A CLINICAL SURVEY IN BLOOD TRANSFUSION PRACTICE IN SINGAPORE

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Over the past few years there has been a steady increase in the demand for blood. This increase has been universal. In Singapore itself, over the last six years there has been a steady increase from a total of 6,519 units of blood for the year 1954 to 11,299 units of blood used in 1959 (Ministry of Health, 1958). This represents an increase of 74% over the last six years. If this rate of increase were to continue then by 1965 we would be using approximately 19,660 units of blood i.e. an average of 1,638 units per month.

Because of this increased demand there has always been from time to time acute shortages of blood of one or other blood group. The problem at the Blood Transfusion centre has been to try to synchronise the varying availability of blood with the varying demand. There has always been difficulty in recruiting regular volunteer blood donors, and in spite of the recent publicity campaign that was carried out by the Ministry of Health there does not appear to be forthcoming a sufficient supply to meet the needs of the near future.

In addition to exploring all the various means of trying to increase the supply, there is also the logical way of trying to see if the repeated crises could be prevented by cutting down the demand. It was with this view in mind that it was decided to carry out a survey of current transfusion practice in the two main hospitals in Singapore, the General Hospital (G.H.) and the Kandang Kerbau Hospital (K.K.H.).

THE INVESTIGATION

Two weeks before the Survey started, a letter was sent to all clinicians in these two hospitals informing them that a survey of current transfusion practice would be carried out during the month of October. They were asked to help by filling in the blood request forms as completely as possible. From each case requiring blood, plasma or Dextran the following information was collected: the diagnosis of the case, the haemoglobin level before and after the transfusion if available, the surgical operation the patient was to undergo and the reason for the transfusion. Request forms that did not contain full particulars or which needed verification were completed by a visit to the patient in the ward. The medical officer or the house officer in charge of the case was consulted when there were points needing clarification.

In order that the transfusion practice as recorded in this survey would not be biased, no mention was made in the letter as to the particular points being looked into. The doctors were NOT urged to exercise reasonable economy in the use of blood.

THE HOSPITALS

The General Hospital is the main civil hospital in the island admitting acute medical and surgical cases. Of a total of 1,191 beds (Ministry of Health, 1958), 639 are for medical cases (Medical Unit 1, Medical Unit 2, Paediatric Units) and 552 are for surgical cases (General Surgical Units A and B, Orthopaedic Unit, Ear Nose and Throat Unit and Ophthalmic Unit).

The Kandang Kerbau Hospital is the main governmental institution in the island admitting maternity and gynaecological cases. Of a total of 490 beds, 114 are for gynaecological and 276 for maternity cases. There are in addition 100 emergency beds mainly for maternity cases.*

The Blood Transfusion Service is responsible for the collection and preparation of blood and for the supply of blood to all hospitals in Singapore except the British Military Hospital. The Centre is situated in the grounds of the General Hospital. The laboratory is open day and night and there is always one laboratory technician to attend to the requests for blood.

A stock of 20 bottles of blood is kept in K.K.H. The pilot tubes of these 20 bottles are retained in the laboratory at the centre in G.H. Non urgent requests for blood for grouping and cross matching come at regular intervals throughout the day. Urgent requests are forwarded immediately irrespective of the time of day. Blood is then matched for these cases

*Latest figures given by Dr. S.N. Kapur. Medical Superintendent K.K.H.

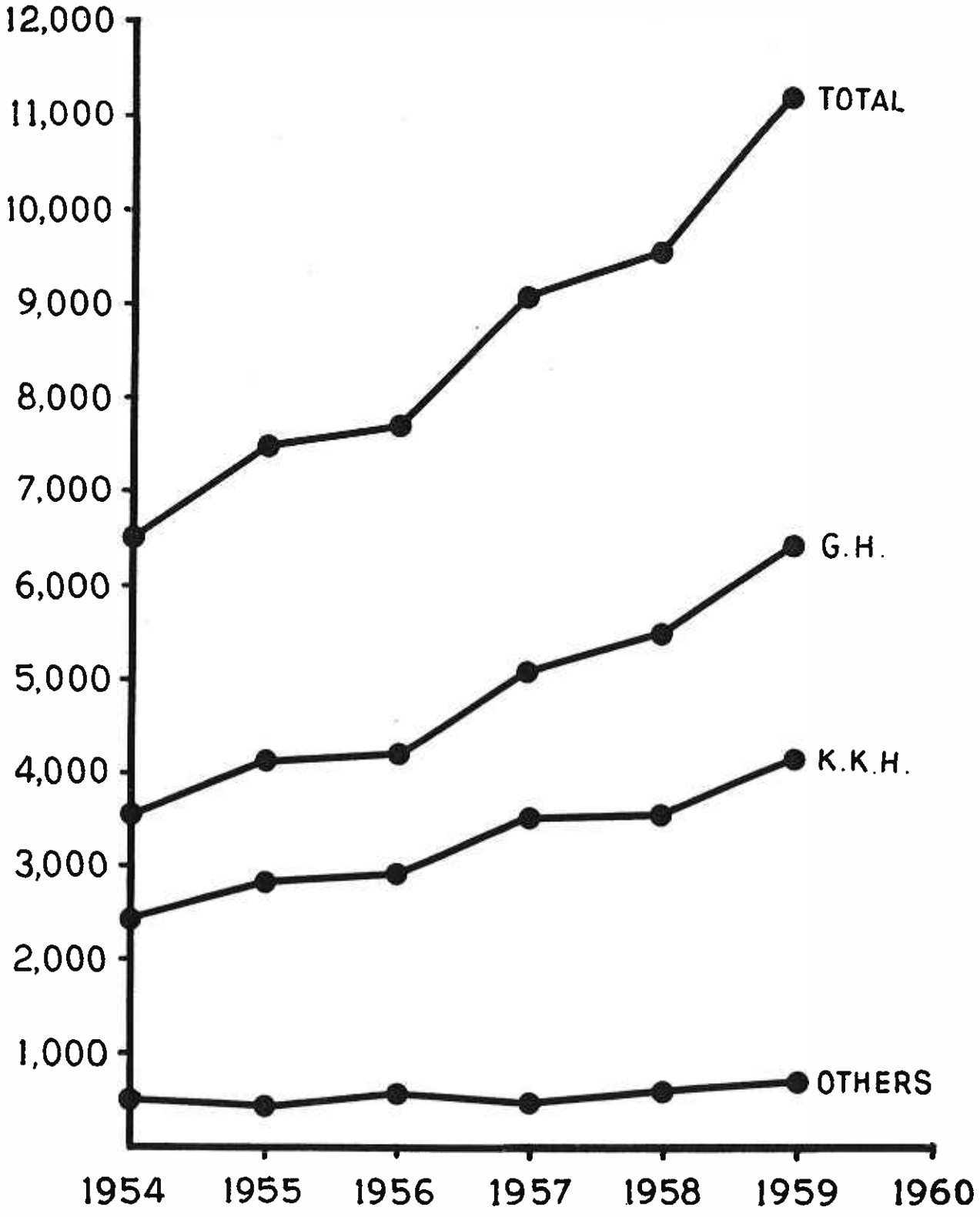

FIG 1. SHOWING NUMBER OF UNITS OF BLOOD USED FROM 1954 TO 1959

with the stock held in K.K.H. The results are then telephoned to the Staff Nurse in charge who then informs the ward doctor when the blood is available. Blood specimens take at least 30 minutes to arrive and even after rapid methods of cross matching a minimum of 45 minutes is required before matched blood can be made available for a patient. This is one of the main reasons why emergency blood is being used more often in K.K.H. than in G.H. and will be discussed later. This arrangement whilst by no means the ideal is the best that can be arranged under existing conditions.

AMOUNT OF BLOOD USED

The survey started on 1st October with a stock of 292 units of blood in the Bank. During the survey a total of 1,006 volunteers donated blood whilst during the same period 1,066 units of blood were used. On completion of the survey there were left 230 units of blood. The detailed disposal of the 1,066 units of blood were as follows: 452 units or 42% of the blood was used by surgical cases, 374 units or 35% was used by obstetric and gynaecological cases, and 162 or 15% was used by medical cases. Other governmental hospitals, and private clinics and hospitals used 78 units or 8%.

Table I. Detailed disposal of blood used by various Units

Surgical A Unit	152 units		
Surgical B Unit	222 „		
Surgical C Unit	74 „	452 units	42%
E.N.T. Unit	4 „		
Gynaecological Unit	154 units		
Obstetric Unit	220 „	374 units	35%
Medical Unit 1	59 units		
Medical Unit 2	62 „	162 units	15%
Paediatric Units	41 „		
Other govrnmental and private hospitals	78 units	78 units	8%
		1066	100%

From the Surgical Units a total 1,059 pints of blood were requested to be cross matched in reserve for 385 patients. Only 452 units of blood were used on 226 patients giving an average of 2 units of blood per patient.

From the medical units 370 units of blood were requested to be cross matched for 173 patients. Only 162 units of blood were used for 85 patients i.e. an average of 1.9 units of blood per patient.

From K.K.H. a total of 1,154 pints of blood were requested to be cross matched for 575 maternity and gynaecological patients. Only 374 units were used for 260 patients i.e. an average of 1.4 units per patient.

This gives an overall average of 1.7 units of blood per patient. This is a very low figure compared to that reported in a recent survey in the London Teaching Hospital where 975 pints of blood were used for 318 patients, i.e. 3 pints per person (Graham-Stewart, 1960).

A study was then made of the number of transfusions each patient received. It was found that 184 obstetric and gynaecological patients, 116 surgical patients and 51 medical patients were given 1 unit of blood each. Thus, during the survey a total of 351 single unit blood transfusions were given, i.e. 33% of all blood issued was used as single unit transfusions. Putting it in another way, of a total of 575 patients, 351 patients, i.e. 61% had a transfusion of only one unit of blood. This will be discussed in greater detail later.

Blood wasted

In only two instances was blood actually wasted during the survey. In one the bottle was accidentally broken and in the other the blood had been left in the open at room temperature for more than 3 hours and was discarded as being unsuitable for use.

Table 2. Number of patients who received 1, 2, 3, 4, 5 or more units of blood

	1 unit	2 units	3 units	4 units	5 units
Obstetric and gynaecological cases	184	48	22	4	2
Surgical cases	116	62	30	7	11
Medical cases	51	21	6	6	5

ANALYSIS OF THE CASES RECEIVING TRANSFUSIONS

Surgical Cases

Gastro-intestinal operations	52	cases
Orthopaedic operations	47	,,
Preoperative anaemia	30	,,
Postoperative anaemia	22	,,
Thoracic operations	19	,,
Genito-urinary operations	10	,,
Burns and skin grafts	10	,,
Intracranial operations	9	,,
Malignancy — sarcoma etc.	6	,,
Cardiac operations	6	,,
Miscellaneous	6	,,

Medical Cases

Hematemesis and malaena		37	cases
Exchange transfusions		13	,,
Medical Anaemia:		32	,,
Haemolytic anaemia	7		
Unknown cause	7		
Uraemia	4		
Leukemia	6		
Aplastic anaemia	4		
Purpura	3		
Hookworm	1		
Miscellaneous		7	,,

Gynaecological and Obstetric cases

Post Partum haemorrhage	72	cases
Abortions	53	,,
Caesarian section	68	,,
Anaemia of pregnancy	14	,,
Hysterectomies	13	,,
Ruptured Ectopic gestation	9	,,
Preoperative anaemia	8	,,
Uterovaginal prolapse	6	,,
Post Partum anaemia	5	,,
Postoperative anaemia	2	,,
Miscellaneous	19	,,

It will be seen that there were 30 surgical patients who needed blood preoperatively and 22 cases who needed blood postoperatively. This constitutes a very large number and will be discussed in detail later. Among medical cases, apart from the 7 cases of anaemia of unknown aetiology, there were no instances where blood could be said to have been given unnecessarily. The one case of anaemia due to hookworms was a four year old child with severe infestation and a haemoglobin level of 25% and early cardiac failure.

PLASMA

A total of 38 units of plasma were used during the month. These were used as follows:

Burns and scalds	13	cases	25	pints
Intestinal obstruction	3	,,	5	,,
Shock — whilst waiting for blood	3	,,	3	,,
Anaemia with malnutrition	4	,,	5	,,

In K.K.H. only 2 pints of plasma were used, one for a case of P.P.H. whilst waiting for blood and the second a case of generalised cachexia due to carcinoma of the cervix.

DISCUSSION

Since the postwar years there has been a steady increase in the demand for blood. This could not have been met without the rapid organisational and technical advances that have been made in the transfusion service. The reasons for this increased demand are many, amongst the most important of which are probably the rapid strides made in surgical techniques and anaesthesia. The use of antibiotics has allowed the surgeon to perform operations which were previously not possible. Radical operations on the oesophagus, lungs, heart, porto-caval anastomosis, pelvic eviscerations are but few of the many major operations being tackled almost daily today.

Whilst not so long ago blood transfusion was a therapeutic event prescribed by consultants only after great consideration, today it has become commonplace. In spite of all the numerous conditions in which blood is being used, there are only two main indications for blood transfusion. The first is to restore the circulating blood volume and the second to make good any deficient or missing elements. The results of this survey will be discussed in relation to the above indications.

Acute haemorrhage

A patient may lose up to 10% (500 ml) of his blood volume without dramatic physiologic changes. A loss of 20% would bring on symptoms of tachycardia, faintness and sweating. However, the body can still adapt itself to the lowered blood volume and blood pressure can be maintained by vaso-constriction. A loss of 30% (1,500 ml) if not corrected would lead to oligaemic peripheral circulatory failure. Haemorrhage of 50% (2,500 ml) or more is probably always fatal if not treated (Lyons & Simpson, 1958).

Blood loss of up to 500 ml. in the old or debilitated, or up to 1,000 ml. in a healthy patient can be considered as moderate loss. In the absence of anaemia or expected continued

bleeding blood replacement is not necessary. If the patient is collapsed blood volume would need replacement, but there is not necessarily any need to increase the oxygen carrying capacity of blood. In these conditions plasma or plasma substitutes, e.g. dextran would be the ideal means of replacement (Graham-Stewart, 1960). A loss of over 1,000 ml. should be replaced with whole blood; and ideally the amount transfused should be equivalent to the amount lost.

The impression obtained is that there is a reluctance to give blood sufficiently and rapidly enough and a lot of small transfusions are given instead. Overloading of circulation is unlikely after massive blood loss and if a reasonable estimate of the loss has been made and a jugular venous pressure watched, this danger is minimal. The other risk of causing further bleeding by correction of blood pressure is considered theoretical and slight compared with the risk of under transfusion.

There were no examples of gross over transfusion during the survey but there were many instances of under transfusion.

Single unit transfusion

Table 2 shows the number of patients who received one unit transfusion as the sole form of transfusion therapy. A total of 351 patients received one unit of blood. 49 of these were given to children below the age of 12 years. This high percentage of one pint transfusions is in marked contrast to the practice in other hospitals where only 4.5% of the blood used was in the form of one pint transfusions (Graham-Stewart, 1960).

The general consensus of opinion is that single pint transfusion should not be given to adults. If the person only needs a single pint of blood, then in all probability he would not have needed it at all (Mollison, 1956). If he had symptoms suggestive of decreased circulatory blood volume, then dextran or plasma would be the ideal fluid for transfusion.

A single pint of blood would raise the haemoglobin by 1 G. per cent (7% Haldane). This is an unimpressive achievement and is not likely to affect postoperative convalescence. Similarly, in elective surgery the adequately prepared patient should be able to withstand the loss of 500-700 ml. of blood. This is not, however, to be interpreted to mean that the surgeon may not find it sufficient to use one unit of blood to replace operation loss in excess of this amount (Shields & Rambach, 1959).

The giving of single unit transfusion is certainly of questionable value especially in the face of many potential hazards. Reactions of one type or another occur at the rate of 3-5 per cent and mortality has been estimated as one in every 1000-3000 transfusions (Guynn & Reynolds, 1958). The mortality figure quoted here is a very high one and could not be said to be applicable in Singapore where over the last 10 years there have beeen only three deaths known to be due to transfusion incompatibility. Deaths that could have been attributed to transfusion e.g. fatal hepatitis, cardiac failure precipitated by over transfusion, air embolism etc. may have occurred without the department being informed. Thus, however excellent the laboratory and clinical facilities may be, the factor of human fallibility can never be entirely removed. The incidence of virus hepatitis is estimated at one in every 200-500 transfusions (Hoxworth et al., 1959). Therefore if blood is necessary it should be given in excess of one 500 ml. unit of blood to justify its use. To give less than this exposes the patient unjustifiably to the hazards of transfusion without apparent benefit (Lyons & Simpson, 1958, B.M.J., 1957).

In K.K.H. it would appear that the high proportion of single unit transfusions is associated with under transfusion rather than with the giving of unnecessary transfusions. Of the 260 patients who received blood, 163 had haemoglobin estimations done 24-48 hours after the last transfusion. The post transfusion haemoglobin level of these 163 patients are shown below. It will be seen that 70 patients (43%) ended up with a haemoglobin of below 60% (Haldane). Further study of these 70 patients showed that 47 patients had one transfusion, 10 had two pints, 11 had three pints and 2 had 4 pints.

Table 3. **Post transfusion Hb. level of 163 obstetric and gynaecological patients**

Post transfusion Hb. level	Below 50%	51-60%	61-70%	71-80%	Above 80%
No. of patients	28	42	55	29	9

The actual number of undertransfused would probably have been more as many patients (97 cases) had no haemoglobin estimation done after transfusion and 315 patients who had blood matched never received any transfusion. It is therefore not possible to comment on them.

There were 9 patients who received only 1 unit of blood and whose post transfusion haemoglobin level was above 81%. These patients would probably not have needed the transfusion at all.

As for single unit transfusions in surgical cases, it has not been possible to come to any definite conclusion. This is because many of the single pint transfusions were given to cases undergoing major surgery. They probably lost more than a single pint of blood but the surgeon or anesthetist in charge probably thought it sufficient that one pint of blood be replaced. Secondly, post transfusion haemoglobin estimations were only done in a few patients. It is possible, however, that at least a few of these patients would not have needed the single pint transfusion.

Transfusion and anaemia

In general transfusion should be used as a method of treating anaemia only when the anaemia is refractory to treatment. In patients with chronic anaemia the haemoglobin level may be as low as 30% before the patient seeks treatment. In such patients transfusion is not without danger as it can easily precipitate cardiac failure. Hospitalisation with bed rest and correct treatment for the cause of anaemia with iron, parenterally if necessary and the other haematinics, vitamin B12 and folic acid when indicated will in most cases obviate the need for transfusion.

Anaemia produced by haemorrhage which is likely to recur e.g. haemetemesis from bleeding peptic ulcer should have blood transfusion to bring the haemoglobin level to within 75-85 per cent.

In haemolytic anaemia, aplastic anaemia, leukaemia and any refractory anaemia the need for blood is obvious. Transfusion is never curative in haemolytic anaemia and when the haemoglobin falls below 8 grams% (55% Haldane) the patient should be transfused, although often it is found difficult to maintain the haemoglobin at this high level. It is usually better to allow the haemoglobin to find its own level and to reserve transfusion only for emergencies. The danger of repeated transfusions causing transfusion haemosiderosis and the stimulation and formation of specific antibodies should always be borne in mind. In treating aplastic, or refractory anaemia and chronic leukaemia, the aim should be to maintain the haemoglobin at a level which would permit the patient to indulge moderate activity, i.e. not less than 75% (Haldane 11 grams%) (Mollison, 1956).

Preoperative transfusion

Whilst it is generally agreed that no patient should be submitted to an operation with a haemoglobin of less than 10 grams%, preoperative anaemia by itself is not an indication for transfusion. Only when the condition of the patient is such that an operation is an immediate necessity is transfusion indicated. In all other cases treatment with iron and haematinics should be able to bring the patient's haemoglobin up to the required standard.

The failure to carry out routine haemoglobin estimation at the time that operation is first decided upon is the main reason for so many patients being found after admission to have a haemoglobin level too low for operation. Unfortunately, many feel that it is probably more convenient and cheaper to give preoperative transfusion for such cases than to discharge them with treatment until such time as the anaemia is corrected and a suitable date found on the already long waiting list.

During the survey it was found that 30 surgical and 8 maternity and obstetric cases had blood preoperatively. 21 of these cases were for urgent operations due to malignancy or other conditions. The remaining 17 were non urgent cases that should have waited until their anaemia was corrected. These included one patient for cardiac operation, 4 for spinal fusions, 2 patients with enlarged prostrate, 3 with non acute cholithiasis, 4 with uterine fibroids, 1 with ovarian cyst and 2 with pyloric stenosis.

Postoperative transfusion

Postoperative anaemia requiring correction is usually an indication of inadequate transfusion during operation. If the anaemia is moderate there is no real justification for transfusion. Anaemia, if severe should be transfused and if detected more than 48 hours after the operation, transfusion should proceed with

caution as there is a real danger of overloading the circulatory system. There were 22 cases of postoperative anaemia in G.H., 3 cases with a haemoglobin level above 70%, 9 cases with haemoglobin level between 60-70%, 5 cases with haemoglobin between 50-60% and 5 cases below 50%.

Taking 60% Hb. as the critical level, then the 10 cases below 60% were undertransfused and blood was indicated for their postoperative anaemia. However, blood was not indicated and was unnecessarily given in 12 postoperative cases with haemoglobin level above 60%.

2 cases of postoperative anaemia and 5 cases of post-partum anaemia received blood in K.K.M.H. The five cases of post-partum anaemia all had haemoglobin below 42% and they all only received a single pint of blood each during delivery. The two cases of postoperative anaemia had haemoglobin above 65% and blood was not indicated for them. There is little justification for giving a patient blood so that he can be discharged from hospital earlier (B.M.J., 1957).

Antepartum anaemia

There were 15 cases of antepartum anaemia, 2 of these were first seen when already in early labour. The haemoglobin was below 50%. The remaining 13 were all first seen in late pregnancy after 34 weeks period of gestation. 8 had haemoglobin levels between 40-50% and 5 had haemoglobin below 40%. In no case was the type of anaemia specified. Blood was these were undertransfused.

14 of these cases had only one unit of blood and 1 had 3 units and in no case was the post transfusion haemoglobin above 60%. Some of these were under transfused.

There were no cases of anaemia of pregnancy before 34 weeks. Such gross examples of anaemia of pregnancy can only be detected by early ante-natal care and by carrying out routine haemoglobin estimation on all cases at the first visit and subsequently whenever indicated. Only if anaemia is suspected and proved and the aetiology found and treatment started early can it be hoped to reduce the number of patients coming so near to term with such gross anaemia.

Emergency blood

5 pints of emergency blood were used in G.H. during the survey. They were for two patients with multiple stab wounds and internal haemorrhage. Another for a patient with multiple lacerated wounds due to a parang attack. The 4th was an accident case with ruptured liver, and the fifth case was a case of peptic ulcer with haemetemesis. One of the patients had only one pint of blood, another died before any further blood could be given and the remaining three had a further one, four, and five units of blood each.

In K.K.H. a total of 45 units of emergency blood were used for 25 gynaecological cases and 20 obstetrical cases. These cases included abortions 19 cases, post partum haemorrhage 15, ruptured ectopic gestation 4, caesarian section 5, uterine haemorrhage 1 and haematoma vulva 1 case. Of these patients, 21 had only one unit of blood, 16 patients had 2 units, 6 had 3 units and 2 had 4 units of blood.

The majority of these patients were usually admitted following delivery at home and on admission they were all found to be in a bad state of collapse necessitating immediate transfusions. Therefore it could be said that in most cases the use of emergency blood was unavoidable. However, looking at the number of transfusions these patients had the impression is that perhaps these patients were not

Table 4. Post transfusion Hb. level of patients who received emergency blood.

Post transfusion haemoglobin	Below 50%	50-60%	61-70%	71-80%	Above 80%	Not known
1 unit	—	3	5	5	—	8
2 units	1	1	3	2	1	5
3 units	2	2	1	1	1	1
4 units	—	2	—	—	—	1

in such a bad state of shock. Of these 45 cases, 21 received only 1 unit of blood as the sole means of replacement therapy. The question, is therefore, did these 21 patients really need the blood or not. It is difficult to answer this question in retrospect but if the post transfusion haemoglobin level could be used as a guide (Table 4), then it could be fairly said that the 5 patients who received 1 unit of emergency blood and had a post transfusion level of 70-80% probably would not have needed the emergency blood. Plasma or dextran could have been used to restore the blood volume and blood pressure. The five patients who received 1 unit emergency blood and had a post transfusion haemoglobin of between 61-70% could have been given plasma or dextran first followed by one pint of matched blood and the three patients with a haemoglobin level of less than 60% should have been given more than 1 pint of blood.

Dextran and plasma

Although the ward doctors were asked to inform the laboratory whenever dextran was being given and to send the patient's blood for grouping and Rh testing before the administration of dextran no such notification was received from any of the units in both hospitals. Enquiry showed that a few bottles of dextran were used during the month though the exact amount was not known. To obtain an idea of the amount of dextran used the information was obtained from the records of the dispensaries in these two hospitals. This showed that in G.H. during the month of October 28 bottles of dextran were issued to the surgical wards and theatres. No dextran were issued to the Medical Units during the month. In K.K.H. no dextran had been issued during October but between January and August 92 bottles of dextran were issued i.e. approximately 12 bottles per month. These figures are only being quoted to show the small number of plasma substitutes that is being used in the hospitals.

The main use of plasma substitutes is the restoration of depleted blood volume when supplies of blood or plasma are lacking or in emergency cases with acute blood loss whilst waiting for matched blood or in moderate blood loss not requiring whole blood. Plasma substitutes should not be used in such large quantities that the Hb. concentration is depressed below 9 grams% (62% Haldane).

There appears to be some doubt as to the value of dextran and doctors in these two hospitals appear reluctant to use it for supportive therapy. It has been said to increase bleeding time and that its fate in the body is uncertain. Clinically it has been shown that dextran is the safe and satisfactory blood volume expander and there is no reason to believe that in moderate amount it increases bleeding time (Artz. et al., 1955). Dextran is either excreted in the urine or metabolised in the body. Some is incorporated in the tissues but does not cause histological changes. Reaction due to dextran is very uncommon, and about the only condition where it is preferable to use plasma or blood is in accidental concealed haemorrhage, where further dilution of clotting factors in the blood is undesirable (Barry et al., 1955).

CONCLUSION

1. Undertransfusion is responsible for a high percentage of cases receiving one unit transfusions.

2. If the routine prescription of 1 pint of blood is done away with and the needs of the patient carefully assessed it might be possible to save some units of blood.

3. The use of plasma or plasma substitutes, e.g. dextran should be encouraged especially when there has been moderate blood loss without severe anaemia.

4. Preoperative blood is not indicated except in urgent cases. Routine Hb. estimations should be carried out as soon as an operation is decided upon and non urgent cases should not be admitted for operation until their anaemia has been corrected.

5. Antepartum anaemia can be prevented by early ante-natal care and routine Hb. estimations done at the first visit. Anaemia if diagnosed should be investigated and treated energetically so that the need for transfusions for anaemia in late pregnancy can be minimised.

6. There is an urgent need for a separate blood transfusion laboratory at K.K.H. to deal with the requests from that hospital. This might also help to decrease the amount of emergency unmatched blood being used.

Finally, as was stated at the beginning, the purpose of this survey was to see if the increased demand for blood could be met by the more economical usage of the present supply, thereby obviating the frequent inconvenient shortages. There were no examples of gross wastage of blood. Whilst some units of blood could have been saved by a more careful

assessment of the needs of the patient and by the early detection and treatment of preoperative and antepartum anaemia, this saving would be offset by the fact that many of the patients were undertransfused and should have been given more units of blood than they actually received. Therefore there is an urgent need for a drive to enrol more blood donors so that the demands for the future may be met. What is needed is not just an increase in the number of relative donors, the majority of whom are either already regular donors, or who donate only once and no more, but a large panel of volunteers who would be prepared to donate regularly. It must be remembered that fundamentally, blood is not provided by the blood transfusion service. Blood is provided by the voluntary effort of a small altruistic section of the community.

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