Perforation.—A review of the literature shows that the estimated incidence of acute perforation among ulcer patients in hospital varies between 4 per cent. (Kruse, 1937) and 19.6 per cent. (Thompson, 1937). Eliason and Ebeling (1929) give 10 per cent., and Brown (1934) 11 per cent.

Haemorrhage.—The frequency of gross haemorrhage is given variously as 18 per cent. (Lahey, 1930), 20 to 25 per cent. (Gordon-Taylor, 1937), 28 per cent. (Kruse, 1937), 30 per cent. (Allen and Benedict, 1933), and 38 per cent. (Goldman, 1936).

Pyloric Stenosis.—The only reference I can find to the incidence of organic pyloric stenosis is that of Kruse, who gives a figure of 20 per cent., but mentions that 51 per cent. of peptic ulcers show some obstructive characteristics. Jordan and Kiefer (1934) report on seventy-nine cases in which a six-hour residue was found in the stomach on radiological examination. Only 11 per cent. of these patients required surgical treatment for relief of the obstruction, and it was assumed that in the remainder the obstruction was transient and due to inflammation, spasm, or oedema.

Carcinoma.—The literature on peptic ulcer abounds with discussions of the frequency with which carcinoma develops on chronic ulcer, and even now that the histological characteristics of ulcer-cancer have been described and generally accepted there is wide variation of opinion. Klein (1938) writes: "Malignant degeneration of chronic gastric ulcer, if it occurs at all, is rare." At the other extreme the astonishing figure of 68 per cent. has been attributed to Wilson and MacCarty, but the latter states (MacCarty, 1927) that it is impossible to determine the correct figure. Dible (1925), in a series of necropsy and operation specimens, estimated an incidence of 1.7 per cent. Gutmann (1935) gives 2 to 4 per cent., and his figures agree with those of Hauser (1926) (3.4 per cent.) and Newcomb (1932) (3.75 per cent.). Stewart's (1926) frequently quoted article gives 6.1 per cent., and from Gömöri's (1933) article a figure of 8.6 per cent. can be calculated. Most pathologists now agree that carcinoma is a rare complication of gastric ulcer, and I believe that this view is held by most surgeons, even if their choice of treatment is influenced by the possibility of malignant degeneration.

I am indebted to Dr. H. H. MacWilliam, medical superintendent of Walton Hospital, for permission to publish this case.

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USE OF STORED BLOOD FOR TRANSFUSION

AN INTERIM REPORT

BY

J. L. HAMILTON-PATERSON, M.D.

Pathologist at Redhill County Hospital, Edgware, Middlesex

Group O blood was collected from the voluntary donors of the Emergency Blood Transfusion Service on September 3 and 4, 1939, for use in the event of air raid casualties. As these did not materialize it was decided to use the blood for patients already in hospital and requiring transfusion rather than waste it completely. To keep up the stock, relatives of these patients who belonged to Group O were bled when possible.

The apparatus used was that issued by the Medical Research Council and described in their publication, *Blood Transfusion Outfit*, September, 1939. The anticoagulant employed was pure sodium citrate. This was preferred to the citrate-saline mixture recommended, as in our experience less haemolysis of the stored blood resulted. At the time when the donors for the Emergency Transfusion Service were tested the samples were stored in this citrate-saline mixture (auto-claved in 1-oz. screw-topped bottles) and in many cases haemolysis was practically complete in forty-eight hours. With sodium citrate solution alone treated in the same way this did not occur.

Method of Storage

Into each bottle 90 ml. (c.cm.) of 3.8 per cent. sodium citrate was put. When blood was added to the 540 ml. mark the final concentration of citrate was 0.63 per cent. The blood was collected straight into the bottle with a needle and a piece of rubber tubing about eight inches long. This was previously lubricated with sterile liquid paraffin. The double-bored cork was not fitted because when the bottle was agitated it disturbed the position of the needle unless a piece of tubing eighteen to twenty-four inches long was used. This was unsatisfactory, as the blood was more likely to clot, and the tubing was much more difficult to clean satisfactorily than the shorter piece. The mouth of the bottle was surrounded by a piece of sterile gauze. Latterly 20 ml. of a 50 per cent. sterile glucose solution has been introduced into the bottle with aseptic precautions. This gives an approximate final concentration of 2 per cent. glucose. The advantages of intravenous glucose in shocked patients is well known, and it also has some value in preventing haemolysis during storage. Spontaneous glycolysis does not occur at the temperature at which the blood is stored, as we have shown by daily sugar estimations over periods of ten days.

The blood was stored in ordinary household refrigerators of the size rented at 2s. 6d. a week, each one of

Drip chamber

which held thirty-six bottles. The temperature was kept between 2° and 4° C. Two small 3 by 3/8 inch tubes were attached to the side of each bottle with adhesive tape. One contained clotted blood for the Wassermann reaction and the other a suspension of red cells in citrate for cross-matching with the recipient's serum.

When the blood was given, the official administering equipment B was used (glass-bead filter). The beads were added to the blood immediately before use. The only modification introduced was a drip chamber (see Fig.), made from 5/8 by 5 inch pyrex test tubes and glass

tubing. This was inserted in the system two inches from the neck of the delivery bottle. If desired the delivery tubing can be filled with saline before puncturing the vein by removing the cork from the drip chamber. During the transfusion it was found that sometimes the weight of the blood in the delivery tube pulled the chamber off the cork. This can easily be prevented by binding the junction with a strip of adhesive tape. Occasionally it was found necessary to cut down on the vein and employ a glass cannula instead of the needle supplied. This whole apparatus has functioned very satisfactorily in practice.

TABLE I

	Date Blood Stored	Date Blood Given	Amount Given	Reaction	Haemoglobin Estimations
1. Male. Bleeding gastric ulcer ..	2/9/39 2/9/39	5/9/39 8/9/39	540 ml. 540 ml.	No reaction "	5/9/39 40% 7/9/39 32% 14/9/39 40% 30/9/39 69%
2. Female. Ulcerative colitis	2/9/39 2/9/39 3/9/39	5/9/39 9/9/39 14/9/39	540 ml. 540 ml. 1,620 ml.	" " "	5/9/39 58% 12/9/39 54% 15/9/39 80%
3. Female. Tuberculous empyema ..	2/9/39	7/9/39	540 ml.	"	6/9/39 72%
4. Female. Threatened abortion ..	2/9/39	9/9/39	540 ml.	Temperature rose from 101.5° to 103.5° and then dropped to normal. Slight rigor half an hour after transfusion	8/9/39 32%
5. Female. Post-partum haemorrhage (breech delivery)	2/9/39 3/9/39	13/9/39 23/9/39	540 ml. 540 ml.	Temperature dropped from 99.8° before to 99° and 97.4° next morning. Pulse dropped also. Slight rigor half an hour after transfusion. No ill effects other than shivering Temperature rose from 98° to 100.2°. No increase in pulse rate. No further reaction	11/9/39 36% 15/9/39 36% 21/9/39 40% 2/10/39 48%
6. Male. Haematemesis	3/9/39 3/9/39	15/9/39 21/9/39	540 ml. 540 ml.	No reaction Temperature rose from 98° to 100.8° on same day and dropped to normal next day. Pulse rate went up to 158. No increase in respiration. No rigor or pain. Perspiration. Symptoms maximal half an hour after transfusion	14/9/39 40% 19/9/39 48% 27/9/39 70% 3/10/39 80%
7. Male. Haematemesis	2/9/39 3/9/39 3/9/39	11/9/39 15/9/39 21/9/39	1,080 ml. 540 ml. 540 ml.	No reaction " "	11/9/39 50% 14/9/39 32% 19/9/39 40% 26/9/39 58% 6/10/39 52%
8. Female. Placenta praevia	3/9/39 3/9/39	16/9/39 22/9/39	540 ml. 1,080 ml.	" "	16/9/39 42% 26/9/39 66%
9. Female. Haematemesis and melaena	3/9/39	23/9/39	540 ml.	Temperature rose from 99° to 102.4° after half an hour. Pulse rate rose from 98 to 116. Some vomiting with the rise in temperature. No definite rigor. Slight yellowness of conjunctivae next day	22/9/39 42% 25/9/39 48% 28/9/39 48%
10. Female. Fibroids	4/9/39	25/9/39	540 ml.	Temperature rose to 102°, pulse to 112. No physical signs or symptoms	23/9/39 32% 26/9/39 38%
11. Female. Fibroids	3/9/39 15/9/39	19/9/39 21/9/39	1,080 ml. 1,080 ml.	No reaction Temperature rose to 103°. Came down to normal after second lot (540 ml.) of blood. No further reaction	19/9/39 17% 21/9/39 18% 22/9/39 36% 6/10/39 52%
12. Male. Aplastic anaemia	3/9/39 15/9/39	27/9/39 6/10/39	540 ml. 1,080 ml.	Temperature rose to 99.6°. Oxyhaemoglobinuria one hour after transfusion. Urine clear 48 hours afterwards No reaction. Temperature remained normal. Pulse dropped from 132 to 104	22/9/39 58% 29/9/39 68% 9/10/39 62%
13. Female. Post-partum haemorrhage	3/9/39	29/9/39	540 ml.	No reaction	
14. Male. Ulcerative colitis	25/9/39 28/9/39 23/9/39	4/10/39 5/10/39 6/10/39	540 ml. 540 ml. 1,080 ml.	Slight rigor only No reaction "	4/10/39 38% 5/10/39 27% 6/10/39 38% 12/10/39 56%
15. Female. Abortion	4/9/39 26/9/39	4/10/39 5/10/39	540 ml. 540 ml.	" "	5/10/39 52% 6/10/39 36% 12/10/39 44%
16. Male. Bleeding peptic ulcer ..	29/9/39	6/10/39	540 ml.	"	7/10/39 70%
17. Male. Lung abscess	28/9/39	5/10/39	400 ml.	"	3/10/39 32% 9/10/39 60%
18. Male. Haematemesis	27/9/39	5/10/39	1,080 ml.	No reaction. Pulse dropped from 110 to 92 immediately	
19. Female. Post-partum haemorrhage	4/9/39	7/10/39	540 ml.	No reaction. Collapsed before. Pulse rapidly slowed to 90	12/10/39 46%
20. Female. Anaemia of pregnancy ..	26/9/39	9/10/39	540 ml.	No reaction	6/10/39 53% 12/10/39 52%
21. Female. Septic abortion	26/9/39	9/10/39	540 ml.	"	5/10/39 52% 9/10/39 52% 12/10/39 52%

Results of the Transfusion

Forty-six bottles of blood have been used. The blood had been stored three to thirty-three days, and the results are shown in Table I. Only in Case 12 was a moderately severe reaction encountered. Within an hour of starting the transfusion the child passed urine coloured a deep red and the temperature rose to 99.6°. On examination no red cells were found in the urine, and spectroscopic examination showed only bands of oxyhaemoglobin. The urine was normal next day and the child had no delayed reaction of any kind. In two cases (Nos. 3 and 4) in which the patients were febrile beforehand the temperature dropped to normal after the transfusion.

Alterations in the appearance of the blood during storage have been noted. The settled red cells turn almost black after three or four days and often a thick white layer of lipid material settles out on the surface of the plasma. After the first week a layer of haemolysis, pink in colour, appears at the junction of the red cells and plasma. After twenty-eight days this may not be more than one inch deep and still only faintly pink. In some bottles, however, the whole of the supernatant plasma was similarly coloured. After thorough mixing, samples from the bottles were centrifuged. The amount of haemolysis was roughly proportional to the depth of the pink layer in the supernatant plasma, but was of course much more marked after shaking the settled blood. In practice we discarded all the bottles in which two-thirds of the supernatant plasma showed this pink tinge. Usually this pink layer was gelled and separated out in the filter. At no time did the blood show bacterial contamination.

The results of transfusion with stored blood are not so dramatic as with fresh blood. Often there is no immediate

change in the patient's condition, and it may be two days before a maximal clinical improvement is noted. Similarly in exsanguinated patients rapid stimulation of blood formation is the exception rather than the rule. Haemoglobin estimations (Haldane) before and after transfusion are shown in Table I.

Summary

When used for transfusion the blood had been kept for varying times (from three to thirty-three days). No really severe reactions were encountered. In one case there was a transient oxyhaemoglobinuria. In other cases there was a slight rise of temperature and pulse rate, and twice the patients had very mild rigors.

Comparison between the length of storage and reaction produced is shown in Table II. Blood given during the first six days of storage produced no reaction, and thereafter the length of time of storage has no effect in increasing the number of reactions encountered. Dramatic improvement in the clinical condition of the patient is much less frequent than when fresh blood is used. Blood regeneration is also slower.

My thanks are due to the medical officers of Redhill County Hospital for their willing co-operation in giving the transfusions and recording clinical data.

Clinical Memoranda

Paratyphoid B Fever with Respiratory Involvement

Early involvement of the respiratory system in enteric fever has been recognized for many years (Vincent and Muratet, 1917; Osler and Macrae, 1925). These cases give rise to considerable diagnostic difficulties, particularly in the early stages of the disease, the true clinical condition usually becoming apparent when other systemic manifestations of enteric fever appear. The following case of paratyphoid B fever is reported because clinical and radiological evidence of lung involvement remained the most striking feature throughout the whole duration of the illness.

CASE REPORT

A man aged 29 was admitted to a general hospital on October 17, 1938, complaining of headache, generalized pains, and a troublesome cough. At the age of 7 he had had a right empyema thoracis treated by rib resection, since when he had been subject to winter attacks of bronchitis. The present illness was considered to be of this nature until the sixth day after admission, when persistence of an irregular pyrexia and a slight degree of splenic enlargement indicated further investigation. Leucocytosis (58,000) with a slight relative lymphocytosis was present, the blood culture was sterile, but specific agglutinins to *B. paratyphosus* B were present in a serum dilution of 1 in 40 (O) and 1 in 180 (H).

The patient was transferred to the Eastern Hospital on October 26. On admission he was rational but fairly ill, and showed both dyspnoea and orthopnoea. Cough was a very troublesome feature and was accompanied by abundant frothy sputum. There was no impairment of lung resonance, but large rales were present at both bases. Examination otherwise revealed slight tumidity of the abdomen, a palpable splenic edge, and complete absence of abdominal reflexes. The bowels were constipated.

On October 28 the patient complained of pain at the angle of the left scapula, which was aggravated by coughing. Some

TABLE II

Length of Storage in Days	No. of Bottles Given	Reaction
3	2	Nil
5	1	Nil
6	3	1 and 2: Rise in temperature 3: Nil
7	5	1: Slight rigor 2, 3, and 4: Nil 5: Nil
8	2	Nil
9	4	1: Slight rigor 2, 3, and 4: Nil
10	1	Nil
11	4	1: Slight rigor 2, 3, and 4: Nil
12	2	Nil
13	4	Nil
16	2	Nil
18	2	1: Slight rise in temperature 2: Nil
19	2	Nil
20	2	Both showed rise in temperature and increased pulse rate
21	4	1: Slight rise in temperature 2, 3, and 4: Nil
22	3	1: Nil 2 and 3: Oxyhaemoglobinuria
26	1	Nil
30	1	Nil
33	1	Nil