Percutaneous umbilical foetal blood sampling: lessons from the first 30 cases

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Summary: **To find about the learning curve of USG-guided foetal blood sampling and the technical aspects for improving the success of this procedure. 30 USG-guided umbilical foetal blood sampling procedures in 26 patients were studied. The earliest procedure was performed at 19 weeks of gestational age and the latest was at 33 weeks. The indications included prenatal karyotyping, prenatal diagnosis of thalassaemia, and Rh isoimmunisation with intrauterine transfusions. The factors improving the success rate were studied. Umbilical end of the cord was used in all except 2 out of these 30 procedures.**

Pure or mixed foetal blood was successfully obtained in 29 procedures out of the 30 performed. Local infiltration at the site of skin entry was not found to be useful. Maternal sedation was also not useful. Approaching the cord a small distance away from the insertion was found very useful in reducing the rate of maternal blood contamination. Foetal bradycardia lasting up to 30 seconds was found to have occurred in some cases. Foetal skeletal muscle relaxants were successfully used for intravascular blood transfusion.

Introduction

Percutaneous umbilical blood sampling (PUBS) has revolutionised the fields of foetal physiology, diagnosis and therapy. Bang et al (1982) first reported umbilical vein blood sampling and direct transfusion of a severely anaemic D-isoimmunised foetus. Subsequently the Paris group (Daffos et al 1985) further developed the technique and expanded indications for it's use. The present study is an analysis of the first 30 cases of USG-guided foetal blood sampling with a view of studying the learning curve and to improve on the technical aspects of the procedure.

Material and methods

An analysis of 30 procedures in 26 patients was carried out. Table I lists the important indications.

Prenatal detection of beta thalassaemia was the commonest indication. Foetal blood culture has the advantage of obtaining a rapid karyotyping over the amniotic fluid sampling. One patient received 3 intrauterine transfusions for Rh sensitisation, the baby delivered at 35 weeks, and was discharged in healthy condition.

Technique

The procedure was carried out in the interventional USG theatre in the department of ultrasonography. The patients were admitted on the same morning. No premedication was used unless the procedure was intrauterine transfusion. Sample of maternal blood was collected to compute the MCV (Mean Corpuscular Volume). The patient was made to lie down in supine position, and initial feasibility scan was performed to confirm the gestational age, viability and to rule out malformations. The site of placental insertion of the cord was visualised. Wipro GE 2000 adv. - II USG machine with a 3.5 MHz convex sector probe was used. After obtaining an informed consent, the abdomen was painted and draped. A sterile condom was used to cover the transducer. Povidone-iodine solution was used as a coupler between the probe and the skin. The operator used the free hand technique,

with the probe in one hand and the needle in the other. A disposable spinal needle of gauge 21-23 G and length 8.9 cms was utilised. Local infiltration was not used as most procedures were accomplished with a single entry and within a short time. The needle was rinsed with tissue culture grade heparin solution of strength 1000 U/ml. Under real time ultrasound guide the needle was guided in the placental insertion of the cord. Foetal blood was aspirated with a sterile 2 cc syringe also rinsed with heparin. The MCV of the sample was tested and compared with that of the maternal blood sample obtained previously. Purity of the sample was thus established. In the case of intrauterine transfusion, pancuronium bromide (0.08 mg) was injected in the foetal circulation which brought about instantaneous and total paralysis of the foetus. This eliminated all foetal movements which could lead to displacement of the needle tip. Infusion of O Rh-negative blood was then begun. In two cases, intrahepatic portion of the umbilical vein was targeted. In both these cases, the placental insertion of the cord was not visible. After the sample was obtained and tested for purity the needle tip was withdrawn. A jet of blood in the amniotic fluid could be seen in all the cases. This bleeding soon appeared to stop after some time. The foetal heart rate was measured. In some cases, a follow-up scan was performed after 2 hrs. The patients of diagnostic PUBS were discharged on the same evening. Prophylactic broad spectrum antibiotics and tocolytics were administered for 5 and 15 days respectively.

Results

The procedure was successful in the recovery of foetal blood in 29 out of 30 cases. Out of the two cases where intrahepatic portion of the umbilical vein was targeted, no blood sample could be obtained in one case. In the other, the procedure was successful. When the success rate was broken down into 3 blocks of ten cases each, a learning curve was clearly apparent (Table II).

The procedure is invasive, and thus not without complications. Table III lists the complications.

Table I
Indications of PUBS

Indication	No. of Procedures
Thalassaemia screening	15
Karyotyping	9
IUT for Rh-sensitisation	4

Table II
Success of PUBS

Procedure No.	Pure foetal blood	Mixed blood	No blood
1-10	5	4	1
11-20	9	1	0
21-30	10	0	0

Table III
Complications of PUBS

Complication	No. of cases
Transient bradycardia	5
Prolonged bradycardia	2
Loss within 14 days	0

Some important lessons were learnt from the initial experience:

1. Pre-procedure feasibility USG cannot be overstressed. In at least one case, the procedure had to be rescheduled because of the gestational age being too early. In other 2 patients, the site had to be altered.
2. The accurate detection of the placental insertion of the cord is half the battle won. Sampling of blood from a free cord loop is next to impossible.
3. Site of entry into the cord should be a centimetre away from the actual insertion of the cord. This minimises the chances of mixed foetal-maternal blood sample.
4. Purity of the sample should be assessed accurately at the same time. The visual impression of the needle tip being in the cord is not sufficient.

Discussion

Percutaneous umbilical foetal blood sampling has become an established technique in the invasive evaluation of at risk foetuses. By and large, the technique is devoid of major maternal and foetal complications. Radunovic and Lazarevic (1989) reported transient foetal bradycardia as the only serious complication in 5 out of 154 procedures. Donner et al (1989) reported 144 procedures with a 12.2% incidence of transient foetal bradycardia and a failure rate of 4/144 cases. A success rate of 98.5% with a loss rate of 1% was reported by Shalev et al (1996). Chances of foetal loss were more following puncture of an artery, and 11 out of 12 losses were associated with a postprocedure bradycardia (Weiner and Okamura 1995). Foetal haemorrhage always remains a possible threat. However, it has been demonstrated that properties of amniotic fluid facilitate coagulation at the site of umbilical vein puncture (Nay et al, 1989). Thrombosis of umbilical vessels also remains a possible complication Jauniaux et al (1989) found no thromboses of the umbilical vessels in 50 cases. Initial difficulty with a higher complication rate has been noticed already (Ville et al, 1995), though Weiner and Okamura (1995) found no relationship between the number of previous procedures performed by the operator and the risk of a loss. The present paper identified the learning curve in the increasing success rates with increasing number of patients. It also identified some important technical considerations which improve the success rate.

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