rally, and died. One of us (R. C.) had two such cases lately; after operation and before transfusion the pulse rate was 150 and pulse volume poor. In each case a litre of blood was transfused; twelve hours later the pulse was of good quality, ranging between 90 and 100, and each patient made an uneventful recovery.

We are quite opposed to the indiscriminate use of blood transfusion when other methods may be confidently expected to suffice, but we are convinced that there is a class of case in which blood transfusion is the only known treatment likely to succeed, and for such the use of donors and their blood appears amply justified both from the medical and the military standpoint; it is no light thing for the soldier to know that every resource, including blood transfusion, if necessary, will be invoked to bring about recovery of his wounds.

Reference to the table of the results of intravenous treatment shows a uniformly lower proportion of failure with blood than with gum, and if the severe abdominal cases and gas gangrene deaths be eliminated, this difference is only accentuated.

This analysis leads inevitably to the conclusion that blood transfusion had greater value than gum infusion, and the fact that in this series blood was given only to

cases which appeared in worse condition tends to make the contrast stronger.

With either method there is usually an immediate response in the pulse rate and quality, but general improvement is by no means always obvious at once; it would be a mistake to judge the value of either treatment only by the immediate effect; the condition of the patient three, six, or twelve hours later is more important than his state five minutes after the fluid has entered his veins; and, judging by this later clinical condition also, the advantage of blood over gum has impressed us.

We have not seen in this series any ill effects ascribable to gum infusions, though these are spoken of by some surgeons; nevertheless, it is well to emphasize the great importance of running the gum in slowly—about fifteen minutes for 500 c.cm. is not too slow; if this precaution be not taken, vomiting, rigors, and athetotic movements are likely to occur. When slowly administered at the proper temperature (37° to 40° C.) the infusion has more often than not a distinctly sedative effect.

Resuscitation work has its depressing side—many cases are brought in obviously moribund—but its successful side renders it undoubtedly worth while.

If there be a shortage of surgical teams it is difficult to arrange for the adequate working of such a ward, for it is hardly practicable to remove a surgeon from the theatre, where he can operate upon, say, twelve cases in twelve hours, in order to spend his efforts on fifteen to twenty badly wounded men, of whom at most seven or eight can possibly be saved by present known methods. Further, if there are insufficient operating surgeons, operable cases will have to be sent to the base for operation, and these very cases may arrive there in condition as acute as those which needed resuscitation at the casualty clearing station, so that in present circumstances one cannot look to the skilled surgeon to do this work.

It is for the administrative authorities to consider whether the necessary medical officers for this work can be found elsewhere; their services can be very valuable in this field.

Conclusions.

1. Resuscitation methods such as have been developed during the war are of the utmost value in war surgery. It is evident that these methods will be equally applicable in the everyday surgery of accidental injuries and in obstetric work.

2. Gum infusion is an advance on the infusion of normal saline, and may enable a patient who has not lost blood excessively to be operated upon successfully. It is not evident that the benefit due to gum can extend over more than a few hours.

3. Where haemorrhage is severe, blood transfusion is the only reliable treatment, and should be given without delay. In such cases it is much superior to gum. In blood transfusion we found no important difference between whole blood and citrated blood.

4. Previous to transfusion a blood-grouping test ought to be done in every case. If possible, the donor should be of the same group as the recipient; failing that, recourse must be had to a Group IV donor.

5. We wish to emphasize the need for observing the strictest surgical aseptic technique towards donor and recipient. The donor must be free from known general infections, such as syphilis or malaria, in so far as can be ascertained by inquiry.

COLLOIDAL MANGANESE IN GONORRHOEAL OPHTHALMIA.

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It will be generally conceded that the treatment of gonorrhoeal conjunctivitis in its severer forms brings but little satisfaction to the ophthalmic surgeon; and any remedy which promises to control the disease more effectively is worthy of prolonged test. I have recently used colloidal manganese in three cases of gonorrhoeal ophthalmia, and all have made excellent progress; the last case, which is reported here, being especially note-

worthy, both on account of its severity and the splendid result obtained.

During the past three and a half years I have had under my care in this hospital many cases in adults. The local treatment adopted varied from time to time. A group of cases was treated by gonococcal vaccine in addition to local measures, but whether vaccine were given or not, there seemed to be little difference in the results taken as a whole. Gradually, however, I became convinced of the uselessness of silver nitrate in combating the disease, and discarded it in the more severe types with much swelling, for in these it invariably appeared to aggravate the condition.

In gonorrhoeal ophthalmia the most dangerous period is during the first few days of the infection, when, owing to the swelling of the eyelids and bulging chemotic ocular conjunctiva, the cornea is obscured over the whole or most of its area, and the removal of discharge from its surface is made difficult or impossible. The continued bathing of the cornea in this discharge introduces the most serious factor, for the corneal epithelium is damaged principally by the action of the gonococcus or its toxins, while the nutrition of the cornea as a whole is also injuriously affected to some extent by the excessive swelling.

It seems certain that the main effort of treatment in this stage should be directed towards controlling and abating the violent reaction to the gonorrhoeal infection, by bringing about a rapid decrease in the conjunctival swelling, and so allowing of thorough yet gentle cleansing of the whole eye by non-irritating collyria. The use of any drug which by its action would tend to increase the swelling is contra-indicated.

Colloidal manganese appears to act in the manner required. It was recommended and given by Captain J. E. R. McDonagh in my last three cases with favourable results. The first case was not of great severity, but the action of the drug appeared satisfactory. In the second case it was not given till corneal ulceration had set in, but the eye healed rapidly, and swelling and discharge abated during its use. The third case was of a most virulent type, and the effect of colloidal manganese, given for the first time from the beginning, was most striking.

Pte. J., aged 24, admitted December 24th, 1918, with gonorrhoeal ophthalmia of the left eye. Two days previously he felt his eye pricking, and the following morning—the day before admission—the eyelids were swollen and difficult to open. On admission both lids were greatly swollen and almost solid, so that they could only with difficulty be separated. There was great tenderness and pain, and the surrounding cheek was also red and swollen. On opening the lids the cornea was found to be completely hidden by overlapping folds of oedematous bulbar conjunctiva. There was an abundant discharge of thin pus. The eye was bathed with warm boric lotion every hour by day, and every two hours by night, and 10 per cent. argyrol was used every six hours. An injection of 1 c.cm. colloidal manganese was immediately given by Captain McDonagh intramuscularly into the buttock. On December 25th there was a slight improvement, and a little part of the cornea could be seen. The lids were more easily parted. On December 26th he still had slight pain; on December 27th he was given colloidal manganese 1 c.cm. as before, and by the following morning he expressed his delight in the almost complete absence of pain. The change was striking: all swelling of the bulbar conjunctiva had completely vanished; the oedema of the eyelids had greatly lessened, and the discharge also had become noticeably less in volume. The cornea was perfectly clear, with its epithelium intact over the entire surface, and the eye was apparently out of danger. On December 31st a third and last injection of colloidal manganese 1 c.cm. was given, and by January 9th the conjunctiva had become almost normal, and discharge had practically ceased, except for gumming of the eyelids after sleep.

The appearance presented by this case on the day following the second injection of colloidal manganese was in truth surprising. In a fairly wide and long experience in the treatment of gonorrhoeal blenorrhoea it had never previously been my good fortune to witness such a dramatic change. No local measures with which I am acquainted would have brought about such a satisfactory termination.

It is hardly necessary to emphasize the danger of drawing inferences from results obtained from any remedy in a small number of cases. Prolonged use of the drug is necessary before definite conclusions which will stand the test of time can be reached. Nevertheless it is well to avoid cultivating the habit of mind which sees the perfection of achievement in everyday methods already in use, and refuses to recognize their defects. Where treatment is too often followed by indifferent results, as in

gonorrhoeal ophthalmia, the need for fresh endeavour becomes insistent. In future we shall use colloidal manganese in the hope that it represents a decided advance over former methods of treatment; in any event we seem to have acquired a valuable therapeutic ally and one worthy of extensive trial.

I have to express my indebtedness to Captain McDonagh for his valuable assistance in the treatment of these cases; and to Lieut.-Colonel W. Turner, C.M.G., O.C. Connaught Hospital, for permission to publish these notes.

METHYLENE BLUE IN PURULENT DISCHARGE FROM THE EYE SOCKET.

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INJURIES to the eye have been of very frequent occurrence in the war, and enucleation has had to be performed in a large number of cases. After an artificial eye has been supplied, the soldier has in many instances suffered from purulent discharge of the conjunctiva in the socket, particularly if the artificial eye has been worn for a long time, or has become rough and irritating for any reason. These sockets have proved themselves very difficult to treat; the ordinary methods of treatment, such as zinc sulphate, alum, or the silver preparations have been found most unsatisfactory.

Adams,¹ in his monograph on the use of methylene blue in eye work, shows that the drug is of value in cases of conjunctival discharge due to the *Staphylococcus aureus*, the more usual lines of treatment having failed.

In the ophthalmic department of this hospital methylene blue (1 in 1,000 saline solution) has been employed as the regular routine method of treatment in cases of discharging eye socket, and the results obtained have been so striking and satisfactory that we were led to inquire how the drug exercised its effect—whether there was a definite germicidal action, and if so, whether there was a selective action for one micro-organism more than another. The present investigation was undertaken at the suggestion of Major Maitland Ramsay, the clinical results having been observed by him in these wards over a lengthened period.

For the bacteriological investigation, carried out in the pathological department of the hospital, nine cases of purulent discharge from the eye socket were taken. They were not selected—save that they were illustrative cases in which actual discharge was present. Some had been under treatment with methylene blue for a time, but in none had the discharge completely stopped. Treatment was suspended in every case for twenty-four hours or so in order that the discharge might be as abundant as possible without prejudicing the welfare of the patient. A feature of the treatment by methylene blue is that although the discharge vanishes after the drug has been in use for a comparatively short time, it is necessary to continue the treatment for a further period (say a fortnight) after the discharge ceases to be obvious to the naked eye, in order to prevent recrudescence.

In each case to be investigated direct microscopic films were made, and agar slopes inoculated; the first step in the research was to find the prevailing organism in the conjunctival discharge. Agar medium was employed for culture throughout, and the results must necessarily be expressed on limited lines. The possibility of demonstrating the presence of micro-organisms which flourish on different media is allowed for, but the finer points of research into the germicidal valency of chemical substances belongs to the expert bacteriologist.

The direct films made from the socket on microscopic examination were practically all negative, as is often the case in films of conjunctival discharge. The agar slopes were incubated for twenty-four hours. Well-marked growth was found in the case of two cultures only, and these were selected for further experiment. In all cases in which any growth appeared the prevailing organism was found to be *Staphylococcus aureus*.

In each of the two cultures selected for further investigation a subculture on agar was made in order to procure