

The Timing of Fetal-Maternal Haemorrhage: Clinical and Forensic Implications

David J R Hutchon*

Memorial Hospital, Darlington, England, United Kingdom

*Corresponding author: David J R Hutchon, Consultant Obstetrician, Memorial Hospital, Darlington, England, United Kingdom, Tel: 00441325253278; E-mail: djrhutchon@hotmail.co.uk

Received date: May 20, 2016; Accepted date: June 20, 2016; Published date: June 27, 2016

Copyright: © 2016 Hutchon DJR. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original author and source are credited.

Abstract

The transfer or haemorrhage of a small amount of fetal blood into the mother's circulation throughout most of pregnancy is common. Larger haemorrhage can sometimes be detected immediately post-partum having occurred during the third stage of labour. It is likely that early cord clamping can sometimes be the cause of a massive fetal maternal haemorrhage with the haemorrhage actually taking place after the cord is clamped. The rationale and implications are presented.

Keywords: Fetal maternal haemorrhage; Fetal blood; Haemorrhage

Introduction

If the mother is rhesus negative and the fetus is rhesus positive and, especially if the two are ABO compatible, these small haemorrhages may initiate sensitisation of the rhesus antibody in the mother [1]. In rhesus positive women the clinical importance of the transfer of blood from the fetus to the mother depends upon the frequency, the volume and the timing. This paper will review the timing particularly in relation to events which may precipitate the haemorrhage.

The capillaries of the terminal villi contain fetal blood pumped by the fetal heart and these capillaries are bathed in the maternal blood circulating through the intervillous space and separated from the fetal capillaries by an extremely thin vasculosyncytial and a basement membrane. It is easy to understand how disruption of the fetal capillaries will result in fetal blood cells circulating through the capillaries to leak out into the pool of maternal blood within the intervillous space.

Chronic Fetal-maternal Haemorrhage

Frequent fetal-maternal haemorrhage of sufficient volume will result in fetal anemia and if not corrected will result in cardiac failure and fetal hydrops. Small numbers of cells are quickly cleared from the circulation and therefore cannot be readily detected.

Traumatic Fetal-maternal Haemorrhage

Accidental trauma to the abdomen and the uterus as a result of a fall or road accident can lead to an acute bleed from the fetal chorionic villi into the maternal circulation and the volume might correlate with the extent of the trauma. A Kleihauer-Betke test [2] will help determine the size of any fetal-maternal haemorrhage and whether Rh immune globulin is required in rhesus negative women to prevent isoimmunisation. Iatrogenic trauma from external cephalic version can also result in a fetal-maternal haemorrhage. Provided the woman is already receiving prophylactic Rh immune globulin [3] the haemorrhage is very rarely sufficient to initiate sensitisation.

Massive Fetal-maternal Haemorrhage

Without a history of trauma the occurrence of a massive fetal maternal haemorrhage is rarely suspected. Massive haemorrhage is considered to be a loss of 80 ml [4] but as high as 150 ml [5] by others. However clearly the critical volume depends on the total volume of blood in the neonate which depends on birth weight. The rate of blood loss is also important for the outcome and a rapid blood loss may be fatal. A neonate who has suffered an acute loss of 150 ml during birth is unlikely to show any signs of life. Lesser degrees of haemorrhage result in reduced fetal movements and if delivery is undertaken the diagnosis reached from the finding of a pale hypovolaemic neonate and a positive Kleihauer-Betke test showing a significant volume of a recent fetal haemorrhage. The possibility of a large fetal maternal haemorrhage may not be considered until after the stillbirth of an exsanguinated neonate [6].

Fetal Maternal Haemorrhage at Birth

The commonest time for a significant fetal maternal haemorrhage is at birth. Significant bleeds may result in a mildly compromised neonate which is similar to a neonate that has suffered a degree of intra-partum hypoxia. However in contrast to the neonate compromised at birth as a result of intra-partum hypoxia, the neonate with a large blood loss may not respond to ventilation until its blood volume is corrected [7]. An emergency transfusion of uncross matched blood or volume replacement with isotonic crystalloid is recommended to restore intravascular volume [8]. In the absence of intrapartum hypoxia, the neonate with a significant bleed just before birth will have normal cord blood gases. Other unidentified factors may affect the tolerance of a neonate to intrapartum hypoxia and acidaemia at birth [9].

Assessment and Timing of the Fetal-maternal Haemorrhage

The recovery of a neonate at birth following the restoration of the intravascular volume with isotonic crystalloid or whole blood confirms the diagnosis of acute neonatal blood loss just before birth. The finding

of a positive Kleihauer-Betke test showing a significant volume of fetal cells and the absence any other fetal blood loss appears to put the diagnosis of an intrapartum fetal maternal haemorrhage beyond doubt. However it is important to consider precisely when the haemorrhage took place. Did it occur before the delivery of the neonate or before the delivery of the placenta. Early cord clamping is well recognized to sometimes result in the retention of a large volume of blood in the placental compartment [10-12] at the expense of hypervolemia in the neonate. This is particularly serious when there has been a degree of cord compression in the presence of a nuchal cord [13]. Logically a large volume of retained fetal blood within the placenta is more likely to be expressed from the placenta into the maternal circulation during the third stage before separation of the placenta. This has been confirmed in a small series [14].

Thus what seems to be an intra-partum event is very likely to be a post -partum event with the fetal blood loss occurring at the time of early cord clamping, as a result of the retention of a large volume of neonatal blood within the placenta. The haemorrhage into the maternal circulation then takes place after the birth of the baby and during the third stage of labour.

Allowing a physiological transition permits the neonate to have a normal redistribution of blood between the placental and the neonatal compartments of the circulation [15]. This redistribution of blood between the placenta and the neonate is termed the placental transfusion. Once breathing is established and the placental transfusion completed, the volume of blood within the placenta is only around 25 ml [11], and even if the full amount of this was expressed into the maternal circulation it would not usually be considered significant.

Abruptio Placenta

Abruptio placenta is the result of premature separation of the placenta which leads to haemorrhage from the spiral arteries supplying the intervillous space. With loss of maternal circulation within the intervillous space transfer of oxygen into the fetal blood is lost from the area of the placenta affected by the abruption. Haemorrhage results in separation of the placenta along the plane of cleavage within the basal decidua. Blood loss from the fetal circulation is rare and only occurs if fetal vessels are damaged as part of the abruption. Thus the blood loss is maternal but the loss of placental function results in fetal hypoxia. With a large placental abruption the fetus is already dead but if it is alive an emergency delivery, usually by caesarean section may be needed to save the baby before any further placental function is lost. At delivery of the hypoxic compromised neonate there is the temptation to clamp the cord immediately and hand the baby over to the neonatal attendant. However if the baby is alive the residual placental function has clearly been sufficient. Thus it is important to avoid further hypoxia and significant hypovolaemia together with the disruption of the transitional circulation caused by early clamping [16]. Early clamping may lead to fetal blood reaching the maternal circulation and the mis-interpretation of the timing of the fetal blood loss.

Forensic Implications of Fetal Maternal Haemorrhage at Birth

The identification of a fetal maternal haemorrhage may provide confirmatory evidence of abdominal trauma in a case of domestic abuse.

A tight nuchal cord may present with an abnormal CTG due to cord compression. If the cord is clamped and cut after the delivery of the head significant hypovolaemia may be present in the neonate and followed by a large haemorrhage of fetal blood from the placenta into the maternal circulation during the third stage of labour. The poor condition of the neonate will subsequently be interpreted as due to a massive fetal-maternal haemorrhage. It is impossible to be certain when the haemorrhage has taken place but a massive fetal maternal haemorrhage just before the birth of the baby is likely to be associated with fetal heart a systole, whereas the fetal heart will be still readily detected up to the moment of birth in the scenario of the nuchal cord described above. Clamping and cutting a tight nuchal cord can nearly always be avoided [17].

When early cord clamping has been carried out, the detection of a significant fetal maternal haemorrhage after birth in a neonate who is found to be hypovolaemic at birth may be considered forensic confirmation of medical negligence.

Conclusion

Fetal-maternal haemorrhage is common and in clinical practice with routine Rh immune globulin prophylaxis is not of any other consequence. Chronic small bleeds will result in fetal anemia and if not recognized hydrops and intra-uterine death. Rarely the haemorrhage is large enough to compromise the fetus. The timing of the haemorrhage however is uncertain and in some cases may actually occur after the birth of the baby and a consequence of early cord clamping with the haemorrhage from the placenta into the maternal circulation during the third stage of labour. Early cord clamping should be avoided if at all possible.

References

1. Zipursky A, Hull A, White FD, Israels LG (1959) Foetal erythrocytes in the maternal circulation. *Lancet* 1: 451-452.
2. Kleihauer E, Braun H, Betke K (1957) Demonstration of fetal hemoglobin in erythrocytes of a blood smear. *Klin Wochenschr* 35: 637-638.
3. Boucher M, Marquette GP, Varin J, Champagne J, Bujold E (2008) Fetomaternal hemorrhage during external cephalic version. *Obstet Gynecol* 112: 79-84.
4. Giacoia GP (1997) Severe fetomaternal hemorrhage: a review. *Obstet Gynecol Surv* 52: 372-380
5. Wylie BJ, D'Alton ME (2010) Fetomaternal hemorrhage. *Obstet Gynecol* 115: 1039-1051.
6. Sebring ES, Polesky HF (1990) Fetomaternal hemorrhage: incidence, risk factors, time of occurrence, and clinical effects. *Transfusion* 30: 344-357.
7. Rennie J (2011) Neonatology p286 in *Obstetrics by Ten Teachers*. CRC Press, Boca Raton.
8. Wyckoff MH, Perlman JM, Lupton AR (2005) Use of volume expansion during delivery room resuscitation in near-term and term infants. *Pediatr* 115: 950-955.
9. Yeh P, Emary K, Impey L (2012) The relationship between umbilical cord arterial pH and serious adverse neonatal outcome: analysis of 51 519 consecutive validated samples. *BJOG* 119: 824-831.
10. Niermeyer S (2015) A physiological approach to cord clamping: Clinical issues. *Matern Health Neonatol Perinatol* 1: 21
11. Farrar D, Airey R, Law G, Tuffnell D, Cattle B, et al. (2011) Measuring placental transfusion for term births: weighing babies with cord intact. *BJOG* 118: 70-75.
12. Hutchon D (2014) Evolution of neonatal resuscitation with intact placental circulation. *Infant* 10: 58-61.

13. Vanhaesebrouck P, Vanneste K, de Praeter C, van Trappen Y, Thiery M (1987) Tight nuchal cord and neonatal hypovolaemic shock. *Arch Dis Child* 62: 1276-1277.
14. Lapidio OA (1972) Management of Third Stage of Labour, with Particular Reference to Reduction Reduction of Feto-Maternal Transfusion. *Br Med J* 1: 721-723.
15. Uwins C, Hutchon DJR (2014) Delayed umbilical cord clamping after childbirth: potential benefits to baby's health. *Pediatr Health Med Therape* 5: 161-171.
16. Hutchon DJR (2015) Ventilation before umbilical cord clamping improves physiological transition at birth or "Umbilical cord clamping before ventilation is established destabilizes physiological transition at birth". *Front Pediatr* 3: 29.
17. Hutchon DJR (2013) Management of the Nuchal Cord at Birth. *J Midwifery Reprod Health* 1: 4-6.