

## **Cases of metabolic acidosis in CTG group not requiring special neonatal care**

### **ST information revealed**

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## **LDB 250**

### **Clinical data**

Para 0. Normal pregnancy. Spontaneous onset of labour 41 weeks of gestation  
Meconium stained liquor, Epidural . Augmented labor.

Normal vaginal delivery at 01:15

### **Neonatal data**

Female: 3735 g

Apgar: 8-9-9

Cord artery:	pH 6.98
	PCO <sub>2</sub> 10.1 kPa
	BDecf 12.2 mmol/l
Cord vein:	pH 7.25
	PCO <sub>2</sub> 4.59 kPa
	BDecf 10.5 mmol/l

### **Neonatal outcome**

Normal neonatal outcome.

### **Assessment of recording**

No data stored.

### **Comments**

Adequate cord acid base data indicating slight metabolic acidosis in a vigorous newborn

## **LDC 369**

### **Clinical data**

Para 0. Normal pregnancy. Spontaneous onset of labour after 39 weeks of gestation  
Meconium, epidural.

Active pushing commenced at 09:15

NVD at 09:27

### **Neonatal data**

Female: 3590 g

Apgar: 7-9-10

Cord artery:     pH 7.00  
                  PCO<sub>2</sub> 9.32 kPa  
                  BDecf 12.4 mmol/l

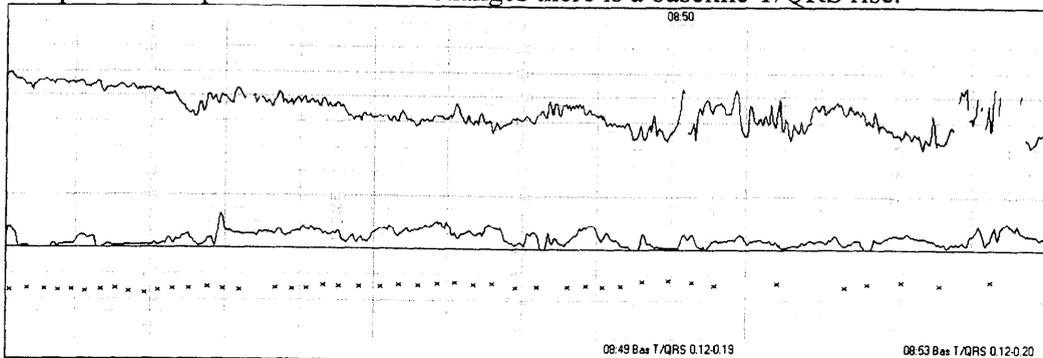
Cord vein:       pH 7.14  
                  PCO<sub>2</sub> 6.96 kPa  
                  BDecf 9.8 mmol/l

### **Neonatal outcome**

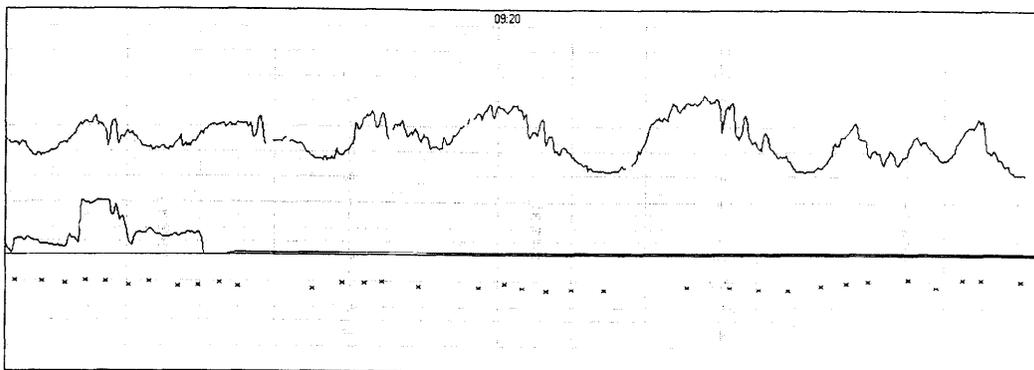
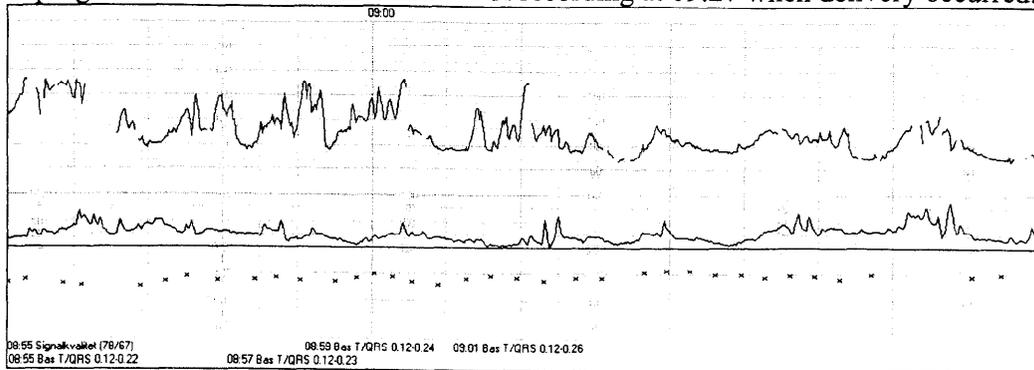
Normal neonatal outcome.

### **Assessment of recording**

Normal FHR pattern until end of 1<sup>st</sup> stage when a variable deceleration is followed by tachycardia. Thereafter the FHR pattern show repeated variable decel, some complicated. In parallel to the FHR changes there is a baseline T/QRS rise.



A progressive ST rise is noted until end of recording at 09:27 when delivery occurred.



### Comments

Hypoxia developing during 2<sup>nd</sup> stage of labor (adequately recorded cord acid-base data). CTG+ST guidelines indicated a need for delivery at 08:53.

## **LDD 297**

### **Clinical data**

Para 2. Normal pregnancy. Spontaneous onset of labour after 39 weeks of gestation  
Clear liquor, augmented labor.  
Scalp pH 7.27 at 04:00  
Active pushing commenced at 04:45  
Mid cavity vacuum for fetal distress at 04:55

### **Neonatal data**

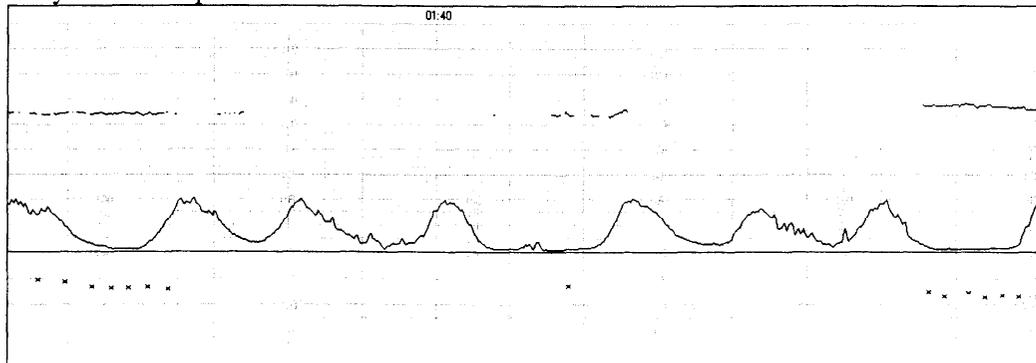
Female: 2800 g  
Apgar: 6-7-8  
Cord artery: pH 7.04  
PCO<sub>2</sub> 4.67 kPa  
BDecf 18.8 mmol/l  
Cord vein: pH 7.12  
PCO<sub>2</sub> 1.98 kPa  
BDecf 21.8 mmol/l

### **Neonatal outcome**

Normal neonatal outcome.

### **Assessment of recording**

Only a short sequence available on the STAN monitor. Disconnected at 01:48.



Fetal surveillance by standard CTG technology thereafter.

### **Comments**

A case of inadequately recorded cord acid-base with low PCO<sub>2</sub> readings causing falsely high BDecf.

## LDE 272

### Clinical data

Para 0. Normal pregnancy. Spontaneous onset of labour after 39 weeks of gestation  
Clear liquor  
Active pushing commenced at 01:00  
Outlet vacuum for failure to progress at 01:26

### Neonatal data

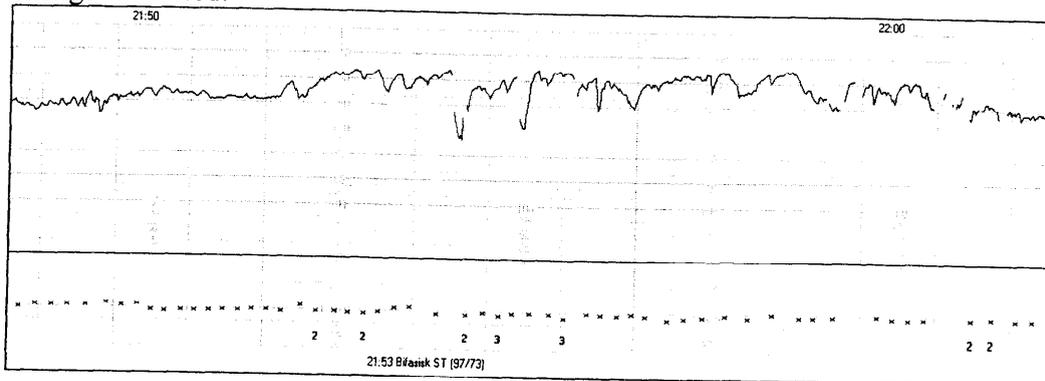
Female: 3930 g  
Apgar: 7-8-10  
Cord artery: pH 7.00  
PCO<sub>2</sub> 8.91 kPa  
BDecf 13.1 mmol/l  
Cord vein: pH 7.06  
PCO<sub>2</sub> 7.07 kPa  
BDecf 13.5 mmol/l

### Neonatal outcome

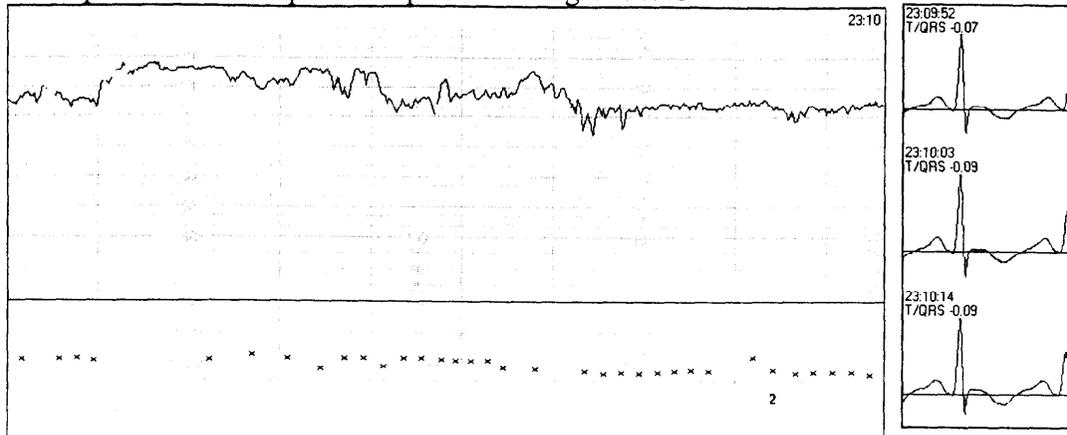
Normal neonatal outcome.

### Assessment of recording

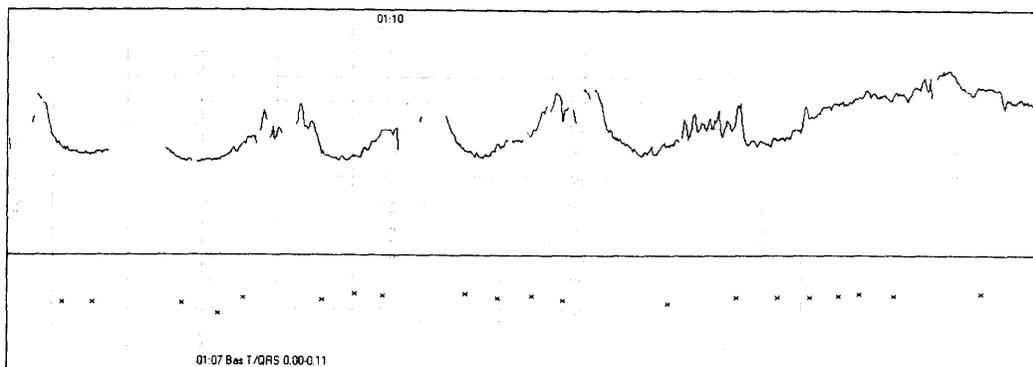
The fetus displayed periods of tachycardia as noted below. In this case biphasic ST changes occurred.



The biphasic ST developed into episodes of neg T waves



With onset of active pushing, the CTG+ST pattern changed with the appearance of bradycardia and T/QRS rise.



### Comments

CTG+ST changes showing periods of tachycardia and ST depression followed by an ST rise in conjunction with active pushing in 2nd stage of labor. This is a typical pattern of a myocardium operating under stress – unknown reason – during 1<sup>st</sup> stage. During the more marked stress in 2<sup>nd</sup> stage, the fetus is capable of responding to hypoxia with an ST rise as a sign of an alarm reaction. Clear indications to intervene with an assisted delivery at 01:06.

## **LDF 308**

### **Clinical data**

Para 0. Normal pregnancy. Spontaneous onset of labour after 39 weeks of gestation  
Clear liquor, epidural, augmentation of labor.  
Active pushing commenced at 16:15  
Outlet vacuum for threatening asphyxia according to CTG at 17:04

### **Neonatal data**

Female: 3580 g

Apgar: 8-10-10

Cord artery: pH 6.93  
PCO<sub>2</sub> 11.08 kPa  
BDecf 13.3 mmol/l

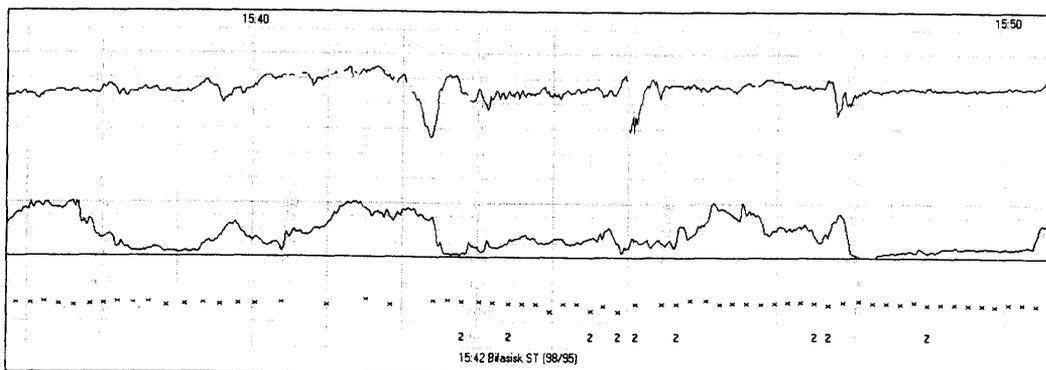
Cord vein: pH 7.02  
PCO<sub>2</sub> 8.8 kPa  
BDecf 12.3 mmol/l

### **Neonatal outcome**

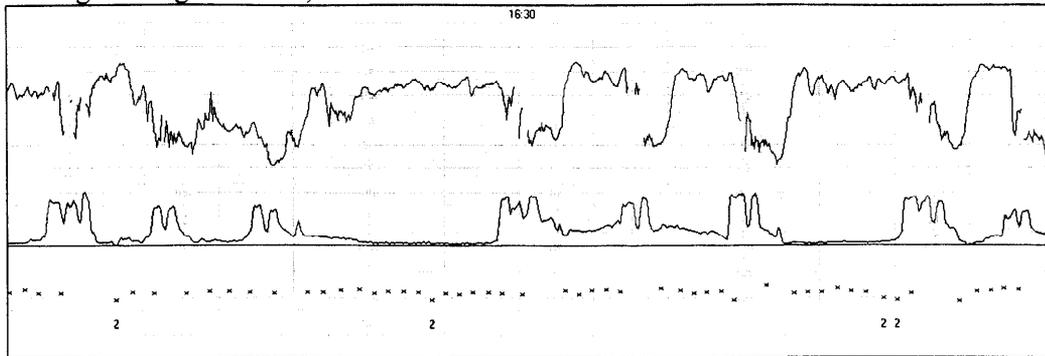
Normal neonatal outcome.

### **Assessment of recording**

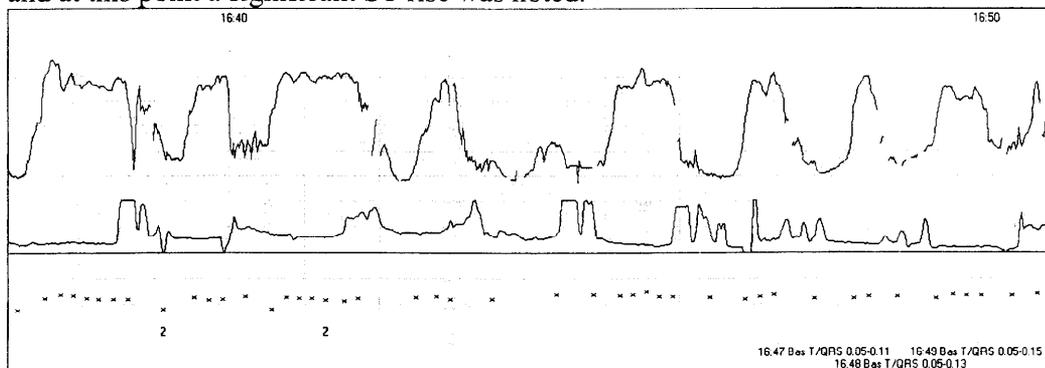
A ST event with biphasic ST was recorded with the development of a tachycardia.



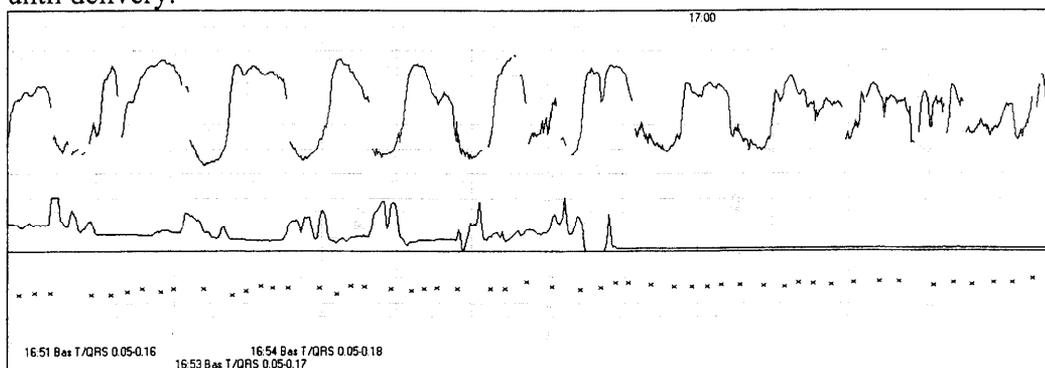
During 2<sup>nd</sup> stage of labor, decelerations started.



These developed into complicated variable decelerations with persistent tachycardia and at this point a significant ST rise was noted.



The ST changes became more marked as labor progressed. The recording continued until delivery.



## Comments

Almost identical situation to LDE 272. CTG+ST changes showing tachycardia and ST depression followed by an ST rise in conjunction with active pushing in 2<sup>nd</sup> stage of labor. This is a typical pattern of a myocardium operating under stress – unknown reason – during 1<sup>st</sup> stage. During the more marked stress in 2<sup>nd</sup> stage, the fetus is capable of responding to hypoxia with an ST rise as a sign of an alarm reaction. Clear indications to intervene with an assisted delivery at 16:47.

## LDH 328

### Clinical data

Para 0. Normal pregnancy. Spontaneous onset of labour after 38 weeks of gestation  
Meconium stained liquor. Augmented labor.  
Active pushing commenced at 03:15  
NVD at 03:53

### Neonatal data

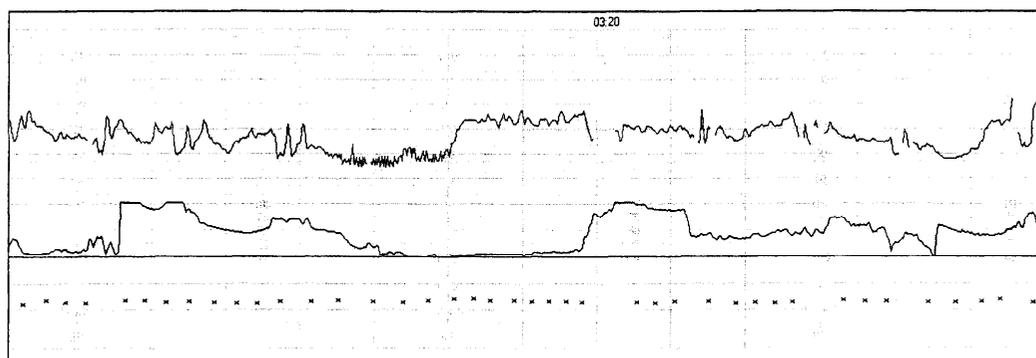
Male: 3170 g  
Apgar: 7-9-10  
Cord artery: pH 6.92  
PCO<sub>2</sub> 10.26 kPa  
BDecf 14.9 mmol/l  
Cord vein: pH 6.98  
PCO<sub>2</sub> 9.02 kPa  
BDecf 13.9 mmol/l

### Neonatal outcome

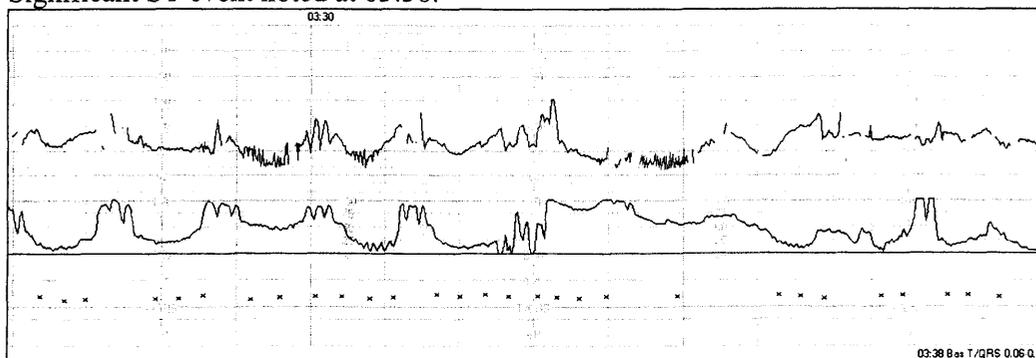
Normal neonatal outcome.

### Assessment of recording

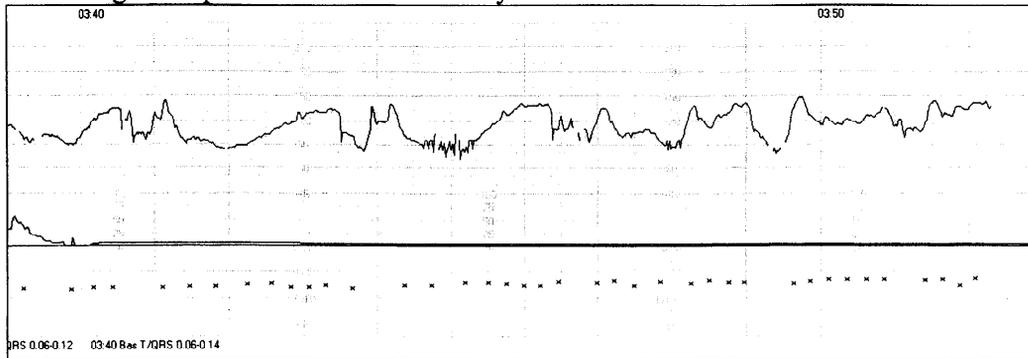
Single complicated decelerations during end 1<sup>st</sup> stage becoming more frequent as labor progressed into 2<sup>nd</sup> stage with active pushing.



Significant ST event noted at 03:38.



Becoming more pronounced until delivery 03:53.



### Comments

Significant hypoxia emerging during 2<sup>nd</sup> stage of labor. A fetus capable of responding with an alarm reaction, including metabolic acidosis and normal Apgar scores. Clear indications to intervene at 03:38.

## MAA 457

### Clinical data

Para 2. Normal pregnancy. Spontaneous onset of labour after 41 weeks of gestation  
Clear liquor  
Active pushing commenced at 15:10  
NVD at 15:15

### Neonatal data

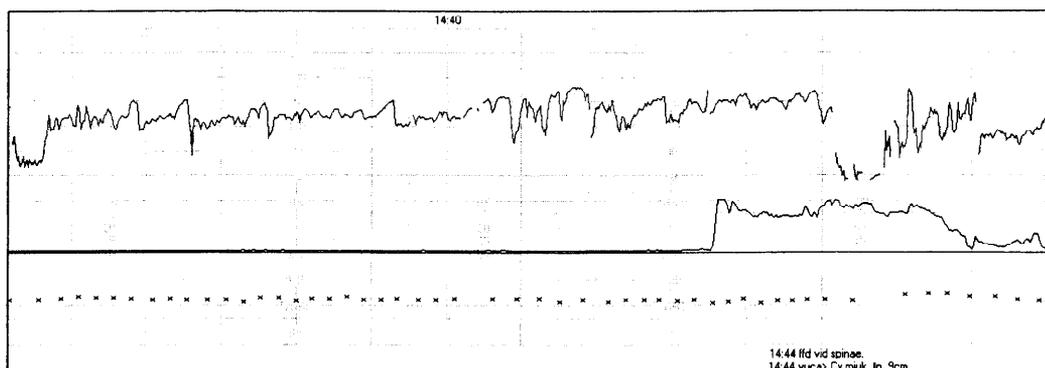
Male: 3805 g  
Apgar: 9-10-10  
Cord artery: pH 7.02  
PCO<sub>2</sub> 8.91 kPa  
BDecf 12.1 mmol/l  
Cord vein: pH 7.23  
PCO<sub>2</sub> 6.25 kPa  
BDecf 6.8mmol/l

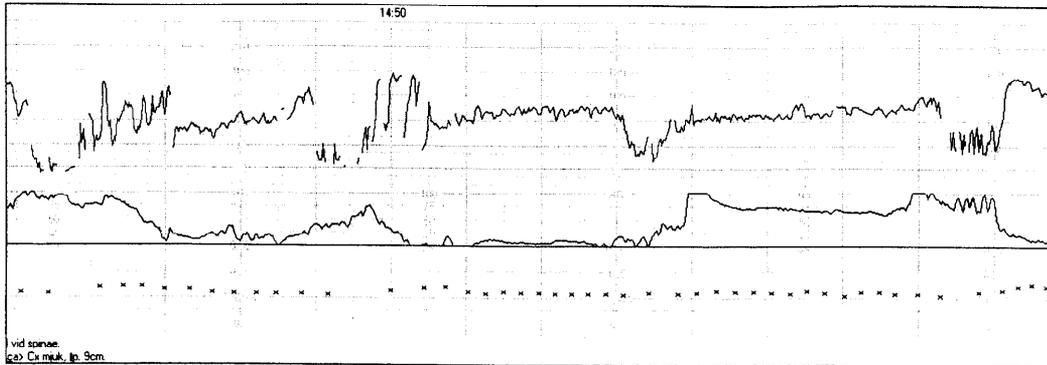
### Neonatal outcome

Normal neonatal outcome.

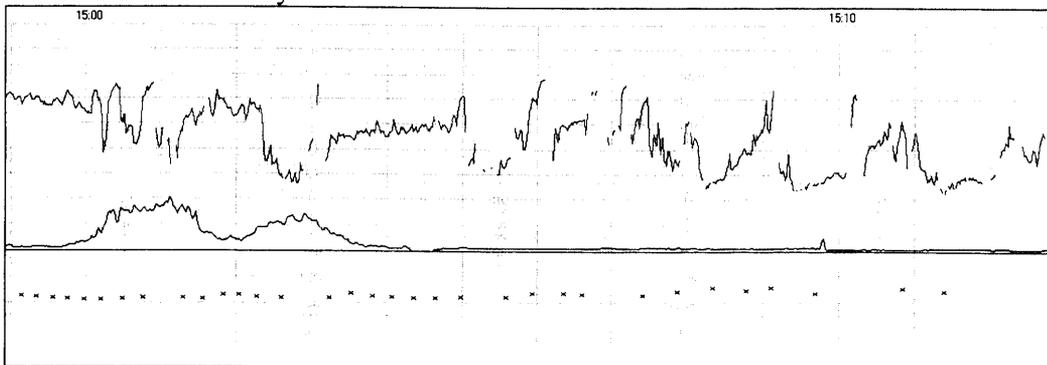
### Assessment of recording

Only some intermediary FHR changes as seen below. Note the small increase in T/QRS with the variable decelerations.





End recording finishing 2 min before delivery. Note the T/QRS rise starting 10 minutes before delivery.



## Comments

Some hypoxia during 2<sup>nd</sup> stage, accurately identified by CTG+ST. The case illustrates a fetus capable of responding and modifying its response according to the duration of cord compression and the degree of hypoxia.

## MAC 534

### Clinical data

Para 0. Normal pregnancy. Spontaneous onset of labour after 40 weeks of gestation  
Clear liquor, epidural, augmented labor.  
Active pushing commenced at 02:10  
NVD at 02:25

### Neonatal data

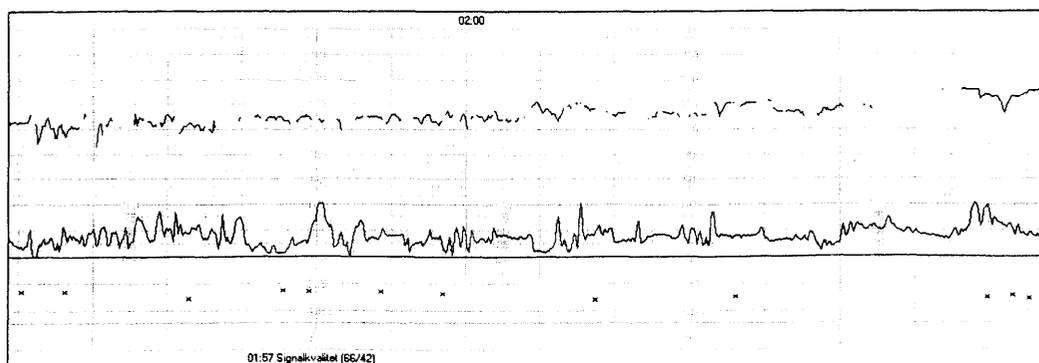
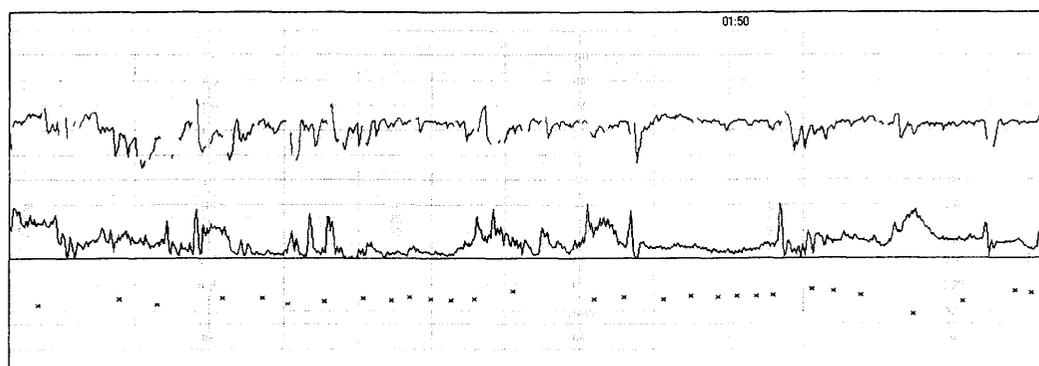
Female: 3480 g  
Apgar: 9-9-10  
Cord artery: pH 7.00  
PCO<sub>2</sub> 6.85 kPa  
BDecf 16.5 mmol/l  
Cord vein: pH 7.32  
PCO<sub>2</sub> 3.95 kPa  
BDecf 9.4mmol/l

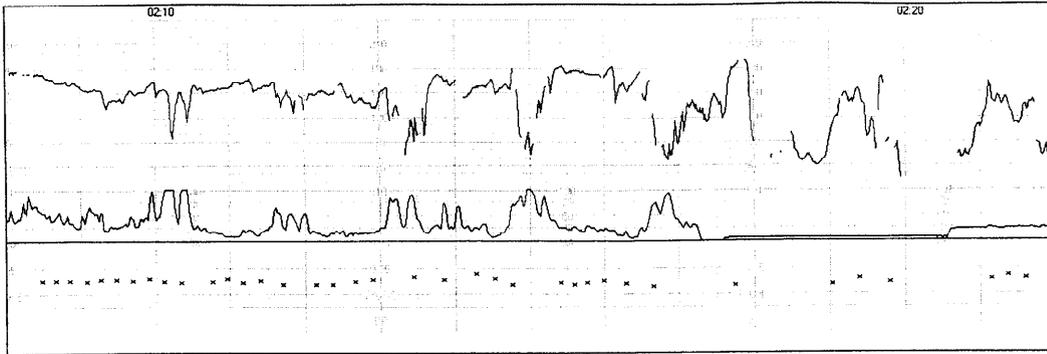
### Neonatal outcome

Normal neonatal outcome.

### Assessment of recording

Normal FHR pattern apart from some complicated variable decelerations immediately prior to delivery.





### Comments

Intermittent cord compression during the last 5-10 minutes causing no clinical problems. Cord twice around neck.

## **MAD 344**

### **Clinical data**

Para 1. Normal pregnancy. Spontaneous onset of labour after 41 weeks of gestation  
Clear liquor, epidural.  
Active pushing commenced at 14:40  
Rotational forceps for threatening asphyxia according to CTG+ST at 14:50

### **Neonatal data**

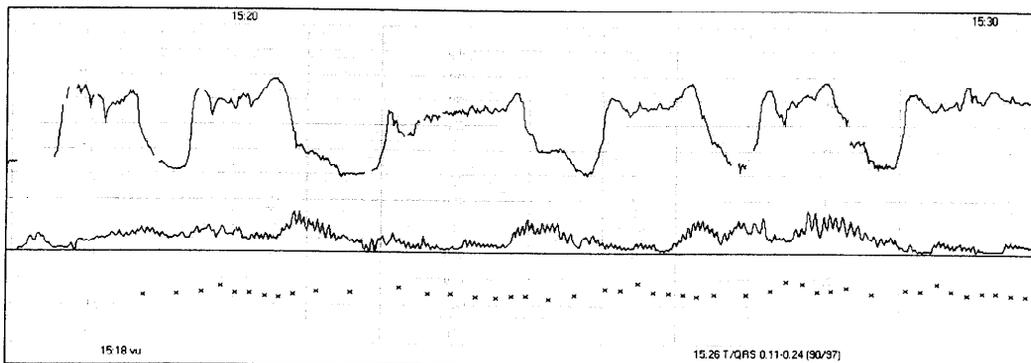
Male: 3290 g  
Apgar: 7-8-9  
Cord artery: pH 6.98  
PCO<sub>2</sub> 9.24 kPa  
BDecf 13.5 mmol/l  
Cord vein: pH 7.21  
PCO<sub>2</sub> 6.53 kPa  
BDecf 7.2 mmol/l

### **Neonatal outcome**

Normal neonatal outcome.

### **Assessment of recording**

A recording characterised by marked variable decelerations becoming complicated as labor progressed into 2<sup>nd</sup> stage. Tachycardia. Episodic T/QRS rise recorded at 15:26.



## **MAD 360**

### **Clinical data**

Para 0. Normal pregnancy. Spontaneous onset of labour after 42 weeks of gestation  
Meconium, epidural, augmented labor.  
Active pushing commenced at 06:10  
NVD at 06:38

### **Neonatal data**

Female: 3910 g  
Apgar: 9-9-10  
Cord artery: pH 7.04  
PCO<sub>2</sub> 7.56 kPa  
BDecf 13.5 mmol/l  
Cord vein: pH 7.27  
PCO<sub>2</sub> 4.91 kPa  
BDecf 8.7 mmol/l

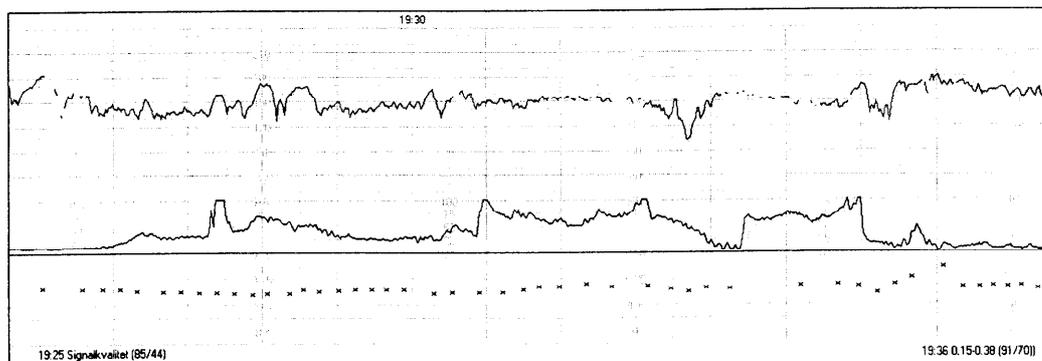
### **Neonatal outcome**

Normal neonatal outcome.

### **Assessment of recording**

A case where the STAN monitor was disconnected approx 9h before delivery.

The data available show a normal FHR pattern. One episodic T/QRS rise was noted at 19:36 illustrating the ability of the fetus to react.



## **MAD 397**

### **Clinical data**

Para 1. Normal pregnancy. Induction of labour after 43 weeks of gestation  
Clear liquor, epidural, augmented labor.  
Active pushing commenced at 23:56  
Outlet vacuum for failure to progress at 00:35

### **Neonatal data**

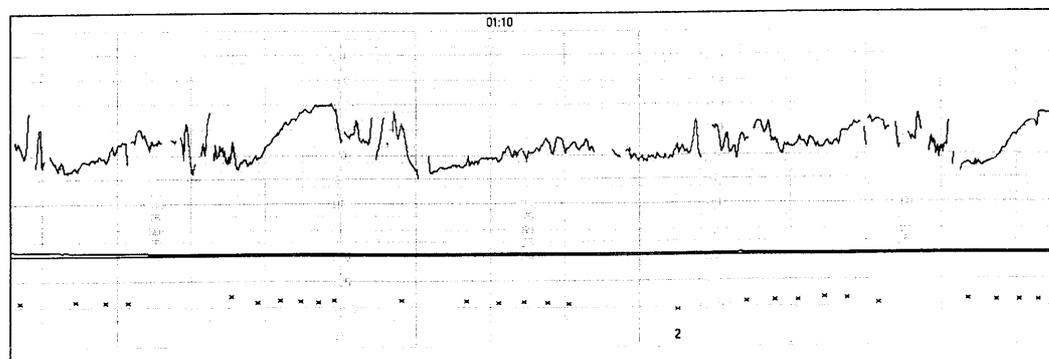
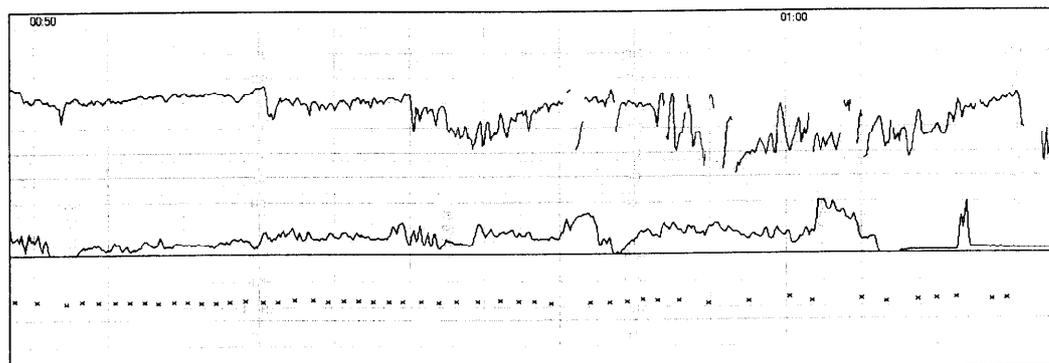
Female: 3520 g  
Apgar: 8-9-10  
Cord artery: pH 7.04  
PCO<sub>2</sub> 5.36 kPa  
BDecf 17.5 mmol/l  
Cord vein: pH 7.10  
PCO<sub>2</sub> 7.01 kPa  
BDecf 11.7 mmol/l

### **Neonatal outcome**

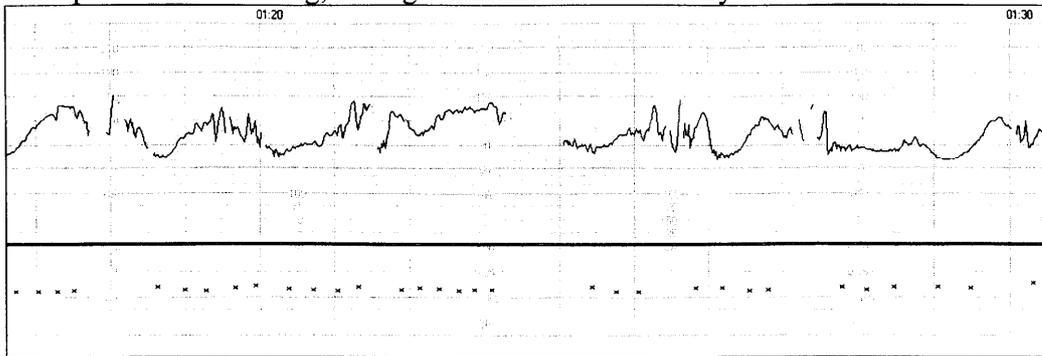
Normal neonatal outcome.

### **Assessment of recording**

Normal FHR pattern with a tendency for reduced variability in 2<sup>nd</sup> stage. Note recorder set on "winter time".



Final part of the recording, ending 5 minutes before delivery.



### Comments

Cord acid-base showing signs of late clamping and a falsely high BDecf in the cord artery. Nothing to indicate marked intrapartum hypoxia. Tendency for a T/QRS rise during the last 20 minutes, reflecting the increase in sympathetic tone.

## MAE 271

### Clinical data

Para 0. Preeclampsia. Spontaneous onset of labour after 41 weeks of gestation  
Clear liquor, augmented labor.  
Scalp-pH 7.29 at 16:33  
Active pushing commenced at 17:30  
Rotational forceps for threatening asphyxia according to CTG+ST at 17:53

### Neonatal data

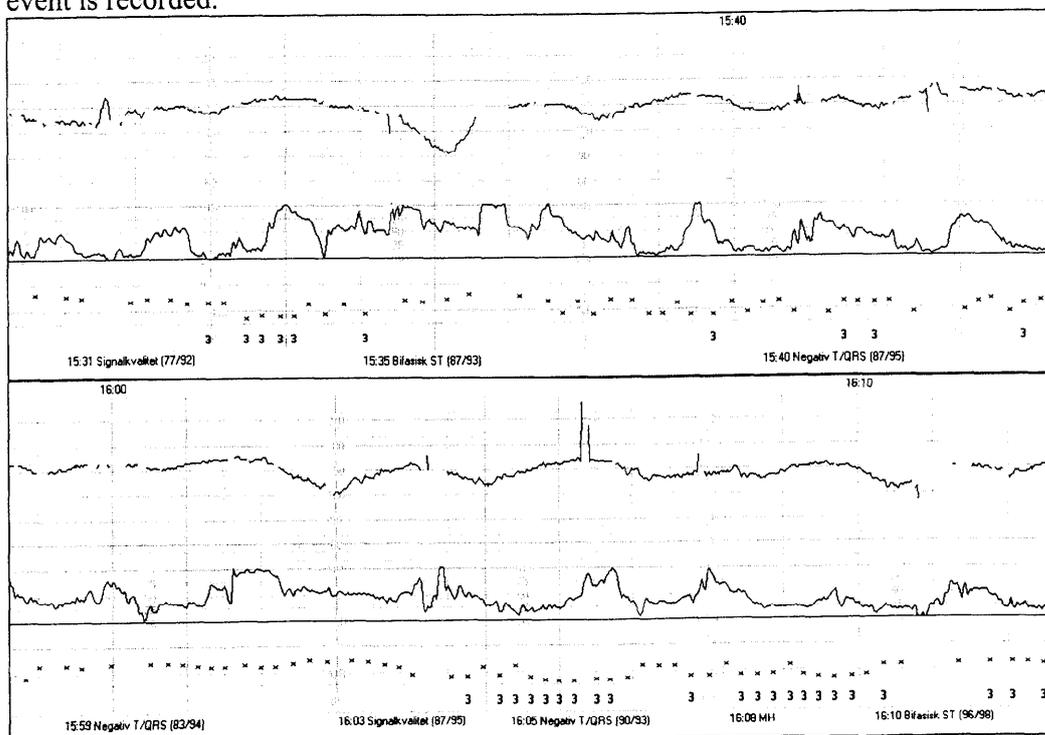
Male: 4570 g  
Apgar: 8-9-10  
Cord artery: pH 6.99  
PCO<sub>2</sub> 8.71 kPa  
BDecf 13.9 mmol/l  
Cord vein: pH 7.22  
PCO<sub>2</sub> 6.27 kPa  
BDecf 7.3 mmol/l

### Neonatal outcome

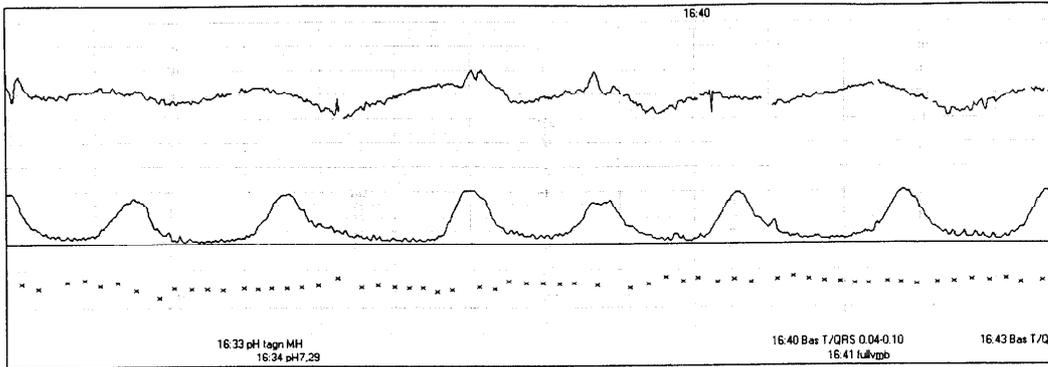
Normal neonatal outcome.

### Assessment of recording

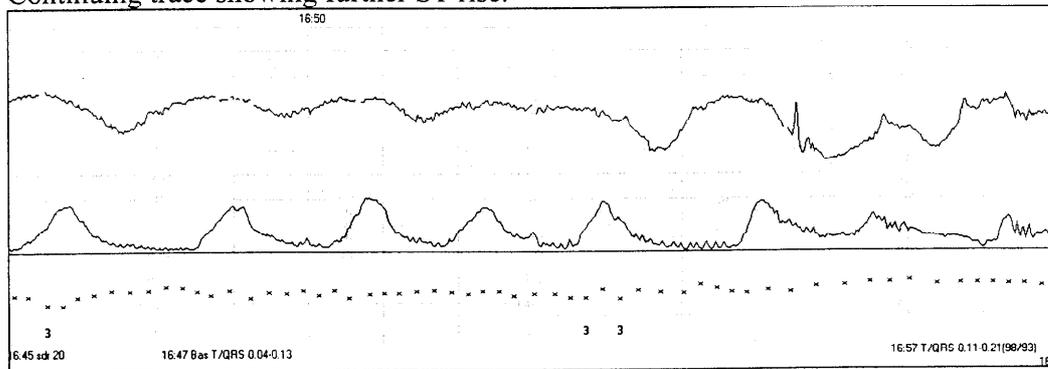
A FHR pattern that already from the beginning is non-reassuring with tachycardia and late decelerations but maintained variability. Very soon, the first Biphasic / neg T event is recorded.



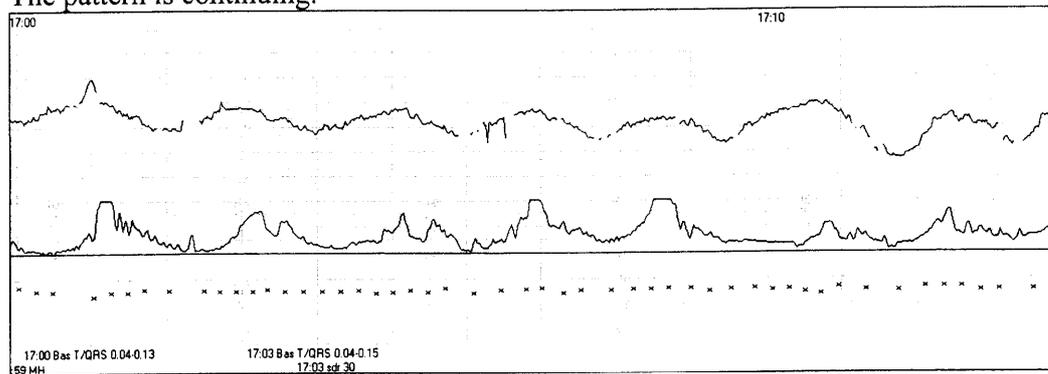
At 16:33 a scalp-pH is obtained, shortly after a baseline T/QRS rise is noted.



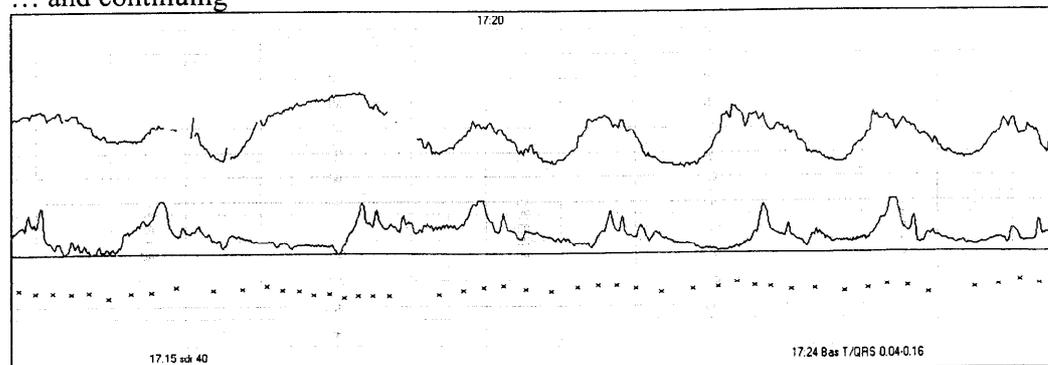
Continuing trace showing further ST rise.



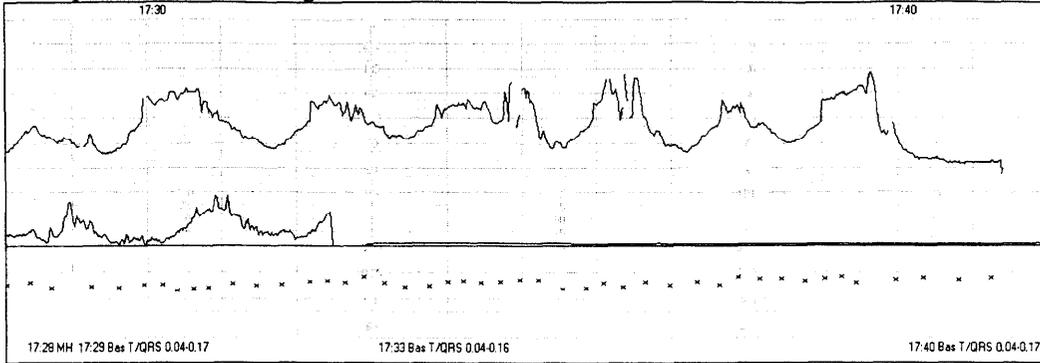
The pattern is continuing.



... and continuing



Final part of the recording, outlet vacuum for fetal distress at 17:53



### Comments

An illustration of gradually developing hypoxia in labor displaying all the fetal ECG features. Clinically, the normal scalp-pH would have provided false reassurance that the FHR pattern although abnormal, was not indicating hypoxia. The additional ST information would have alerted the clinician and according to CTG+ST guidelines an intervention would have been indicated approx 16:10.

The case also illustrates the capacity of this fetus to manage by utilizing its key resource, increase in sympatho-adrenal activity and myocardial glycogenolysis.

## **MAE 340**

### **Clinical data**

Para 0. Normal pregnancy. Spontaneous onset of labour after 39 weeks of gestation  
Clear liquor  
Active pushing commenced at 04:15  
NVD at 04:53

### **Neonatal data**

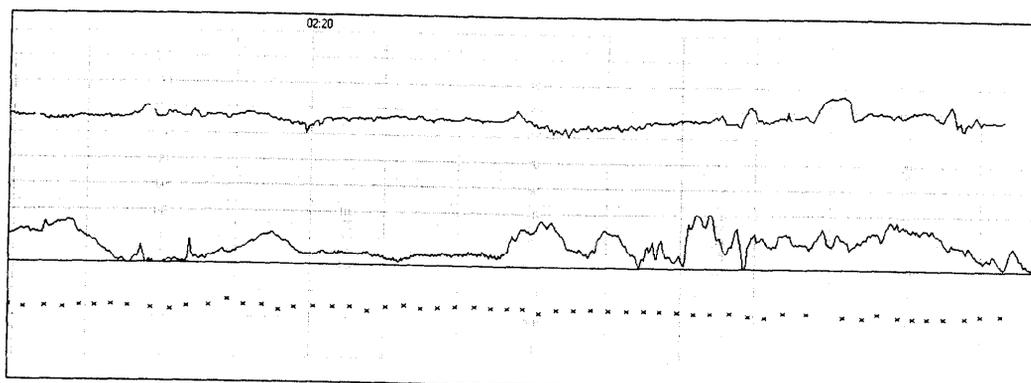
Female: 3085 g  
Apgar: 8-8-8  
Cord artery: pH 7.02  
PCO<sub>2</sub> 8.42 kPa  
BDecf 12.8 mmol/l  
Cord vein: pH 7.07  
PCO<sub>2</sub> 8.67 kPa  
BDecf 9.9 mmol/l

### **Neonatal outcome**

Normal neonatal outcome.

### **Assessment of recording**

Normal FHR pattern. Unfortunately, the STAN monitor was disconnected for unknown reason at 02:30. Delivery occurred at 04:53.



## **MAE 444**

### **Clinical data**

Para 0. Normal pregnancy. Spontaneous onset of labour after 39 weeks of gestation  
Clear liquor, augmented labor.  
Active pushing commenced at 04:15  
NVD at 04:32

### **Neonatal data**

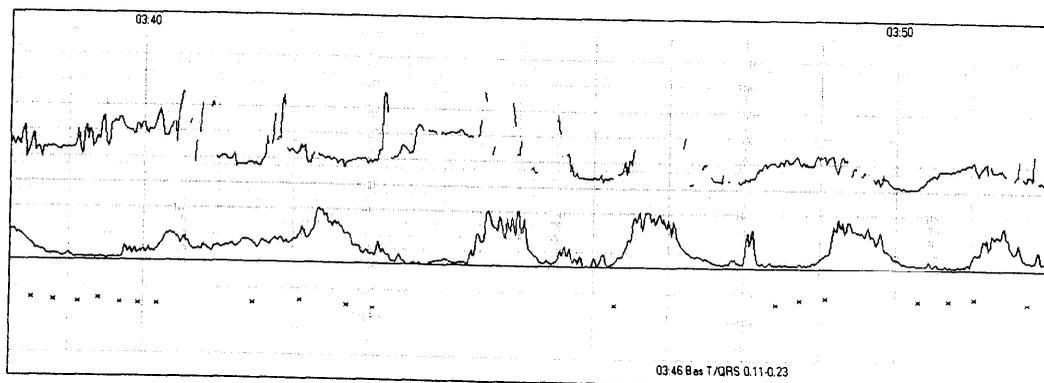
Male: 3320 g  
Apgar: 9-9-10  
Cord artery: pH 6.99  
PCO<sub>2</sub> 9.45 kPa  
BDecf 12.7 mmol/l  
Cord vein: pH 7.09  
PCO<sub>2</sub> 7.11 kPa  
BDecf 12.0 mmol/l

### **Neonatal outcome**

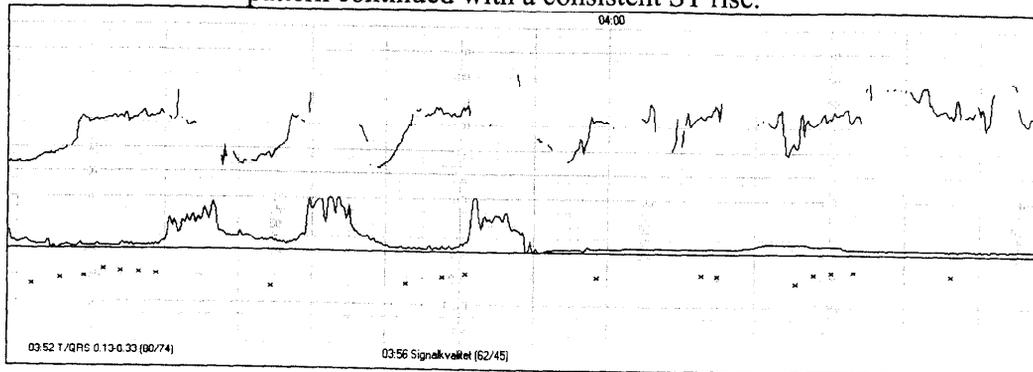
Normal neonatal outcome.

### **Assessment of recording**

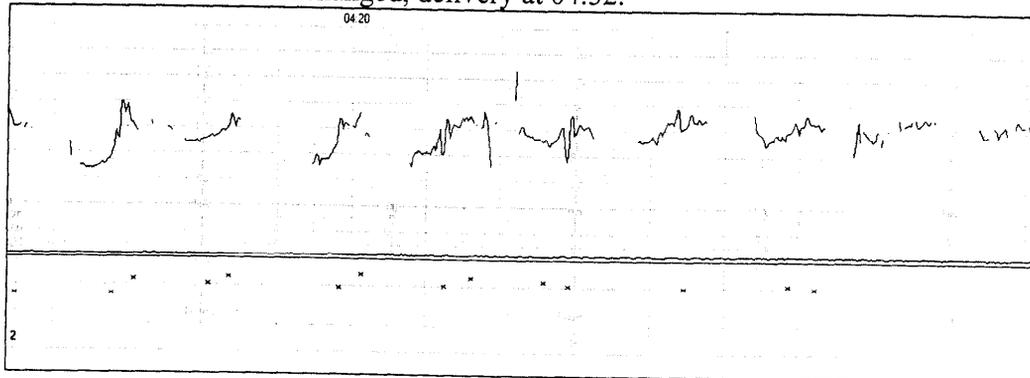
Prolonged bradycardia with a ST rise note at end 1<sup>st</sup> stage of labor.



The abnormal FHR pattern continued with a consistent ST rise.



The situation remains unchanged, delivery at 04:32.



### Comment

Hypoxia developing during the last 30 minutes of labor. The fetus is able to compensate utilising key resources. Indication to intervene according to CTG+ST guidelines at 03:52.

## MAE 491

### Clinical data

Para 0. Normal pregnancy. Onset of labour after 41 weeks of gestation

Mid cavity vacuum for failure to progress at 21:35

### Neonatal data

Male: 4115 g

Apgar: 5-8-10

Cord artery: pH 7.03  
PCO<sub>2</sub> 8.24 kPa  
BDecf 12.8 mmol/l

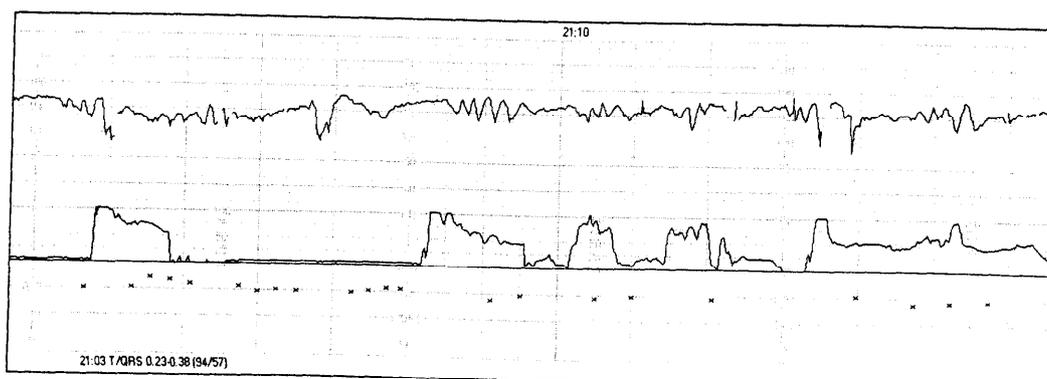
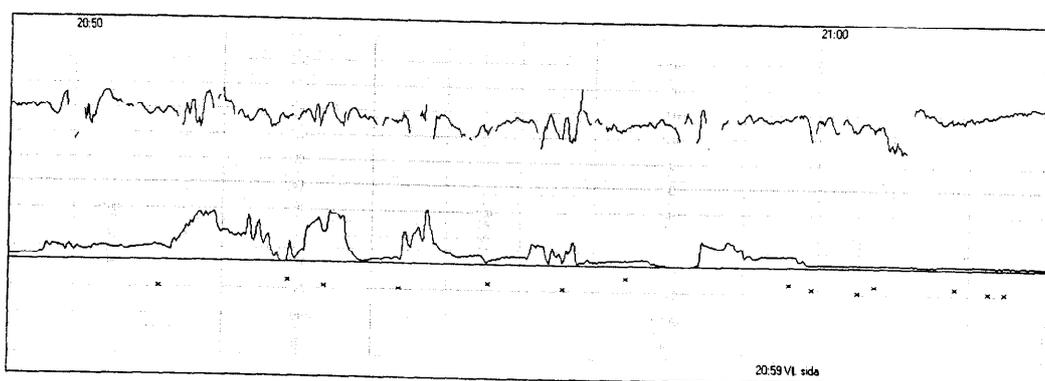
Cord vein: pH 7.25  
PCO<sub>2</sub> 5.32 kPa  
BDecf 8.5 mmol/l

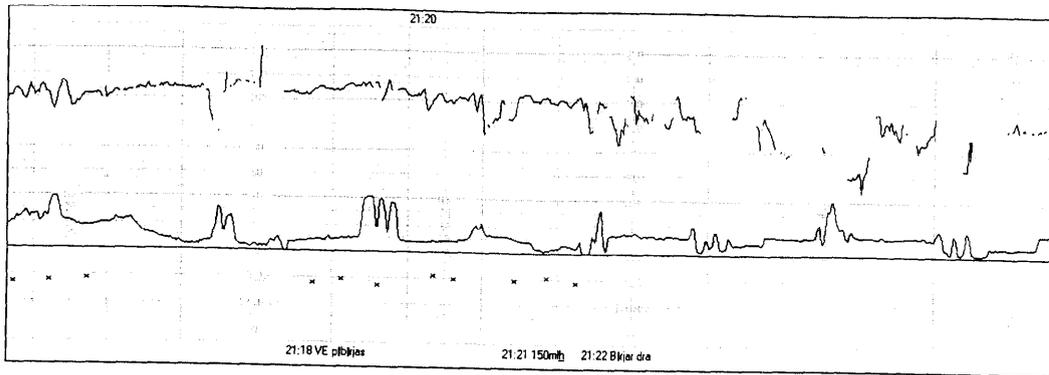
### Neonatal outcome

Normal neonatal outcome.

### Assessment of recording

Apart from some tachycardia, normal FHR pattern. ST showed an episodic event of  $>0.15$ . Thus in case of an intermediary FHR pattern (tachycardia), CTG+ST guidelines indicated a need for intervention.





**Comments**

Difficult case to assess with the data available. However, ST indicated a need for the fetus to respond to the stress of labor.

Note, this case has been excluded but there is nothing to indicate inadequate data.

## **MAF 237**

### **Clinical data**

Para 0. Normal pregnancy. Spontaneous onset of labour after 40 weeks of gestation  
Clear liquor  
Active pushing commenced at 22:05  
NVD at 22:18

### **Neonatal data**

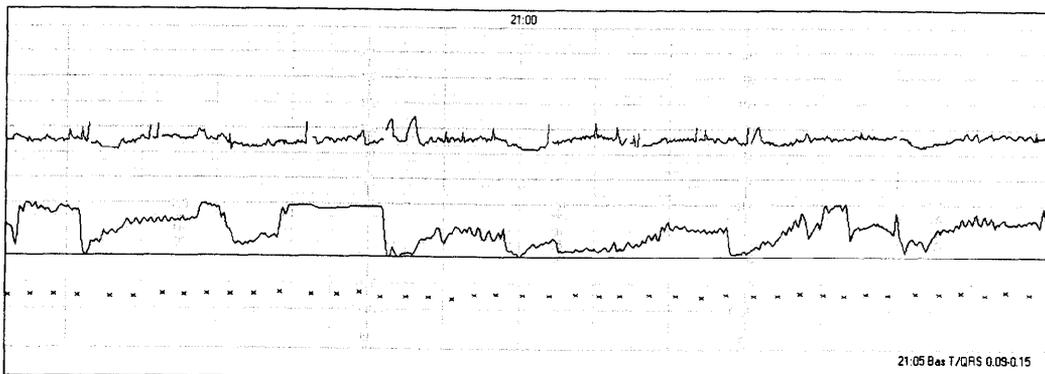
Male: 3940 g  
Apgar: 9-10-10  
Cord artery: pH 7.02  
PCO<sub>2</sub> 8.85 kPa  
BDecf 12.2 mmol/l  
Cord vein: pH 7.05  
PCO<sub>2</sub> 8.75 kPa  
BDecf 10.8 mmol/l

### **Neonatal outcome**

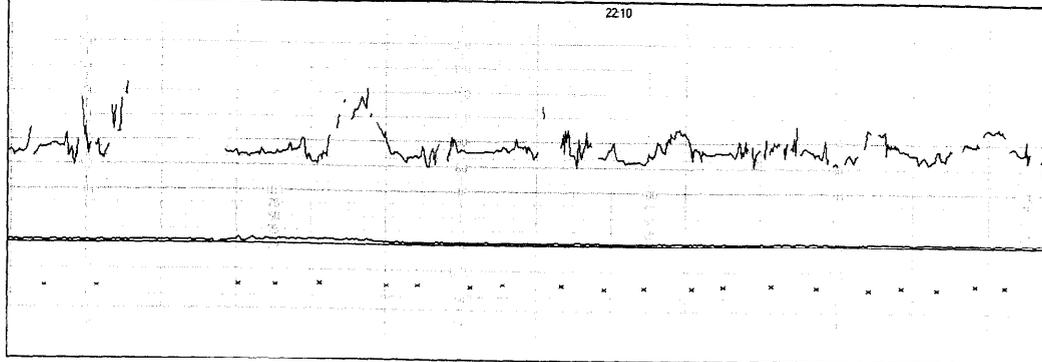
Normal neonatal outcome.

### **Assessment of recording**

Decrease in baseline FHR noted at 12:52 in parallel to a baseline T/QRS rise.



The FHR + ST pattern improved in 2<sup>nd</sup> stage, the graph showing the final recording. NVD at 22:18.



### Comments

FHR+ST changes indicating some cord blood flow reduction at end 1<sup>st</sup> stage of labor. Borderline case. The data indicate a fetus adapting to the events of labor.

## **MAF 244**

### **Clinical data**

Para 0. Normal pregnancy. Spontaneous onset of labour after 41 weeks of gestation  
Clear liquor, augmented labor.  
Active pushing commenced at 08:00  
NVD at 10:16

### **Neonatal data**

Female: 3960 g  
Apgar: 8-10-10  
Cord artery:     pH 7.00  
                    PCO<sub>2</sub> 8.43 kPa  
                    BDecf 13.9 mmol/l  
Cord vein:        pH 7.24  
                    PCO<sub>2</sub> 5.1 kPa  
                    BDecf 9.6 mmol/l

### **Neonatal outcome**

Normal neonatal outcome.

### **Assessment of recording**

Discontinued recording. Data missing  
Inadequate recording.

## **OEF 241b**

### **Clinical data**

Para 2. Normal pregnancy. Induction of labour after 42 weeks of gestation  
Meconium, augmented labor.  
Active pushing commenced at 18:00  
NVD at 18:09

### **Neonatal data**

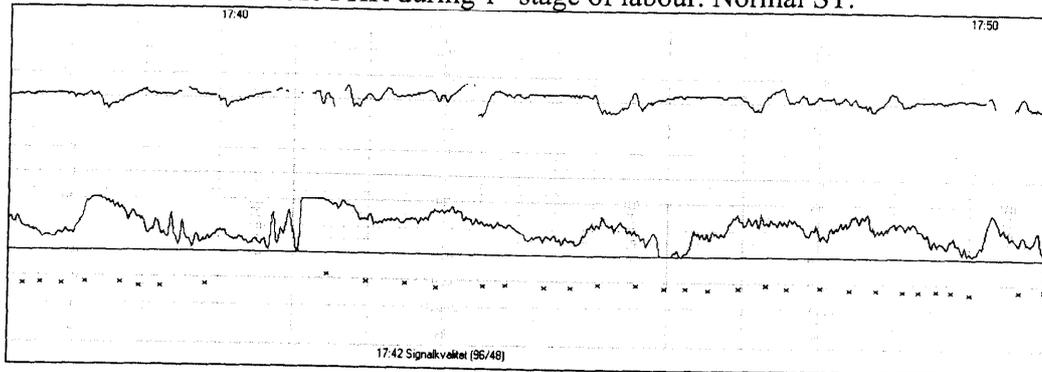
Male: 3835 g  
Apgar: 7-10-10  
Cord artery: pH 6.96  
PCO<sub>2</sub> 8.89 kPa  
BDecf 15.0 mmol/l  
Cord vein: pH 7.37  
PCO<sub>2</sub> 4.62 kPa  
BDecf 4.4 mmol/l

### **Neonatal outcome**

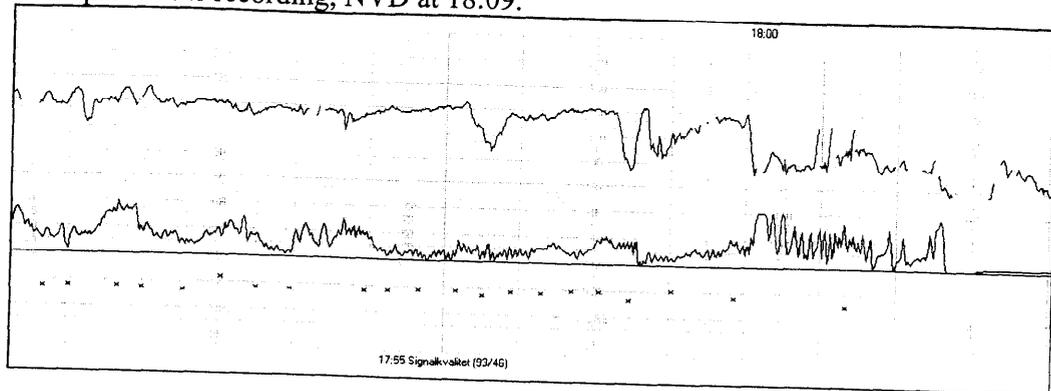
Normal neonatal outcome.

### **Assessment of recording**

Some increase in baseline FHR during 1<sup>st</sup> stage of labour. Normal ST.



Final part of the recording, NVD at 18:09.



### Comments

Selective cord metabolic acidosis indicating an acute hypoxia during the last phase of labor, typically seen with cord entanglement.  
Normal ST waveforms. No FHR abnormalities either.

## OEH 267

### Clinical data

Para 0. Normal pregnancy. Spontaneous onset of labour after 40 weeks of gestation  
Meconium, epidural, augmented labor. Maternal pyrexia of unknown cause.  
Active pushing commenced at 17:30  
NVD at 18:45

### Neonatal data

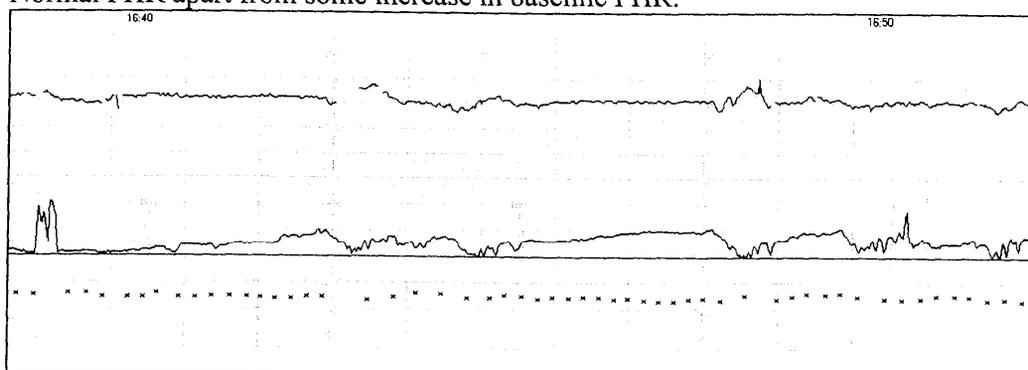
Female: 4060 g  
Apgar: 8-10-10  
Cord artery: pH 6.93  
PCO<sub>2</sub> 10.55 kPa  
BDecf 14.0 mmol/l  
Cord vein: pH 7.04  
PCO<sub>2</sub> 8.81 kPa  
BDecf 11.2mmol/l

### Neonatal outcome

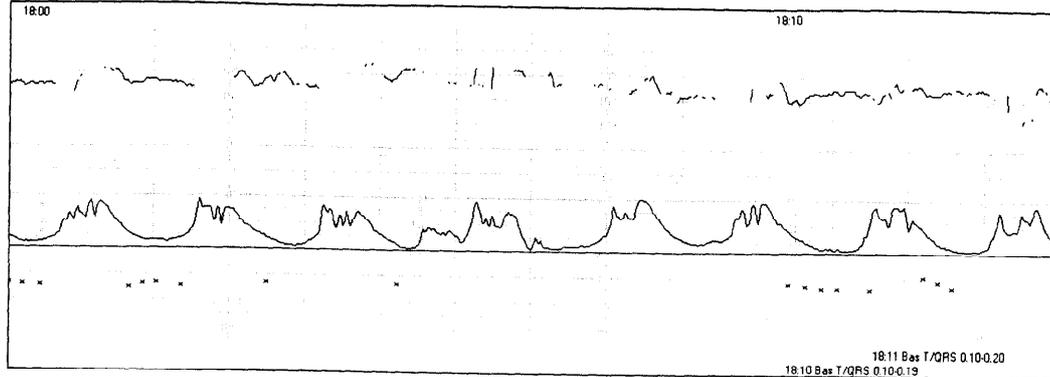
Normal neonatal outcome.

### Assessment of recording

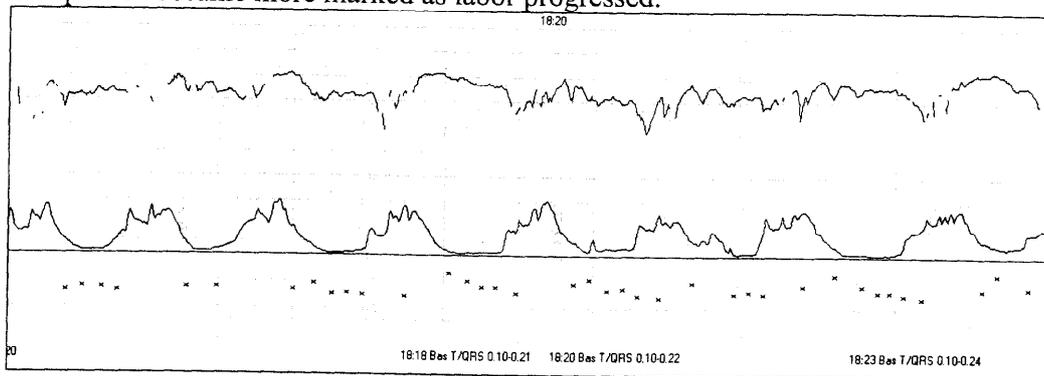
Normal FHR apart from some increase in baseline FHR.



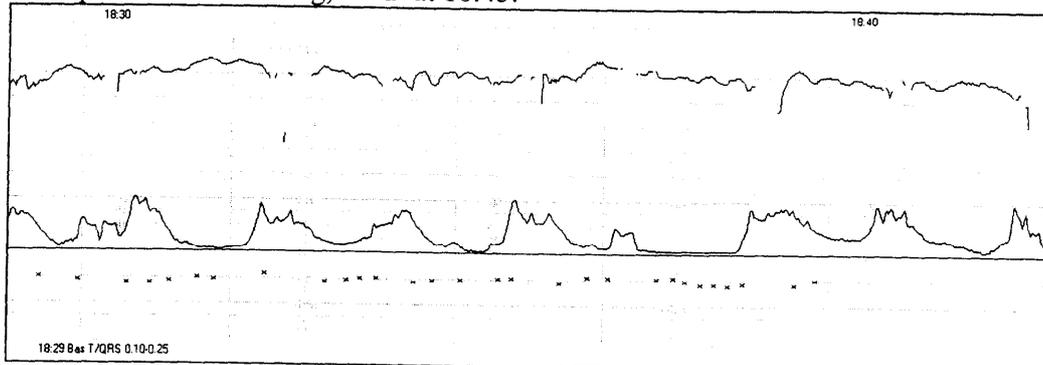
During 2<sup>nd</sup> stage a further increase in baseline FHR was noted with a rise in baseline T/QRS.



The pattern became more marked as labor progressed.



Final part of the recording, NVD at 18:45.



## Comments

Intrapartum hypoxia in 2<sup>nd</sup> stage of labor. Tachycardia and ST rise indicating a fetal alarm reaction that enables the neonate to manage its neonatal adaptation well. According to CTG+ST guidelines, there was an indication to intervene at 18:18 (intermediary FHR + baseline T/QRS rise of 0.11).

## **OEI 327**

### **Clinical data**

Para 1. Normal pregnancy. Spontaneous onset of labour after 40 weeks of gestation  
Clear liquor, augmented labor.  
Active pushing commenced at 08:00  
NVD at 08:50

### **Neonatal data**

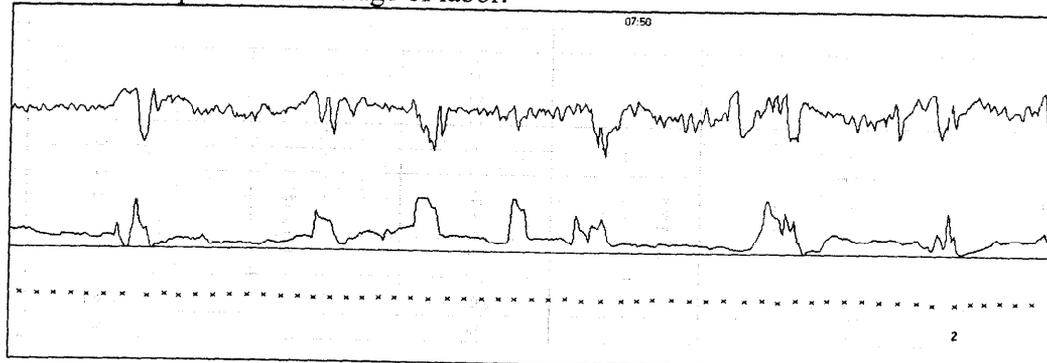
Female: 3835 g  
Apgar: 9-10-10  
Cord artery: pH 7.04  
PCO<sub>2</sub> 8.11 kPa  
BDecf 12.5 mmol/l  
Cord vein: pH 7.10  
PCO<sub>2</sub> 6.78 kPa  
BDecf 12.2 mmol/l

### **Neonatal outcome**

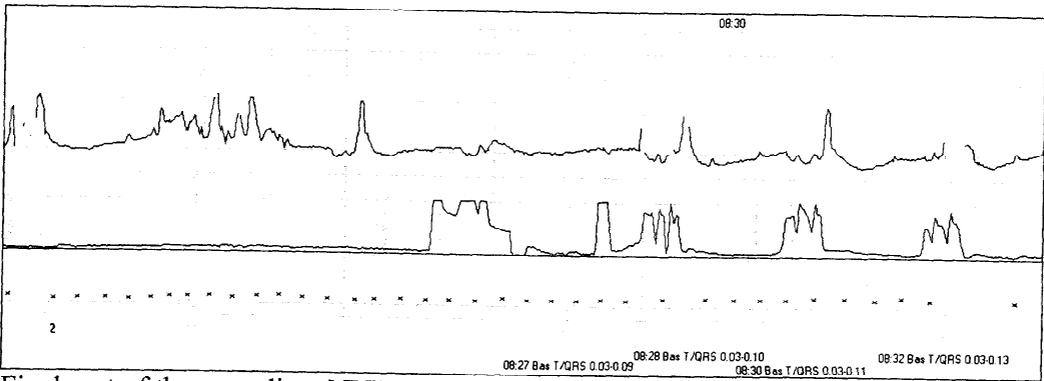
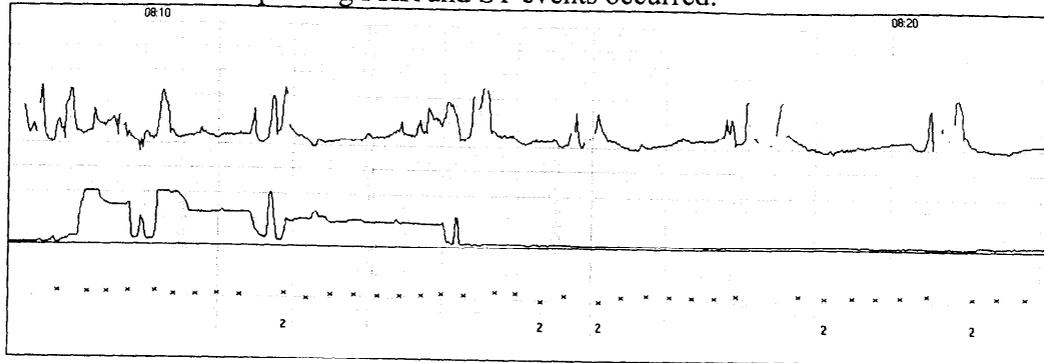
Normal neonatal outcome.

### **Assessment of recording**

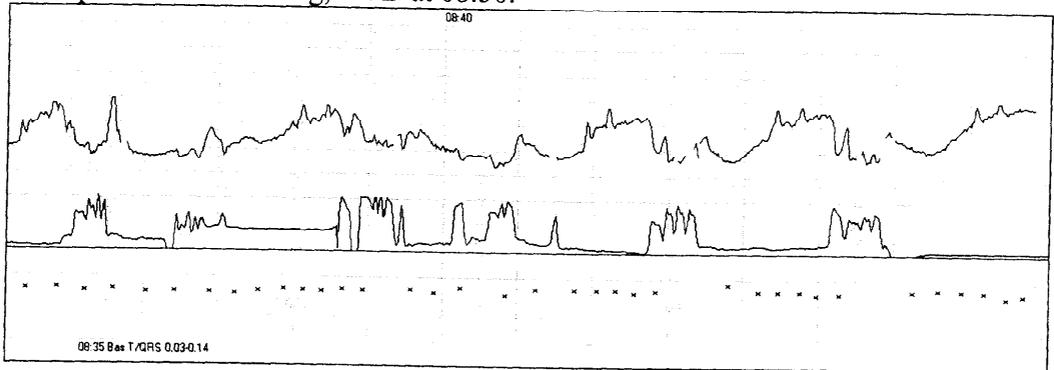
Normal FHR pattern in 1<sup>st</sup> stage of labor.



With onset of active pushing FHR and ST events occurred.



Final part of the recording, NVD at 08:50.



### Comments

A case of hypoxia developing during 2<sup>nd</sup> stage. Indication to deliver at 08:30.

## OEK 384

### Clinical data

Para 0. Normal pregnancy. Spontaneous onset of labour after 42 weeks of gestation  
Meconium, epidural, augmented labor.  
Active pushing commenced at 11:11  
NVD at 11:58

### Neonatal data

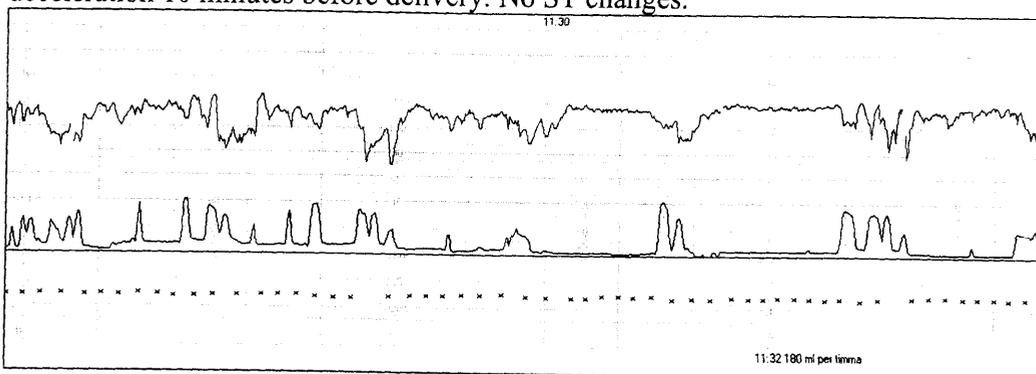
Female: 3350 g  
Apgar: 9-10-10  
Cord artery: pH 6.86  
PCO<sub>2</sub> 10.9 kPa  
BDecf 16.9 mmol/l  
Cord vein: pH 7.04  
PCO<sub>2</sub> 7.22kPa  
BDecf 14.2 mmol/l

### Neonatal outcome

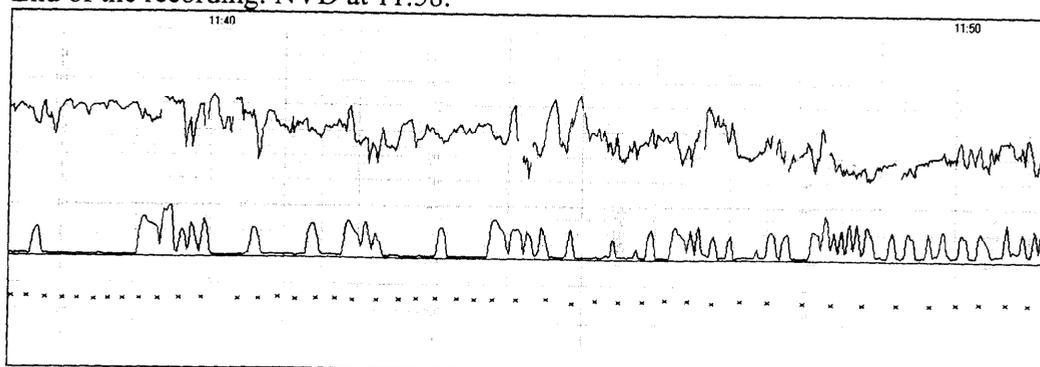
Normal neonatal outcome.

### Assessment of recording

Apart from some increase in baseline FHR, normal FHR pattern during 1<sup>st</sup> stage of labor. Uncomplicated variable decelerations during 2<sup>nd</sup> stage finishing with a deceleration 10 minutes before delivery. No ST changes.



End of the recording. NVD at 11:58.



## **Comments**

Remarkably low cord pH with metabolic acidosis considering a largely normal FHR and ST pattern. Vigorous neonate.