Succession Splash.

It may be possible to elicit this sign in haemo-pneumo-thorax. It is never justifiable to attempt to do so in the early stages, and with *x* rays at hand it is never necessary.

Metallic tinkling: I do not remember that I have ever met with this sign in gunshot wounds of the chest.

Voice Sounds.

Modifications of vocal resonance are apt to be misleading. The most constant and reliable sign is aegophony, which I have not met with except when there was fluid in the chest. It is usually best heard at or near the upper level of the fluid, and may be localized to a very restricted area there.

Diminished vocal resonance does not always accompany even a large haemothorax; it may be considerably increased. Occasionally the vocal resonance is increased without any obvious intrathoracic change, even on *x*-ray examination. I do not know what is the explanation of this sign occurring in a chest which has been hit or penetrated. I have met with it frequently in the first few hours, and have not been able to attach any importance or diagnostic significance to it. Possibly it is due to a partial deflation of the lung insufficient to produce the physical signs of collapse.

In pneumothorax the voice sounds and the cough may acquire a characteristic metallic ring. This metallic ring is also sometimes heard with the inspiratory soufflé in a closed pneumothorax, and indicates that a large opening communicates with the pneumothorax from the bronchus.

Auscultation is made very difficult when surgical emphysema is present. If the surgical emphysema is considerable and obvious, it will be recognized at once that auscultation can be of little assistance. Often, however, the emphysema is not evident, and the auscultatory sounds become very puzzling, particularly when the surgical emphysema is mediastinal, substernal, or subpleural, and does not extend to the subcutaneous tissues.

Under all circumstances auscultation should reveal the approximate position of the heart, and this is a point which requires determining in every case of gunshot wound of the chest.

X rays.

It is impossible to treat chest wounds adequately without *x* rays. From the time a case comes within reach of surgical assistance to the time he is finally discharged as cured, and even long after if untoward sequelae are suspected, *x* rays are constantly required. At the outset it is only with *x* rays that the probable track of a missile and its position, if retained, can be ascertained. The position of the heart and diaphragm, their movements, damage to the lung, collapse of the lung, haemothorax, and pneumothorax can only be accurately determined by *x* rays interpreted in conjunction with physical signs.

Radiography alone is insufficient; the cases must also be radioscopically examined and the parts be seen in movement with fluoroscopic screen, in a sitting-up position if possible.

It must be remembered that pieces of clothing can never, and fragments of bone only rarely, be seen with *x* rays.

General Considerations from the Physician's Standpoint.

The first consideration is to save life; the second is to restore function as completely and as quickly as possible.

All wounds of the parietes and thoracic contents should receive the surgical attention they require at the earliest possible moment.

Haemorrhage must be arrested and every possible step taken to early avert infection.

No fluid, whether blood, serum, or pus, must be allowed to collect in the chest. Early and frequent aspiration must be resorted to whether thoracotomy has been performed or not.

Any fluid in the chest is dangerous from two points of view: (a) It is a nidus for sepsis. (b) It interferes with the expansion, not only of the injured, but also of the uninjured lung, setting up conditions favourable to the development and spread of bronchitis, bronchopneumonia, and lobar pneumonia.

Foreign bodies, metal, clothing, and bone, should be removed whenever possible. They are dangerous, not only

from the point of view of immediate sepsis, but from that of subsequent interstitial fibrosis.

Resection and open drainage as formerly practised for empyema is an unsatisfactory operation, and is shown by experience in this war to be rarely necessary if the early treatment, according to modern methods, is not neglected.

REFERENCE.

¹ Duval: *War Wounds of the Lung*, Preface.

RESUSCITATION WORK IN A CASUALTY CLEARING STATION.

BY

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This report deals with work amongst wounded men (stretcher cases only) received in a tented casualty clearing station during three weeks of activity on a sector of the Western front (September 27th to October 15th, 1918). Until October 4th there were eight surgical teams working, but subsequently only six.

TABLE I.

Period.	Admissions (wounded).	Operations.	Percentage.
Attack on the Canal du Nord: Eight days—Sept. 27 to Oct. 4, 1918...	1,713	479	28
Quiet period: Four days—Oct. 5 to Oct. 8, 1918 ...	275	71	26
Fighting on the Escaut Canal north of Cambrai: Seven days—Oct. 9 to Oct. 15, 1918...	835	353	42

TABLE II.—Classification of Operations.

	First Period.	Second Period.	Third Period.
Abdominal	31	1	9
Chest-abdomen	12	1	1
Chest	15	4	12
Fractured femur	23	2	15
Fractured femur with multiple wounds	6	4	3
Large flesh wounds	40	—	26
Knee-joints	33	3	13
Multiple wounds: Amputations, fractured tibia, humerus, forearm, etc.	314	56	274

It will be noticed that during the third period proportionately far fewer abdominal cases could be operated upon. This was largely due to the increase in distance of the unit from the front line during a time of rapid advance. Most of the cases arrived more than twenty hours after being wounded, and a large number died soon after admission from advanced peritonitis. The earlier abdominal cases, too, on the whole responded badly to resuscitation methods, and intravenous methods of treatment in such cases were not often successful, even if they were not obviously contraindicated.

A large number of cases of chest wounds, mostly with other complicating wounds, were admitted, and there were opportunities for keeping cases until better fitted for evacuation.

Total chest wounds	194
Aspirations	93
Operations on chests or chest wall	31

Of 21 deaths recorded in the chest wards one-half could clearly be ascribed mainly to causes other than the chest wound. In 33 cases the haemothorax fluid was proved bacteriologically to be infected, streptococcus being found in 79 per cent., anaërobe bacilli in 57 per cent., and staphylococcus in 50 per cent.

During this time a total of 450 cases were examined by x-rays by Captain Campbell Haddow, of No. 6 Mobile X-ray Unit. Almost all of these were stretcher cases—89 were radiographed for multiple wounds, the abdomen was examined in 85, the chest in 92, buttocks in 46, and knees in 70 cases. Of the other cases, fractured femurs were numerous and a fair number of foreign bodies were localized in the limbs.

Before giving an account of the work in the resuscitation ward we would mention the value of gas and oxygen anaesthesia, given by means of a Boyle's apparatus which was at our disposal. For all types of badly shocked cases, and notably also in severe gas infections, it was a very great aid to successful operation and the maintenance of resuscitation.

Resuscitation Ward.

This was a long marquee connected by a covered way with the operating theatre. Well warmed by stoves, it had twenty-four beds and a small operating bay with two tables, well lit, for intravenous treatment. Cases admitted were not lifted from their stretchers unless they were damp or in discomfort; the moving of the patients was thus facilitated.

In this ward there were two sisters, one trained orderly, and two general duty men. During the first active period two M.O.'s—one for day and one for night—were available; subsequently one only could undertake the work. The successful management of such a ward is very greatly dependent on the skill and untiring patience and energy of the sisters and nursing orderlies, and in this instance nothing was lacking of these essentials.

We aimed at quick resuscitation, so as to avoid the onset of gas gangrene; no sharp clinical differentiation is possible between the condition of shock and the toxæmic condition common at the onset of gas gangrene, both being frequently accompanied by vomiting and lowered blood pressure.

The general lines of resuscitation treatment were followed; these are sufficiently well known to make a detailed account unnecessary here. Warmth applied by hot air, from a paraffin stove, ventilating over the patient into his blankets, and from hot-water bottles, was the first and most important element. To quench thirst by water, sweetened lemonade, and other mild drinks was an insistent need and a useful aid; it was necessary to prevent excess of drinking in a good many cases of shock and abdominal wounds, in which vomiting was persistent. Morphine judiciously given, heroin in chest cases, and camphor as a cardiac stimulant, were all utilized when desirable. So far as possible morphine was not given in doses larger than $\frac{1}{4}$ grain nor more than once in twelve hours—exceptions to this general rule seldom had to be made.

Intravenous injections were largely used in the worst cases. If there were obvious bleeding not controllable by mechanical means, it was thought better to avoid methods which increase blood pressure, otherwise gum infusion was given, unless the case seemed very urgent, when blood transfusion was preferred. Always as soon as possible operation was done. As a general rule, blood transfusion was reserved for the post-operative stage when all bleeding points had been secured.

An analysis of results sheds some further light on the comparative values of blood transfusion and gum infusion. Although this work was done under circumstances of stress and the treatment was controlled by simple clinical methods of observation only, we do not think a discussion of results is thereby invalidated.

TABLE III.—Records of Intravenous Treatment and Totals for the General Work of the Ward.

Total admissions	234
Deaths within 48 hours = failures	68 = 25 per cent.
Deaths in C.C.S. later	24 = 10 "
Total intravenous treatments	74
Deaths within 48 hours = failures	23 = 31 per cent.
Deaths in C.C.S. later	4 = 5 "

For practical purposes cases that died within forty-eight hours of admission have been regarded as failures from the resuscitation standpoint. This classification includes some deaths from gas gangrene and from abdominal wounds of such severity that no resuscitation methods could be expected to avert death. The later deaths have not been regarded as resuscitation failures.

TABLE IV.—Pre-operative and Post-operative Treatments.

	Total Intravenous Treatments.	Success.	Failure.
<i>Pre-operative:</i>			
Blood	18	12	6
Gum	17	9	8
Blood + gum	6	5	1
<i>Post-operative:</i>			
Blood	21	18	3
Gum	7	4	3
Blood + gum	5	3	2
<i>Total:</i>			
Blood	39	30	9
Gum	24	13	11
Blood + gum	11	8	3

Blood transfusion or gum infusion was given in seventy-four instances in all, and twenty-three (31 per cent.) of these were "failures" in the sense described. This group of cases included most of the severe wounds of the limbs, but fewer chest, abdominal, and cranial wounds, which usually were less suitable for intravenous injections, at any rate before operation.

Generally, those exhibiting shock only with lesser degrees of hæmorrhage were given in the first instance gum infusion, blood transfusion being withheld unless gum showed insufficient benefit. To patients who, before operation, were in fair condition, but on whom a prolonged operation was expected to produce more shock, gum infusion was given with satisfactory results. In cases with evidence of severe hæmorrhage, blood was given as early as possible, and we cannot emphasize too strongly the necessity for this measure being applied with no delay in such cases.

In this series, therefore, the giving of blood was restricted to a class of case in worse condition as compared with the "gummed" cases.

In a few post-operative cases in which gas gangrene tissue had been found a solution of sodium bicarbonate 2 per cent. and glucose 6 per cent. in distilled water was given with advantage. It was autoclaved at 105° C. in spring-stoppered bottles. The surgical measures taken, however, had certainly the major share in saving these patients.

After operation in abdominal cases, and in some major amputations, rectal infusions of sodium bicarbonate 5 per cent. and glucose 5 per cent. were used; the value of providing ample fluid in such cases was demonstrated convincingly.

Blood Transfusion Methods.

The donors were very light walking wounded cases, who volunteered with admirable spirit. There was always time to make the rapid macroscopic grouping test, and, whenever possible, a donor of the same group as the recipient was used. Failing that, a Group IV donor was taken.

Two transfusion methods were utilized: (1) The whole blood method using the Vincent tube, with paraffined surface; and (2) a very simple citrate method; the latter more commonly.

The Vincent tube was coated by means of a solution of paraffin in ether, as demonstrated by Major Alton. This method of transfusion when successfully performed is very rapid and satisfactory, the facility with which pressure can be applied to force the blood into the recipient's vein is not uncommonly advantageous. If any delay or mishap occurs, however, the blood drawn off may be wasted through clotting, and so an alternative simple citrate method was adopted by one of us (A. F. S.) and generally used; it gave quite satisfactory results.

Citrate Method.

The blood was drawn from the donor by a short curved glass cannula, or alternatively by a wide hollow needle, and the flow directed into a sterile graduated measure containing 5 per cent

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-