

# Neonatology - Get in control of fetal scalp blood sampling

January 2006



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## Interview

Fetal scalp Blood Sampling (FBS) – not exactly wishful thinking for the mother, nor for the obstetrician? The procedure is regarded as cumbersome, the sample quality is questionable and the consequences of the result may be instrumental vaginal delivery or Caesarian Section (CS).

acute**care**testing.org has talked to Jan Stener Jørgensen MD PhD, Consultant Chief Obstetrician, at the Odense University Hospital (OUH), Denmark about their local procedures for fetal scalp blood measurement. Jan Stener Jørgensen is well known for his engagement in the use of FBS and he certainly does not find the procedure cumbersome.

## How long have you been engaged in FBS?

I have worked intensely with FBS since 1993 when I did a PhD project on fetal pulse oximetry. In that connection

I had to draw blood samples from the fetal scalp to compare with the fetal oxygen saturation and found that the sampling equipment available was insufficient and that one had to sample too much blood. I developed new equipment and had it put into production. Since then I have traveled all over the country and talked about FBS. It has revolutionized the use of FBS in Denmark and to some extent in the other Scandinavian countries and Iceland, as well.

In my opinion it is an intrapartum monitoring tool that is quite indispensable. It is easily performed and without any major discomfort to the mother if you do it correctly and prepare her for what is about to happen. The mother does not see it as much different from a routine vaginal examination during labor.

## Please introduce your labor ward

OUH is a national and regional hospital for Region South, covering four Danish counties with a catchment

area of 1 million inhabitants. We have approx. 3800 deliveries per year. Of these, 60 % are multipara, many with a previous CS. Eight percent of births are premature (earlier than 37 weeks of gestation), including those earlier than 28 weeks.

We receive a lot of pathology of various kinds; all premature births, women with diabetes, rhesus immunization, heart disease, and fetal malformations from the entire region plus we have national functions for all of Denmark in a few areas. Our frequency of CS is approx. 25 % of births. Assisted vaginal (ventouse) frequency is 5-6 %, which is very low. We do CTG (CardioTocoGraphy) monitoring in 50 % of births.

CTG derives fetal heart frequency, either externally via Dobbler or internally via caput electrode (fetal ECG), to identify asphyxia. We do FBS in 10-15 % of births. As of February/March 2006 we will implement STAN (ST analysis) monitoring. STAN analyzes the ECG complex from the CTG electrode to identify ischemic changes in the baby's heart, caused by asphyxia.

### Is FBS a routine procedure in your ward and who performs it?

With FBS being used at a frequency of 10-15 % of deliveries, it may be considered a routine procedure. It is seen as a useful and accessible procedure to disprove or confirm pathological CTG curves. The number of FBS samples made by obstetricians will be inversely proportional with their experience in interpreting CTG curves.

Obstetricians do the FBS samples and midwives do the cord samples.

Cord pH is measured on all newborns. Now we only sample arterial blood, but together with the implementation of STAN monitoring as of February/March we will do double sampling, i.e. venous as well as arterial.

### What are the indications for performing fetal scalp blood sampling in your ward?

Primarily upon suspicion of imminent asphyxia due to pathological or suspicious-looking CTG changes. The problem with CTG is that it is very sensitive but not particularly specific, i.e. you may see suspicious-looking CTG changes without there being anything wrong. Therefore you need a method to increase the specificity, and that is pH.

Sometimes it may be difficult to register anything with CTG, and then FBS may be necessary.

In some cases thick meconium in the amniotic fluid alone may warrant FBS.

### Are there any contraindications?

Yes, you may have a CTG curve that is suspicious looking, but suddenly it straightens and becomes normal. If the CTG curve is normal, there is no need to worry about the baby. There are very few falsely negative CTGs.

On the other hand, if asphyxia is quite evident, don't waste time on measuring pH. For example, if a woman is admitted with abruption (loosening) of the placenta, if the baby has no sound of a heartbeat, if there is cord prolapse, etc.

Other contraindications are e.g. HIV and facial presentation; if the baby looks forward, you don't want to stick the scalpel in its eye (!).

### Describe the OUH procedure for fetal scalp blood sampling

The method is quite standardized.

The equipment you use for the sampling procedure is crucial to its success!

1. It is a prerequisite that the fetal membranes have ruptured and the waters have broken. The cervix must be 3-4 cm dilated under normal circumstances so you have access to the fetal scalp.
2. An amnioscope, a metal or plastic tube, is led transvaginally towards the baby's scalp and the skin

is illuminated. You wipe away blood, amniotic fluid, fetal fat. When you have a naked piece of skin, you scratch the skin a little to create hyperemia and to make the blood collect under the skin.

3. Then you smear the puncture site with Vaseline to make the blood collect in a drop. Those who have problems with Vaseline affecting the measuring result should try using the semiliquid old-fashioned cream type (but do not use too much!), instead of the liquid type, which can potentially enter the blood sample.
4. We use a scalpel reaching a depth of 1.4 mm (max. allowable depth is 2 mm). The blade is oblique, you tip the knife slightly to increase the cut surface and to make the blood run fast enough. The kit we use at OUH and in many other Danish labor wards has this special single-use scalpel mounted on a metal rod. The scalpel is released by pushing a small button.
5. You sample the blood drop by inserting another metal rod with a capillary tube attached into the blood drop (keep the tip of the tube inside the blood drop during the whole sampling procedure – and hold the rod with the tip of the tube upwards!). Previously we put both knife and capillary tube on the same rod so as to cut and sample at the same time. But you have to wait for the blood to collect anyway, so you may as well remove one rod and sample with the other. It is also easier, doing it in two steps.
6. We sample in two capillary tubes. Then we have an extra one if the first one is no good. Each tube needs 35  $\mu\text{L}$  to measure pH. If you want a complete blood gas status, you need 55-60  $\mu\text{L}$ .
7. After sampling, the doctor gives the samples to a nurse or an assistant. They turn the tube upside down between two fingers so that the blood mixes with the heparin coated on the inside of the tube. However, all gloves must be talcum free as it interferes with the result. We hardly ever need to mix with a mixing wire and magnet, as we have a blood gas analyzer nearby.
8. Make sure that the blood gas analyzer nearby is in the “ready mode” before doing the FBS.
9. It takes 90-120 seconds from the sample has been

taken until it has been measured. This works in 98 % of the cases.

### Which parameters are included in a fetal scalp blood measurement at OUH?

We follow some very basic general guidelines to make things as standardized and easy to handle as possible; that is why we only use pH.

Ideally, you ought to have a full blood gas status every time, but till now no international guidelines exist on how to act on the individual parameters, apart from pH. You must know specifically how to use a full blood gas status during delivery and be quite aware of the difference between respiratory and metabolic acidosis and their combination to handle it correctly.

People who are familiar with it use base excess, BE. If you have a pH of 7.15 and a BE of  $-3$  and a relatively high  $p\text{CO}_2$ , then it is a respiratory acidosis. Perhaps you have sampled after a long contraction, or there may be too frequent contractions. Look at the  $p\text{CO}_2$  – if it is high, the acidosis could be harmless.

### What is essential when evaluating a result from a scalp sample?

You always have to look at the clinical picture before you look at the individual parameters or CTG traces. You assess the mother's situation; is it her first birth or is she multipara, has the delivery started spontaneously or has it been induced, is she at term, gone over time or is the baby premature, is she suffering from preeclampsia, has she had a CS before, does she bleed, etc.?

You so to speak turn your back on the CTG trace and the FBS and clinically assess the mother. Then you go through the CTG analysis with that assessment in mind and see if a pH measurement is indicated. Then you compare pH and CTG and see if the delivery is in fair progression. Based on that you set up your action plan. pH is just a part of a larger clinical picture.

We know that scalp pH varies during birth from 7.45

to 7.25 under normal circumstances. A pH of 7.20 is basically normal, but if it drops below 7.20 you have to act on it. Then you deliver many babies with a pH between 7.20 and 7.05 who actually only suffer from a short-termed respiratory acidosis caused by accumulation of CO<sub>2</sub>, perhaps as a consequence of too frequent contractions (or hyperstimulation). You don't know what would have been the outcome, had they not been delivered.

This is taken care of with STAN that accepts respiratory acidosis and reacts solely on the metabolic component that is directly caused by lack of oxygen.

Premature babies should have a higher pH cut-off value. With a premature baby younger than 32-34 weeks you should have a pH cut-off line at 7.25. If the value gets below that line, you deliver the baby. Premature babies are more affected by acidosis and more easily suffer brain damage.

### Can you trust the pH result and its clinical value?

Yes, in any case the measurement is correct – but whether it always precisely reflects the central fetal conditions is very much discussed.

You can be certain that if scalp pH is high, you will not find low pH centrally. You may perhaps imagine the opposite – that there are scalp areas with poor microcirculation, where the blood will not flow properly and where you will have a low local pH.

### What is the flow of action upon an evaluation?

If a pathological CTG is confirmed by a critical pH, the baby is delivered with ventouse (cup) or CS, depending on the progression of the delivery.

If pH is not critical, but the CTG remains the same (non-reassuring/pathological), you do another test.

If CTG restores to normal, in principle you don't have to

repeat the test. Most doctors will do two tests, because they are “spot checks”, a sort of thumbnail sketch of the situation at a particular moment.

In principle you can do innumerable samples but in practice the unwritten rule is that if you go beyond five samples you should consider delivering the baby. After all, scalp sampling is an invasive procedure and it is critical if you all the time are close to acidosis and asphyxia.

### It is a common problem in labor wards that scalp blood coagulates even before analysis or inside the blood gas analyzer. How can this be overcome?

1. Make a sufficient incision so the blood will flow more freely. Scalp blood has hyperviscosity and coagulates faster than non-scalp blood.
2. Avoid transportation and analyze within 1-2 minutes. Everybody knows that time is essential for success.
3. If it is not possible to analyze within a few minutes, implement a standard procedure where a mixing wire is inserted in the capillary tube before collection of the sample. Use plastic end caps. Mix with the magnet from the moment the sample is collected, or it will coagulate even before you reach the blood gas analyzer.
4. Avoid transfer from one container/tube to another. It increases the risk of coagulation.

### How is the procedure perceived among staff?

The labor wards that use the pH procedure find it ingenious whereas the wards that don't use it think that it is of no relevance. When it is implemented, then everybody – including the most recently employed – is happy with the added security at night that if you are in doubt about the monitoring trace and the status of the baby, do an FBS and find out if things are bad or not.

It is easy to do a cesarian section – the trick is to avoid it if it is not indicated.

## How do you see the future of fetal monitoring?

Fetal pulse oximetry could be a supplement, but it has never found any real clinical application. We are not quite sure how to use it.

Scalp lactate is probably also part of the future. It is used in Sweden, for instance. There is, however, no precise enough description showing that it works as planned, and it is not particularly widespread. Or pH and lactate together.

When you use STAN as a continuous monitoring system, you can decrease the frequency of fetal scalp blood samples. It is unlikely that they can be eliminated: It takes 20 minutes for STAN to collect a reasonable complex to react upon. In this period, you monitor the CTG signal and when in doubt, you do an FBS. When in doubt of a STAN event, you will also do a pH to get more information.

STAN fetal monitoring is part of the future – and so are FBS and the scalp pH!

## INTERVIEWEE

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