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Autologous Transfusion in Obstetrics

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ABSTRACT

Aim of study: To assess the safety of blood collection for autologous transfusion in pregnant women and the effects of the procedure on the fetus.

Method: Prospective study involving obstetric patients undergoing elective lower segment Caesarean section (LSCS) between 1993 and 1994 were recruited for autologous transfusion. Continuous cardiotocograph monitoring was carried out throughout the duration of the procedure and the fetal haemodynamics was studied before and after by doppler blood flow ultrasound.

Results: The results show that there was no fetal deceleration or increased uterine activity as monitored by cardiotocography. The mean pulsatility index (PI) for the umbilical artery before the procedure was 0.9560 and after was 0.0820 which is a significant difference (p value = 0.035).

Conclusion: Autologous blood collection seems to be a safe procedure for both the mother and the fetus. However, autologous transfusion remains an unpopular choice amongst pregnant women.

Keywords: autologous transfusion, elective Caesarean section, pregnant women

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INTRODUCTION

With the current concern regarding acquired immunodeficiency syndrome (AIDS) and other transfusion associated diseases such as viral hepatitis, there is much apprehension amongst recipients of homologous blood.

Even with strict infectious disease screening of donor blood, there is still the possibility of blood transfusion reaction and this may range from temporary chills and rigors to haemolysis which can be life-threatening. The recipient may also develop alloantibodies from transfusion. This is especially tragic in females of reproductive age as it may result in complication to the fetus and neonate in subsequent pregnancies, as the neonate may develop haemolytic disease of the newborn (HDN).

Presently, the use of autologous blood for transfusion is increasing in popularity and more patients are demanding its use. Blood donation for autologous use poses no greater risk than donating for homologous transfusion for most patients. However the issue of donor safety is more complicated when the blood donor is a pregnant woman. Experience is limited and complications have been reported during blood collection. These include premature labour and fetal distress.

In our local context, the Singapore Blood Transfusion Service (SBTS) has so far found no evidence of complications in the pregnant women who have donated blood for autologous transfusion at their own requests. However, fetal well-being was not monitored at the time of collection and before encouraging more women to do so, the safety of autologous transfusion to the fetus must be established. It is with this in mind that the Department of Obstetrics & Gynaecology, Singapore General Hospital set up a protocol in conjunction with the SBTS to monitor pregnant patients who are donating their own blood to determine the safety of acute bleeding during pregnancy and the effects on the fetus.

In this study, we aimed to assess the safety of blood collection for autologous transfusion in pregnant women and the effects of the procedure on the fetus. We also hope to establish risk factors if any, that may be a contraindication to blood donation during pregnancy.

PATIENTS AND METHODS

A study of women listed for elective Caesarean section at the Department of Obstetrics & Gynaecology, Singapore General Hospital was conducted. This was performed with the consent of the obstetrician-in-charge as well as the informed consent of the patients. A protocol was established jointly by the Singapore Blood Transfusion Service and the Department of Obstetrics & Gynaecology to obtain donated blood from the pregnant women.

Inclusion criteria for the study were: (1) women with singleton pregnancies; (2) a haemoglobin level $\geq$ 11.0 g/dL; (3) a haematocrit $\geq$ 34%, and (4) gestational age $\geq$ 36 completed weeks.

Exclusion criteria included: (1) women with weight $<$ 45 kg at the time of collection; (2) women tested positive for infection markers in the blood serum (positive VDRL, HIV, hepatitis B antigen); (3) women with multiple pregnancies, and (4) women with obstetric complications where the fetus may already be compromised, such as pre-eclampsia and severe intrauterine growth retardation.

Women listed for elective Caesarean section were informed of the study and consent taken from them. The haemoglobin level and the haematocrit were checked to ascertain eligibility. All patients were given iron supplements at this time.

One unit of blood was collected from 36 weeks of amenorrhoea (this would generally be 2 weeks before elective Caesarean section). The phlebotomy was performed in the Labour Assessment Ward with the staff from the Singapore Blood Transfusion Service and the obstetric team in attendance.

Before venepuncture, maternal and fetal well-being was assessed. Maternal temperature, blood pressure and pulse rate were recorded. Ultrasonography was performed on the Acuson by a single obstetric investigator. Biophysical profile according to the modified Manning's criteria and doppler blood flow studies on the umbilical artery, the middle cerebral artery and the thoracic aorta were performed and recorded. A continuous cardiotocograph monitoring was then carried out for 10 minutes.

Venepuncture and blood collection was carried out by the Singapore Blood Transfusion Service team. This was done with the patient in the left lateral position. The fetus was monitored continuously throughout the procedure using cardiotocography (CTG). The amount of blood collected ranged from 300 to 430 mLs and this took about 10 minutes. Fetal bradycardia would be an indication for termination of the procedure immediately and appropriate action would be taken by the investigator.

After the collection, the patient remained on continuous CTG monitoring for 30 minutes. The biophysical profile and blood flow studies were repeated and the results recorded.

During Caesarean section, patients received autologous blood only when indicated. Patients were informed prior to surgery that in the event of unanticipated excessive blood loss intraoperatively, homologous blood would be given in addition to autologous blood. After delivery, the hospital records were reviewed and the following were recorded:

1) medical and obstetric complications;
2) the type of Caesarean section performed, that is, whether elective or emergency, lower segment or classical;
3) the indications for Caesarean section;
4) the estimated intraoperative blood loss;
5) the fate of the autologous blood, and
6) the neonatal outcome based on birth weight, APGAR scores at 1 and 5 minutes, cord haemoglobin level and haematocrit.

RESULTS

Twenty-three patients consented to participate in the study between 1993 to 1994. Two were not eligible because of low haemoglobin levels and one had flu on the day of blood collection. Subsequently, 20 patients took part in the study.

All the patients donated blood between 36 and 38 weeks of amenorrhoea. The mean volume of blood collected was 410 mLs.

Of the 20 patients analysed, 3 had gestational diabetes mellitus on dietary control and 2 were older than 35 years of age. Six women were primigravida and the rest were multiparas. The indications for Caesarean section are recorded in Table I.

Table I – Indications of Caesarean section

Indication	Number of patients
3 previous LSCS	1
2 previous LSCS	6
1 previous LSCS + other indication	6
Placenta praevia	2
Primip breech	5

* LSCS = Lower Segment Caesarean Section

During blood collection, there was no fetal deceleration or increased uterine activity as monitored by cardiotocography. All cardiotocographs except one showed a reactive fetal heart trace throughout. One fetus demonstrated reactive tachycardia during blood collection that was sustained after the procedure. However, fetal heart rate had returned to normal at the time of ultrasound scanning.

The haemodynamics of the fetus was examined by performing doppler blood flow studies of the above mentioned vessels before and after blood collection. The mean pulsatility index (PI) for the umbilical artery before the procedure was 0.9560 and after was 0.0820; this was a significant difference with a p value of 0.035. The mean PI for middle cerebral artery was 1.4320 before and 1.6090 after the procedure with a mean difference of 0.1770. This increase was significant (p = 0.104). The PI for thoracic aorta had a mean value of 2.0475 before and 2.0875 after. This was not significant (p = 0.630).

All except one had elective lower segment Caesarean section as scheduled. The remaining patient had an emergency Caesarean section 1 week after blood donation at 39 weeks of gestation. No complications were recorded in any of the cases. None of the patients had blood loss that exceeded 800 mLs during operation. The pre-delivery haemoglobin for those transfused ranged from 10.5 to 13.5 g/dL (mean = 12.09) and for those not transfused, it ranged from 10.5 to 14.3 g/dL (mean = 12.2786). This difference was not statistically significant (p = 0.643). The amount of blood lost intraoperatively ranged from 250 mLs to 600 mls (mean = 390 mls) for those transfused and 300 to 700 mLs (mean = 346.88 mls) for those not transfused. This difference was also not statistically significant (p = 0.349). Eight patients had autologous blood transfusion although there was no real indication or excessive blood loss. There is a tendency amongst anaesthetists to transfuse autologous blood in most cases.

All babies were delivered at term. The mean birth weight was 3116 g. All APGAR scores at 1 minute were more than 5 (range 5 – 9) and 5 minutes were more than 7 (range 7 – 9). There were no neonatal complications recorded. Of the 20 cases, only 7 neonates had the cord haemoglobin and haematocrit levels checked; and the results were normal.

DISCUSSION

Despite improved and stringent standards in blood banking patients receiving homologous blood are still at risk of disease transmission and blood incompatibility. For hepatitis, the combined risk of hepatitis B or C transmission is believed to be less than 0.5% per unit transfused[14]. Although this risk is low, it is still an otherwise preventable hazard. Likewise, the fear of contracting AIDS is not unfounded, although with HIV antibody screening of donor blood, the risk is estimated to be 1 in 250,000 transfusion or less[2]. However, given the serious consequence of AIDS and the "window period" of HIV carriers, even this small risk is not acceptable. Moreover, transfusion reactions are common and approximately 1% to 3% of blood transfusion recipients develop alloantibodies for life[7].

Thus, concern about the risks associated with homologous transfusion has led to an increased use of autologous blood transfusion in recent years. Autologous blood avoids the risk of disease transmission; and likewise, recipients of autologous blood are at no risk for either acute or delayed immune-mediated haemolytic transfusion reactions from minor blood group antibody incompatibility.

There are little or no major problems associated with blood donations in the general population. However, there is very little information in the literature concerning blood donation in pregnant women; especially with regards to maternal bleeding on the fetus. Donation of blood has not been encouraged in the gravid female because of fear of potential complications of premature labour or fetal compromise[4,11]. More recently, Kruskall et al[10] have shown that there were no adverse fetal effects in women who donated blood pre-operatively in the third trimester. To date, blood donation by pregnant women is still not acceptable in most centres except for autologous transfusion purposes.

In our study, 20 patients donated one unit (ranging from 300 – 430 mLs) of blood from 36 to 38 weeks of gestation. This period of gestation for blood collection was selected because if labour or fetal distress occurred during or after blood collection leading to immediate delivery, it eliminates the problem of prematurity, for at this gestation, the perinatal morbidity and mortality would not differ from that of a term neonate.

It has been reported that the overall risk of reactions during blood donation is 1.9% to 4.8%[12]. To determine the safety of blood collection, both the mother and the fetus were monitored before, during and after the procedure. All the 20 women tolerated the procedure well. None of the mothers showed any adverse reactions during blood collection such as pallor, dizziness, fainting, tachypnoea or convulsions. There was no significant change in maternal haemodynamics and the vital signs remained stable.

No evidence of fetal distress was documented on cardiotocography. All except one showed a normal reactive fetal heart trace. The exception showed an increase in baseline heart rate but the trace remained reactive. The post-donation biophysical profile was normal. The fetal heart rate eventually returned to normal.

Biophysical profiles were determined and these were normal both before and after the procedure for all fetuses.

The haemodynamics of fetal and maternal-fetal circulations were looked into by performing doppler blood flow studies of the umbilical artery, middle cerebral artery and thoracic aorta both before and after blood collection. There was a significant decrease in the pulsatility index (PI) of the umbilical artery ($p = 0.035$). It would appear that the maternal-fetal circulation compensates for the acute blood loss and thus there is no compromise of blood flow to the fetus. There was also a significant increase of PI of the middle cerebral artery but no significant change to that of the thoracic aorta. There was thus no evidence of redistribution of blood to the fetal head in preference to the rest of the body; for in such cases, the middle cerebral artery (MCA) PI would decrease instead of increase. The increase in MCA PI could not be explained.

No uterine activity was recorded and none of the patients complained of contraction pains occurring during or after the procedure.

All fetal outcomes were favourable and there appeared to be no complications of the neonate that were apparent at birth. The cord haemoglobin and haematocrit levels may be useful as an objective evidence that the neonatal blood status remains unaffected by blood collection. However, this could not be assessed as the tests were overlooked and not performed in many of the cases by the obstetrician-in-charge.

From our study, we conclude that there is no evidence of fetal distress during maternal bleeding. It would also appear that autologous donation in pregnancy does not result in premature uterine activity. Only one patient required emergency Caesarean section when she went into established labour 7 days after blood donation. She was at 39 weeks of gestation, and this is the usual period spontaneous labour would occur. The number of cases in this study group was small, and a larger group of women at an earlier gestation is required to conclude on the effect of blood donation on uterine activity.

Autologous blood collection seems to be a safe procedure both for the mother and the fetus. However, it must be emphasised that the procedure was carried out under strict criteria. The blood collection was performed in the late third trimester under monitoring and all the women who participated were healthy pregnant women with little or no obstetric complications. Because of the small numbers involved, there may be other risk factors that are contraindications to autologous blood donation that have not been identified. The collection of 300 – 430 mLs of blood in one sitting appears safe. The number of units of blood that can be safely collected over a period of time without any maternal or fetal haemodynamic compromise is uncertain.

Overall blood use in elective Caesarean section is low. From this study, 8 patients (40%) had autologous blood transfusion. This, however is not a true reflection of blood requirements because there was no definite indication for transfusion in any of the cases. Autologous blood was transfused because the blood was theirs.

It has been suggested that the cost to the patient for autologous donation may be 20% to 25% higher than the charge for receiving a unit of homologous blood. This is attributed mainly to administrative and manpower costs[3]. There is no doubt as to whether the cost benefit ratio would justify the implementation of an autologous transfusion programme for all obstetric patients. However, the advantage of autologous blood transfusion cannot be quantified by dollars and cents. Rather, the benefits of autologous transfusion in the prevention of disease transmission and long-term consequences of allosensitisation must be an incentive in these women.

In our community, there is still a misconception with regards to blood donation in the general population especially amongst females. A large number of people continue to perceive that blood donation is harmful, and would adversely affect their health and well-being. Therefore, these people would prefer to have other people donate blood for them. The introduction of autologous blood donation to healthy young women may be a step in recruiting blood donors in time to come.

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