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BLOOD TRANSFUSION.

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Bombay.

I was asked by Dr. B. N. Purandare to read a paper on blood transfusion before this society and I immediately consented knowing fully well that I have to read it before an audience most of whom have given many transfusions and know everything about it. But I consented only because I wanted to learn something from your experience.

We owe all our knowledge of blood groups to Landsteiner,—who in 1900, first showed that the serum of one normal human being can agglutinate or hæmolyse the bloods of certain other individuals and it was he who pointed out the importance of blood groups in blood transfusions.

If blood cells of individuals of certain groups are mixed with the serum of individuals belonging to certain other groups, the red blood cells will come together in clumps. This phenomenon of agglutination forms the basis for the division of all human-beings into four groups O, A, B, and AB. According to Landsteiner the existence of the four blood groups depends upon the presence or absence of two agglutinogens A and B in the red corpuscles and two agglutinins *a* and *b* in the serum. Several different nomenclatures for the four blood groups have been used but because of the confusion on many occasions on International Nomenclature has been officially recognised by the Health Committee of League of Nations now.

Blood Groups in relation to age:

Agglutinogen can be demonstrated in the red blood cells of a foetus of 37 days. Sensitivity increases throughout antenatal and postnatal life up to 20 years of age. After this it becomes constant. Agglutinins are usually not developed at birth but rapidly increase in titre thereafter upto the age of puberty, after which time the titre falls gradually. Whatever agglutinins are formed at birth are usually derived from the mother.

Technique of Grouping:

There are various methods of determining the group, porcelain dish method being quite reliable and convenient. 1 per cent or 2 per cent suspension of unknown cells is mixed with sera of Group

A and B and kept for some time. These sera should be of high titre and then only serious mistakes in grouping can be avoided. It is better to use a control serum of group O to check the results of group found out by A and B sera Or the result may be checked by mixing cell suspension of Group A and B with the unknown serum and confirming the first result.

The results may be read by naked eye examination or lens but it should always be confirmed by microscopic examination. Pseudo-agglutination can be detected by this means only.

Sources of err or in blood Grouping:

(i) The mixture of serum and cell suspension may not be kept for sufficient time and so agglutination may be missed.

(ii) The grouping sera may have a low titre and so fail to agglutinate the corpuscles for a long time.

(iii) Some corpuscles are not sufficiently sensitive for agglutination and this commonly happens with subgroups A2B.

(iv) Presence of certain other agglutinins such as cold agglutinins or autoagglutinins.

(v) In addition to these known ones there are certain irregular or anomalous agglutinins.

***Rh Factor*:**

Recently another agglutinogen has been demonstrated in the corpuscles. Similar antigen is found in the red corpuscles of M. rhesus and so this antigen has been named Rh factor. Normally immune bodies against this Rh factor do not exist in the serum. It has been found that about 85 percent of the population possess this additional agglutinogen in the corpuscles: When Rh+ve blood is transfused to Rh—ve recipient it may result in the production of anti Rh immune bodies in recipients' serum. These may react with the Rh positive corpuscles at the next transfusion. On this basis some of the post transfusion hæmolytic reactions can be explained.

Relation of Rh factor and Erythroblastalis Faetalis:

Now it has been proved that it is the Rh factor which is responsible for the condition of erythroblastalis fætalis:

The theory briefly is like this:

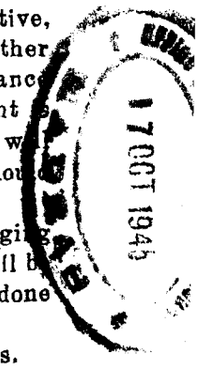
If Rh-ve woman conceives from Rh positive man, the child may be Rh positive or -ve depending on whether the father is homozygous (Rh rh) or heterozygous (Rh rh).

If the father is homozygous all the children will be Rh positive and if heterozygous, each child will have an even chance of being Rh-ve and of escaping the disease.

So Rh -ve mother having a Rh positive faetus might produce anti Rh agglutinins as a result of immunisation with fætal blood. The anti-bodies pass through the placenta and in suitable concentration cause hæmolysis of the fætal red-cells.

With this new etiology of the condition of erythroblastalis fætalis it becomes quite obvious that the ideal donor is Rh-ve belonging to the same group as the child. If such donor is not available Rh -ve of Group O may be used. If mother's blood has to be given it should be washed free of plasma and only corpuscles should be transfused, for it is the presence of anti Rh agglutinin in mother's plasma which bring about the destruction of fætal corpuscles.

In some cases of erythroblastalis fætalis mother is Rh positive, in such cases if isoimmunisation is responsible it seems that another antigen must be involved. This Rh factor is of great importance in cases of transfusion in a pregnant woman. If the patient is Rh -ve and the foetus Rh positive, Rh positive donor's blood will give severe reactions and so in such cases the patient's blood should always be tested for the presence of Rh factor.



After knowing all the factors which are concerned in bringing about an agglutination or hæmolysis of the donors cells, it will be convenient here to know the various procedures that should be done to see the compatibility of blood.

(1) Grouping of the recipient by reliable sera and controls.

(2) Cross matching of the donor's and recipient's blood.

(3) Recipient's serum and suspension of donor's corpuscles tested for hæmolysis and agglutination at 37°, in cold and at room temperature. This test is very important after first transfusion and in cases of pregnant patients even for the first transfusion. Any negligence in doing these tests may result sometimes in severe post transfusion reaction.

Indications for Transfusion:

The therapeutic value of blood transfusion depends upon the following main effects:—

(1) Volume of circulating blood is increased.

(2) An immediately availble supply of oxygen carriers is supplied.

(3) Bone marrow is stimulated.

(4) Coagulability of blood may be increased.

(5) Some natural or immune antibodies are transferred from the door to the recipient

I am going to restrict myself to the indications in obstetrical and gynæcological practice only.

(1) Shock and hæmorrhage in obstetrics and gynæcology.

This shock is mostly due to blood loss. This, in early stages is replaced by transference of intercellular fluid to the blood vessels and thus the blood loss may be partly compensated by dilution of the blood, but this dilution in later stages leads to anoxæmia, which in turn increases the permeability of capillaries and thus again there is hæmoconcentration due to transference of fluid to tissue

spaces. This is seen in prolonged bleeding of incomplete abortion and ectopic pregnancy.

In postpartum hæmorrhage, the bleeding is continuous and may be severe enough to produce an early collapse.

Patients with late pregnancy toxæmia, particularly with hypertension may collapse even in the presence of even a small postpartum blood loss.

From an analysis of the Glasgow Royal Maternity Hospital it has been concluded that mortality rate from hæmorrhage has been much reduced by transfusions.

Transfusion also is advocated in functional uterine bleeding preferably from pregnant women.

Before some of the major gynæcological operations, transfusion may be given in very low patients.

Selection of a Donor :

There is always a great difficulty in getting a donor in hospital as well as in private practice. The immense value of blood transfusion has not yet appealed to many, and lay people have still got a notion that even a healthy man cannot stand any loss of blood. Because of these difficulties it always becomes a great job to get a suitable donor. It is high time now that some kind of public instructions and demonstrations should be given to root out this silly notion from laymen's minds. With these points in view some days ago a Civil Hospital Emergency Committee was appointed with few very enthusiast workers, but as far as my knowledge goes people did not respond to it and very little is heard of it now.

At present the Red Cross Society has maintained a transfusion service and as far as possible they try to give a suitable donor. Their register also appears to have comparatively fewer names, as many times the same donor is seen to come over and over again. Sometimes it becomes difficult to get a donor from this service on holidays and Sundays, as many of the donors have no arrangements for receiving phone calls, and so the service sometimes cannot provide donors for obstetrical emergencies. With all that, they deserve to be congratulated for keeping it going on in spite of so many difficulties.

The donor must be healthy and all possibilties of syphilis, malaria, hypersensitiveness etc. should be excluded. A healthy donor can give 500 c.c. of blood without any ill effects. It is advised that he should not give another donation after this loss at least for three months.

In the present war because of the establishment of the many blood banks the problem of effect of donation of blood on the donor was studied in greater details. The results of these investigations are as follows :—

(1) Incidence of fainting is 28 per cent to 6.85 per cent.

(2) Fainting is more common in women than in men and pecially when menstruating

(3) More common in younger donors.

(4) Common when donor is fasting for many hours.

se of a Universal Donor :

It is preferable to use a donor of the same group as the recipient, sometimes the agglutinins of the donor are of high titre and a ansference of such a blood might cause hæmolysis of the recipient's ells and might cause mild reaction after a small transfusion and a evere or fatal one after a large transfusion.

lethod of Transfusion :—

Blood may be transfused either unmodified or by modifying it by dding various anticoagulants. There are staunch advocates on either side and the relative advantages of transfusion of unmodified or of citrated blood do *not* appear to be settled as yet.

Unmodified Blood :—

The advantages of whole blood are that it contains in a relative unaltered from the clotting elements leucocytes, immune bodies etc. which the physician often desires to use. This method therefore appears to be of choice in hæmorrhagic conditions, infections, cachectic conditions and in all diseases where the opsonic and phagocytic powers of the blood have to be made use of. The advocates of this method claim that the cirated blood gives rise to more reactions than unmodified. Wiener and others have now definitely proved that the severe reaction were not due to the cirate but were due to other factors especially foreign matter derived from the apparatus. They have shown that thorough cleaning and sterilisation of the apparatus brings down the reaction to a very low level.

The best and most popular method of transfusing unmodified blood is by syringe valve method. Various modifications of such syringes are available.

Citrated Blood :—

There are many anticoagulants, of which sodium citrate is most useful and reliable. The quantity of sodium cirate recommended is 0.25 to 0.3 per cent.

A 2 per cent sodium citrate solution should be prepared in physiological saline : 15 cc. of this should be taken for 100 ccs. of blood.

The sodium cirate should be neutral. The water must be treply glass distilled water.

There are many advantages of using citrated blood, the main being the ease with which it can be manipulated. The method is best in most of the surgical, obstetrical and gynæcological conditions.

Other anticoagulants :—

Heparin : The donor is given 1 mg. of heparin per kg. of body weight and the transfusion should be started within 10 minutes and

completed within 30 minutes. The donor's coagulation time is altered for about 1½ hours. Heparinised blood has no effect on the recipient. The effect of *heparin* in the donor can be immediately destroyed by the intravenous injection.

Heparin can also be used in proportion of 0.1 to 0 2 gm. per 100 cc. of blood. By this way clotting is prevented from 105 to 120 minutes. Heparin acts by inhibition of platelet agglutination.

Recently a new drug—'Dicuomarin' with anticoagulant property has been described. It acts at the prothrombin level. It takes about 24 hours to act So far it has not been given any trial as an anticoagulant for blood transfusion purposes.

Technique of Transfusion :—

The blood may be collected in a saline flask containing requisite amount of 2 per cent citrated saline and then given by gravity method. This method has some disadvantages, the main being that the blood is exposed to air for a long time and so chances of contamination and hence post transfusion reactions are many. The ideal method is to collect the blood in a closed bottle and give it by drip method. This method may be described in details ;

Materials required :—

(1) Fair-deals or filtrair's bottles with a lid having a rubber diaphragm.

(2) 2½" long B. D. needles of 15, 16 and 17 sizes for use of the donors. In females it is better to use size 17 needle.

(3) Transparent rubber tubes for collection and transfusion of blood.

(4) A specially prepared 6" long neddle of the same bore as B. D. 15 size for collection.

(5) Air filters.

(6) Drip with one outlet and two inlets.

(7) A glass adapter for needle.

(8) B. D. 18 size or 20 may be used for recipient.

Method of Sterilization :—

2 per cent solution of sodium cirate in normal saline in requisite amount in the bottles and the lid is kept loose. Then it is sterilised in an autoclave with the lid loose. After sterilisation is finished, the lid is tightened when the solution is hot.

The needles and rubber tubes are boiled in 0.1 per cent NaOH solution for 5 minutes, washed throughly in distilled water and then sterilised by boiling.

The air filters are sterilised in hot air oven.

The blood is collected in this bottle by piercing the rubber diaphragm and not by opening the bottle. The bottle must be well shaken to prevent clotting and the blood should fall directly in the solution and not to the side of the bottle.

The transfusion apparatus should contain a drip with a side nozzle and a filter for the blood. To the side nozzle is attached another filtrair bottle containing sterilised saline. This helps in washing off the whole rubber tube and prevents the sedimentation of the blood in the rubber tube when the blood is given slowly. The blood should be allowed to go by gravity at the rate of 40 drops per minute or with the same number of drops per minute as the pulse rate. The saline should be allowed to flow at intervals. The blood is given by method of gravity. The main advantages of this method are :—

(1) Complete asepsis can be maintained, this being a closed system.

(2) The rate of blood flow can be controlled.

(3) Biological test can be done.

In this method about 20 ccs. blood are injected in the recipient's vein and if after 10 to 20 minutes no reaction occurs a large quantity may be injected. This test should be used as a supplement to the methods of typing and cross matching.

Routes of Transfusion :—

(1) Intravenous—This is the usual route. Sometimes the veins are collapsed and it may not be possible to get in even after desection. In these cases other methods have to be used.

(2) Through sternum—In adults this is one of the easy routes in cases where it is difficult to get in a vein. Recently Hamilton Bailey has described this method in details in one of the *B. M. J.* issues. He uses special sternal puncture needles.

(3) In children—Tibial puncture is better and easier than sternum, as the sternum is very thin in them.

(4) Sagital sinus in children.

Dr. B. N. Purandare will demonstrate this apparatus at the end of this paper.

Post Transfusion Reactions :—

Post transfusion reactions can conveniently be divided into three large groups—Allergic, Haemolytic and Pyrogenic.

Allergic reactions : are manifested as urticaria etc. It is seen that such reactions are more common when the donor's blood is collected after meals and particularly if he has taken some proteins to which the patient is sensitive. These can be prevented in some caaes by bleeding the donor when fasting. These reactions respond well to adrenaline.

Haemolytic reaction : The usual symptoms are fullness of head, restlessness and anxiety, a sudden sharp pain in the lumbar region, precordial oppression, dyspnœa, coughing etc. This may be followed by collapse, shock or hæmoglobin urea. Sometimes the patient gets complete suppression of urine. Certain cases exhibit a bleeding tendency. Some develop jaundice later on.

These reactions are explained as follows:—When blood hæmolyses, it is excreted by the kidney and in it forms acid hæmatin which blocks the tubules and causes anuria. This work has been supported by experimental work and recently by p. m. examination of kidneys in cases of crush syndrome. In this condition the kidneys showed casts of myohæmoglobin in the tubules causing obstruction, anuria and other symptoms.

The factors which are responsible for these hæmolytic reactions are:—

(1) Transfusion of blood of an incompatible group—this can be avoided by doing the typing and grouping very carefully.

(2) Use of a so called "Universal donor". In these cases possibility of hæmolysis exists if more than 200 ccs. are transfused in a severely anæmic patient or if the donor's serum is of a high titre. Prevention is to avoid such a universal donor whenever possible.

(3) Another factor is the presence in patient's serum of atypical agglutinins and hæmolysins acting on donor's corpuscles.

(4) Rh factor—presence in Rh negative patient's serum of iso-immune Rh bodies, which cause hæmolysis of Rh positive carpuscles—or—donar. Preventing is to use a Rh—ve donor.

(5) In certain cases there is no in vitro incompatibility of blood. Such cases should be classified as "Unavoidable" in the present state of our knowledge.

Many of these hæmolytic reactions are likely to occur in obstetric practice and they can best be avoided by careful typing, cross matching, testing in vitro for hæmolyiss and agglutination at 37°C, at room temperature and excluding the presence of cold agglutinins This can be done only by a man specially trained in these procedures

Treatment for haemolytic reaction :—

If symptoms appear, transfusion should be immediately stopped. and urine should be alkalinised. A rapid method of alkalisation of urine is as follows:—10 cc. of 2 M or 3 M sodium lactate solution (which is sterilised by autoclave or filtration) and 10 cc. of saturated solution of sod. bicarbonate (sterilised by filtration) are injected intravenously. Intravenous glucose also may be given to produce diuresis.

Pyrogenic Reactions :—

Symptoms are sensation of chill, rigors, rise of temperature etc. These reactions for a long time were supposed to be due to citrate itself. Now it has been proved beyond doubt that other factors are responsible for these, such as foreign bodies in the transfusion apparatus, old blood clots or fibrin strands, distilled water used to prepare the solution incomplete sterilisation of the rubber tubes etc

These reactions can be prevented as follows:

(1) Using reliable and best quality material (sod. citrate and sod. chloride).

(2) Using fresh treply glass distilled water.

(3) Cleaning the apparatus as follows after using it: After thoroughly cleaning it in tap water and removing all dirt particles and blood clots—the apparatus is boiled for five minutes in 0.1 per cent NaOH solution. Then it is thoroughly washed in distilled water and then sterilised.

(4) The rate of blood flow should not be too fast—the ideal spread being the same number of drops of blood per minute as the pulse rate.

Some of these can be prevented by administering ephedrine and luminal ½ to 1 hour previous to the transfusion. This also puts the patient to rest and minimises the excitement of the transfusion.

It has been observed by certain workers that pyrogenic reactions are more marked in the following conditions:—

(i) Blood dyscrasias, leukaemia, purpura etc.

(ii) In febrile than in afebrile patients.

(iii) Persons suffering from septic diseases.

(iv) Patients treated for gynæcological troubles: Our experience in the K. E. M. Hospital with preserved blood also is the same.

Follow up of the patient after a transfusion—Immediate:—

Watch must be kept on pulse rate, any other distressing symptoms and especially for any symptoms of hæmolytic reactions.

Delayed: In cases of urticaria adrenaline must be injected. In cases of hæmolytic reactions patient's serum and urine must be examined for evidence of hæmoglobinæmia and hæmoglobinurea respectively and the patient's and donor's blood should again be tested to exclude the error of transfusion of an incompatible blood.

It is better to examine the 1st, 2nd and 3rd samples of urine after every transfusion for evidence of hæmoglobinurea.

Other blood except from a donor:—

Placental blood: This blood has been given a trial but the yield from the placenta is very little, about 80 cc.s and moreover it is very difficult to avoid contamination.

Cadaver blood: Cadaveric blood has been given an extensive trial in Russia and probably a great progress will be done during this war. In must be collected within eight hours of death. This method has not yet been tried here.

Other blood Substitutes:—

Plasma: Some of the results of plasma transfusion in obstetric hæmorrhage and shock are so striking that it is felt by some that every lying in institution should be equipped with plasma. At least for the present preparation of plasma is not easy in small hospitals.

It is possible only for very big institutions to have sufficient quantity of plasma and they if possible should supply it at moderate charges to the other hospitals. A healthy donor can give 500 ccs, of blood and from this the maximum yield of plasma is about 250 ccs. This plasma should be pooled i.e. the plasma from different groups must be mixed together and then redistributed into different bottles ready for supply. This pooling together is supposed to diminish agglutinin titre of high titre plasma and thus lessen the risk of reactions. Even this plasma in vitro may give rise to agglutination of recipient's corpuscles and so theoretically such a palsma should not be given, but for practical purposes 500 cc. of pooled plasma may be safely given if the rate of introduction is slow. This is explained as due to dillution of the plasma by recipient's plasma and so the titre of the plasma introduced goes still lower and chances of agglutination of recipient's corpuscles become less. Some material gets deposited in the liquid plasma stored in cold after sometime, and so it has to be filtered before use. The ideal plasma is of Group AB, as it does not contain any agglutinatinins. It is said that allergic reactions after plasma are more common than with whole blood.

Because of the sedimentation of some material in plasma dried plasma is preferable.

The other blood substitute is lyophilised or evaporated blood serum. It helps to maintain the osmotic tension in the blood.

One more preparation has recently been described as a blood substitute. It is despiciated bovine serum This is a serum of animals which has been detoxicated by some chemical processes. Few reports of its trial have been published but its general use requires more clinical trials.

A word about the Blood Bank must be mentioned. The K.E.M. Hospital has been running a blood bank of their own for over two years, and the clinicians there, feel that it is serving a very useful purpose. The published statistics about the post transfusion reaction of Bank Blood compare very well with the citrated blood or unmodified blood in Western countries but unfortunately my experience as far as reactions are concerned was not so in the K.E.M. Hospital. I find that the pyrogenic reactions are high.

Before I take my seat I must thank Dr. B. N. Purandare for asking me to read this paper, and you all for the patient hearing.

Dr. B. N. Purandare demonstrated the blood transfusion apparatus used by him in his private hospital. The citrate solution is kept in ampoules. He has been using it for a long time and has never seen any reactions following it use though they are preserved for a long time. The bottle with the special lid, which has one outlet and one inlet for air is used by him. The citrate is first filled in the bottle

in requisisite amount or praferably a little in excess and then blood is collected with the usual precautions.

Sometimes a long clot forms in the collecting metal rod and falls to the bottom of the bottle which sometimes causes an obstruction to the blood flow. To prevent this, the metal rod is removed very quickly from the bottle at the end of collection of blood from the donor.

Then the lid is changed and another special lid mentioned above is used.

A drip with a side nozzle is included in the transfusion apparatus.

DISCUSSION

Dr. B. N. PURANDARE said that cadaveric blood had been tried in K. E M. Hospital by Dr. Dikshit on 50 patients and was found satisfactory. He thought that gynæcological patients in the hospital reacted badly to blood transfusion becau·e of the defect in the techinque, the use of the open method instead of the closed method of transfusion.

He did not think that fresh sodium citrate was essential. He did not observe any reactions with old samples of sodium citrate prepared in triple distilled water and stocked properly in sterile ampoules. He also demonstrated the dried plasma bottle and the method of preparation and administration. He asked Dr. Wardekar whether he had noticed the reactions in the patient after a plasma transfusion that one would expect with a blood transfusion. He cited one of the cases who complained of pain in the back, feeling of suffocation, and cramps in the legs while receiving a plasma transfusion. He persisted with the transfusion after which the patient developed urticaria for which adrenaline was given. The patient had two or three blood transfusions previously, and he wondered if this had anything to do with the reactions produced by the subsequent plasma transfusion.

Dr. M. S. TALWALKAR wanted to know how much blood should be given to a ptaient at one siting. He did not think that plasma was a good substitute for blood in cases of hæmorrhage where only blood can replace blood. In shock, plasma can certainly be tried. He asked if it was advisable to try bone marrow transfusion in those cases where the veins get easily blocked or are difficult to get into in collapsed patients.

Dr. JUNGALWALA preferred trying bone morrow transfusion in those cases where the veins are difficult to expose or to get into. The best site for bone marrow transfusion is the manubrium sterni and he demostrated the special needle and the technique.

Dr. SARAIYA said that the indications for blood transfusion were: hæmorrhage, anæmia and infections. He has tried transfusion into the femoral vein in badly collapsed patients. Thrombosis of the femoral vein after such transfusions is due to neglect and

careless technique. He prefers this method of transfusion to bone marrow transfusion.

With anæmic patients blood transfusion is treacherous, and the result depends on the condition of the myocardium.

In cases of infection, blood transfusion does not give good results,

He asked Dr. Wardekar if blood transfusion was advisable in cases of anæmia with high blood pressure; if it was necessary to group the blood of new born babies before giving them a blood transfusion.

Dr. KARANDE referred to an article in the Year Book of Obstetrics and Gynæcology 1943 where it is stated that it is not necessary to match the blood of new born babies as they are supposed to be immune to reaction,

Blood transfusion should be restricted to cases of hæmorrhage, where the results are good. For anæmias he is chary about giving blood transfusion, which, if absolutely needed, should be given in small quantities and very slowly. If any reactions developed, the transfusion should be stopped immediately. When collecting blood from the donor, it is better to filter the blood through gauze pieces to avoid any mishaps that may result from clots blocking the tube.

Plasma also should be fitered to prevent any reaction. Plasma is a good substitute for loss of fluid if not for loss of blood. He asked if the Rh factor was being determind in Bombay.

Dr. B. N. PURANDARE said that patients with severe anæmia and high blood pressure, should receive a blood transfusien soon after delivery to avoid the effects of the sudden drop of blood pressure that occurs soon after delivery in these toxæmic patients. He has tried sternal transfusion in a very small child with sarcoma bothriod on the day previous to operation but found that he could not give more than 50 cc. due to some obstruction. So he subsequently finished the transfusion by injecting the blood into one of the tibias. He has tried transfusion into the femoral vein by close method in two cases without any thrombosis. The femoral vein is very easy to find and there is no need to cut on to it to expose it.

Dr. JHAVERI said that most blood transfusions at the Bhagat Hospital were given for secondary anæmias. At the first transfusion a small quantity is given, and the transfusion is repeated a second and even a third time if necessary.

Dr. WARDEKAR, answering Dr. B. N. Purandare's questions said that Dr. Dikshit's work on cadavaric blood was not published anywhere and so was not known. During his stay at K. E. M. Hospital he tried for cadaveric blood, but for one reason or the other a suitable cadaver could not be obtained. Referring to Dr. Purandare's question about old sodium citrate ampoules, he said that the preparation of triple distilled water and sodium citrate solution, filling of ampoules and their sterilisation should be done on the same day. The old distilled water should not be used, as it is such water which generally gives rise to pyrogenic reactions. These sealed ampoules may be used any time later on. The reaction after plasma transfusion in this particular case may be due to high sensitivity of patients corpuscles or high agglutinin titre of the plasma of that particular batch. Answering Dr. Talwalkar's question, he said that 500 cc. of blood raises hæmoglobin by 10 per cent. In obstetric cases a transfusion of 500 to 800 ccs. is recommended.

If patient is not anæmic befeor hæmorrhage, the immediate thing to be combated after hæmorrhage is shock and not percentage of hæmoglobin, so plasma serves this purpose very well, though whole blood is preferable. Plasma moreover can be always kept ready for emergency.

In reply to Dr. Saraiya's question, he said that agglutinogens are present in now born babies, but the titreis not high. The agglutinins start developing after 10th day usually, and if present before that day, have a very low titre. It is not necessary to group the babies blood. In children it is better to give blood transfusion by tibial puncture rather than by sternal puncture.

In anæmic patients with hypertension if a transfusion has to be given it is better to give a suspension of red blood corpuscles. Plasma must be filtered after mixing, in order to remove the coarse particles.

As far as my knowledge goes no pathologist in Bombay is determining Rh positive and negative bloods, but they do in vitro test for hæmolytic reaction before every transfusion.

The greatest danger of a large blood transfusion in severely anæmic patients, is the sudden failure of the heart which has adalrey undergone a fatty degeneration. In such cases 100 cc. should be given preferably by sternal puncture and repeated every 4 or 5 days.

Dr. N. A. PURANDARE thanked Dr. Wardekar for his excellent paper. Referring to the previous clinical meeting he thought that the help of a pathologist was more essential than the help of an anæsthetist.

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