Fetal blood sampling

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Fetal scalp blood sampling

- Fetal scalp blood sampling is an intrapartum procedure intended to assess the presence and degree of fetal acidemia by analyzing fetal capillary blood.
- An amnioscope with a light source is used to expose the fetal scalp, which is cleansed of blood, mucous, and amniotic fluid.
- The scalp is smeared with silicone gel so that a droplet of blood forms when the scalp is punctured with a 2-mm blade.
It is contraindicated when the mother is known to have a serious transmissible infection,
✓ such as HIV or
✓ hepatitis,
✓ and in fetuses at increased risk of a bleeding diathesis.
Rare complications described in case reports include infection, hemorrhage, and leakage of cerebrospinal fluid.
• Both pH and lactate measurements require the same laboratory facilities for micro sample analysis.
• Less blood is needed for measurement of lactate than pH,
• otherwise one test does not clearly perform better than the other.
• Intrapartum fetal scalp blood sampling to measure pH or lactate has not been clearly proven to reduce emergency cesarean deliveries or operative vaginal births or to improve long-term perinatal outcome.
Fetal scalp blood testing is a technique used in obstetrics during labor to confirm whether fetal oxygenation is sufficient.

The procedure can be performed by creating a shallow cut by a transvaginally inserted blood lancet, followed by applying a thin pipe to the site that samples blood by capillary action.
Two constituents that are commonly tested by this method are PH and LACTATE, both being indicators of acid base hemeostasis.

A low PH and high level of lactate indicate that there is acidosis, which in turn is associated with hypoxia.
PH and lactate appear to have the same sensitivity in indicating hypoxia during labour.

Analysis of PH requires a relatively large amount of blood (30-50 Micro L), and sampling failure rates of 11-20% have been reported.

Analysis of lactate only requires 5 micro L of blood.
For this reason and many others, including quality control issues, cost, patient discomfort, sample failure rates up to 10 percent, and unavailability of sampling kits, fetal scalp blood sampling is performed rarely in the United States and elsewhere.
Management:

- Ensure that the lactate Pro TM machine is available, calibrated and functioning.
- The membranes must be ruptured and the cervix at least 3 cm dilated for the procedure to be attempted.
- Other technical considerations include the amount of effacement, station, application of the vertex to the cervix, volume of amniotic fluid and amount of baby hair.
This procedure may be uncomfortable and intensive for the woman.

it is intensive to the fetus.

Explain the procedure to the woman and obtain verbal consent.

Assemble the equipment on the trolley.

Place the woman in the left-lateral position or in lithotomy with a wedge under the right hip to reduce the risk of supine hypotension.
• Sampling is performed under direct vision via an amnioscope to avoid contamination with amniotic fluid.
• The incision site is carefully cleaned and a thin layer of petroleum jelly is applied.
• The baby’s fontanelles should be avoided.
• Disposable blades, fixed in a plastic mount are used in a blade holder from which the blade does not protrude more than 2 mm.
Dilated cervix

Fetal scalp

Blood droplets collected for analysis
• A 2 mm fetal scalp incision is made with steady pressure of the blade.
• The blood is collected in pre-heparinised glass capillary tubes.
• Pressure is applied to the incision site with a dry swab until the bleeding stops.
• Discard the blade in the sharps container.
• Document the procedure, the result and the subsequent plan of management.
• Post natal examination of the baby should include examination of the sampling site.
<table>
<thead>
<tr>
<th>Fetal blood sampling</th>
<th>Lactate (mmol/L)</th>
<th>PH</th>
</tr>
</thead>
<tbody>
<tr>
<td>normal</td>
<td>&lt;= 4.1</td>
<td>&gt;= 7.25</td>
</tr>
<tr>
<td>Pre-acidotic range</td>
<td>4.2 - 4.8</td>
<td>7.21 - 7.24</td>
</tr>
<tr>
<td>Acidotic range</td>
<td>&gt;4.8</td>
<td>&lt;= 7.20</td>
</tr>
<tr>
<td>If the Lactate result is...</td>
<td>Action</td>
<td></td>
</tr>
<tr>
<td>-----------------------------</td>
<td>--------</td>
<td></td>
</tr>
<tr>
<td>Less than (&lt;) 4.2 mmol/L</td>
<td>Normal, no action required</td>
<td></td>
</tr>
<tr>
<td>4.2 - 4.8 mmol/L</td>
<td>Continue to monitor EFM</td>
<td></td>
</tr>
<tr>
<td>Greater than (&gt; ) 4.8 mmol/L</td>
<td>Repeat lactate testing within 30 minutes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Delivery is indicated</td>
<td></td>
</tr>
</tbody>
</table>
FETAL SCALP BLOOD SAMPLING

© protocol to try to confirm fetal distress

① pH > 7.25
   ⇒ labor is observed

② 7.20 < pH < 7.25
   ⇒ the pH measurement is repeated within 30 minutes

③ pH < 7.20
   ⇒ another scalp blood sample is collected
      immediately
   ⇒ mother is taken to an operating room and prepared for surgery
   ⇒ delivery is performed promptly if the low pH is confirmed
<table>
<thead>
<tr>
<th>If the PH &gt; 7.25</th>
<th>observe</th>
</tr>
</thead>
<tbody>
<tr>
<td>If the PH 7.2 and 7.25</td>
<td>Repeated within 30 minutes</td>
</tr>
<tr>
<td>If the PH &lt; 7.2</td>
<td>Repeat immediately</td>
</tr>
<tr>
<td>If PH still low</td>
<td>Prompt delivery</td>
</tr>
</tbody>
</table>
Fetal pulse oximetry:

— Although intuitively a promising technique for fetal evaluation, fetal pulse oximetry has not been useful clinically.

Data from human and animal studies suggest that fetal arterial oxygen saturation (SaO₂ by blood gas co-oximetry) >30 percent is usually associated with pH >7.13.
Fetal pulse oximetry

Or Continuous monitoring of fetal oxygen saturation (FSpO2) or fetal pulse oximetry (FPO) is a method of fetal assessment, measures the oxygen saturation of hemoglobin in fetal blood.
In humans, the mean fetal oxygen saturation (SpO2 by fetal pulse oximetry) during the first and second stages of labor is 59±10 percent and 53±10 percent, respectively.

In the setting of an abnormal FHR pattern, fetal SpO2 <30 percent for greater than 10 minutes has been associated with an increased risk of fetal acidemia.
However, in a 2014 systematic review and meta-analysis of randomized trials comparing the outcome of pregnancies in which both fetal pulse oximetry and cardiotocography results were available for intrapartum clinical management with the outcome of controls in which only cardiotocography results were available (n = seven trials, 8013 women), fetal pulse oximetry had no statistical effect on the overall rate of cesarean delivery or the rate of maternal or infant outcomes evaluated; the rates were similar in both groups.
Indication:

- Suspected fetal compromise suggested by an abnormal CTG pattern.
Contraindication:

- Clear evidence on continuous EFM (electronic fetal monitoring) of serious, sustained fetal compromise.
- Fetal bleeding disorders (e.g. suspected fetal thrombocytopenia, haemophilia)
- Face or brow presentation or uncertain presenting part
- Maternal infection (e.g. HIV, hepatitis virus, and herpes simplex virus and suspected intrauterine sepsis) (GBS +ve does not preclude FBS)
• Suspected intrauterine sepsis
• Gestation less than 34 weeks gestation
• Active second stage of labour.
Relative contraindication:

- Gestation range 34 weeks to 36 weeks and 6 days
- Maternal pyrexia above 38°C
Fetal blood sampling:

- Fetal blood sampling (FBS):
  - refers to three techniques used to gain access to fetal blood:
    1. cordocentesis (also known as percutaneous umbilical blood sampling),
    2. Intra hepatic blood sampling (intra hepatic portion of the umbilical vein or the left portal vein), and
    3. cardiocentesis.
The techniques for FBS can also be used for intravenous administration of medication (eg, digoxin) or blood products (eg, platelets, red blood cells) to the fetus.

PROCEDURE — The maternal abdomen is prepared with an antibacterial solution and draped. Aseptic technique should be used.
Site — Prior to fetal viability, FBS can be performed in a room used for sonographic examinations or in a labor room.

After viability, the procedure should be performed in proximity to an operating room since an emergency cesarean delivery may be required if non reassuring fetal heart rate patterns develop during or after the procedure.
Laboratory/imaging — A sample of maternal blood is drawn before the procedure for comparison with the fetal samples that will be obtained.

An obstetrical ultrasound examination is also performed to confirm fetal viability and to determine fetal position and the location of the placenta.
• **Intravenous access** — Placement of a maternal intravenous catheter allows easy and rapid administration of analgesics, antibiotics, and fluids, as needed, and is prudent preparation in the event of procedure-related complications necessitating emergency cesarean delivery.

• **Antibiotic prophylaxis** — No randomized trials evaluating the efficacy of antibiotic prophylaxis in this setting have been performed. Given that FBS is a "clean" procedure with a low risk of infection, most centers have elected not to use antibiotic prophylaxis.
• **Fetal paralytic drugs** — Reducing fetal movement is not routinely necessary for FBS, but can be helpful when movement is likely to dislodge the needle, such as during prolonged procedures (eg, fetal transfusion) or for accessing sites other than a cord insertion on an anterior placenta.

• Atracurium (0.4 mg/kg) given intramuscularly provides paralysis for up to an hour with minimal fetal cardiovascular effects.
**Needle** — A 20 to 22 gauge spinal needle is generally used for FBS.

Smaller bore needles prolong the period of time required to obtain fetal blood and are more difficult to manipulate because they bend.

A 22 gauge needle is preferable before 24 weeks of gestation because of the small diameter of the umbilical vessels, and also when thrombocytopenia is suspected because it may reduce the risk of bleeding at the insertion site.
- The length of the needle should take into account the distance from the skin to the target segment of cord, and the possibility that intervening events, such as uterine contractions, may increase this distance.
- The standard length of a spinal needle is 8.9 cm (excluding the hub), but longer needles are available (up to 15 cm).
COMPLICATIONS:

- fetal Bleeding, Fetomaternal bleeding.
- Cord hematoma
- Failure rate
- bradycardia, and
- infection, all of which may be life-threatening, are the major fetal complications associated with cordocentesis.
- Fetal loss
- Maternal complications unrelated to the pregnancy are unusual.
Indications:

- Fetal blood is sampled to aid in the diagnostic evaluation of fetal disorders.
- For evaluation of fetal anemia
- For evaluation of fetal infection
- For evaluation of fetal hypoxia
This image shows anterior blood sampling from the umbilical cord.

This image shows posterior blood sampling from the umbilical cord.
In PUBS, a fine needle is inserted into the mother's abdomen, then guided to the umbilical cord, providing direct access to the fetal blood.