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The clinical significance of electronic fetal heart rate monitoring in twins

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ABSTRACT

Objectives: Fully effective intrapartum cardiotocographic (CTG) fetal heart monitoring is still missing. Visual analysis is far from credibility. Additional, computerized analysis techniques were proposed however they did not substantially decrease possible risks of fetal asphyxia. In twin pregnancies the problem is even more complicated. Our goal is to find the most valuable parameters in intrapartum CTG surveillance in twins, based on actual FIGO criteria.

Material and methods: Study included 58 women in labor who had been admitted to Delivery Department of tertiary care hospital with twin pregnancy in a period of one year. The features of the CTG (e.g., baseline, oscillation, decelerations, brady- or tachycardia) were grouped to create three variables that were closest to the FIGO CTG scale. All three groups were compared according to neonatal status (Apgar score at 5 min ≥ 7 or < 7; pH value in umbilical artery ≥ 7.20, < 7.20 or < 7.10 and BE (base excess) > or ≤ –12). Fetal status and its acid — base equilibrium was compared either with long term variability (LTV), short term variability (STV), or percentage of the signal loss.

Results: Out of 58 twin pregnancies, a total of 116 babies were born. One baby was born dead. From this group, 11 deliveries were natural births and 47 deliveries were C-sections. None of the analyzed features (pH, BE, Apgar, CTG features except tracing length, CTG FIGO categories) were statistically different between groups of singleton and twin pregnancies, except percentage of C-sections. No differences were found either for STV or LTV and fetal status.org CTG categories.

Conclusions: Prior to cardiotocographic tracing of twins during labor, ultrasound examination should be mandatory. Considerable loss of signal in CTG tracing in twins should provoke ultrasonographic confirmation of the fetal status.

Key words: fetal heart; twin pregnancy; monitoring; cardiotocography

INTRODUCTION

Since the 1950s, electronic fetal heart monitoring has become a key part of our intrapartum fetal surveillance. In the 1970s, Dawes and Redman introduced the first computerized antenatal fetal heart rate (FHR) analysis [1]. The Dawes and Redman cardiotocography (CTG) is valid to use for any gestation over 26 weeks, however it is not suitable for intrapartum analysis. Considering the ongoing debate around its use, there are possible risks associated with antenatal fetal monitoring and its ability to predict or prevent asphyxia and acidosis in fetuses. Even the American College of Obstetricians and Gynecologists have raised concerns around the use of continuous fetal heart rate monitoring and its connections to an increased risk of unnecessary cesarean sections [2]. Overall, the risks associated with fetal heart rate monitoring around the time of childbirth warrant more nuanced study.

Due to the lack of reliability associated with fetal heart pattern visual analysis, additional analysis techniques, such as short- and long-term variability analyses have been proposed in the literature. All modern computer systems (e.g., Monaco, Philips, etc.) allow for easy access to these measurements. Despite this, the number of studies involving analysis of fetal heart rate and perinatal results is limited. This is particularly true in Polish twins, where fewer patients deliver by vaginal birth each year, rendering assessments of the electronic, computerized surveillance valuable. Access to this technology might encourage obstetricians to promote vaginal births in twins. Spencer et al. [3] described a correlation between International Federation of Gynecology and Obstetrics (FIGO) criteria for cardiotocography (CTG) and fetal outcomes. CTG was evaluated with "CTG online" software system, which calculated FIGO criteria (including baseline, deceleration, variability and acceleration measurements). FIGO classification was modified but the idea remained. Because of the large number of the false positive values of the CTG traces recorded in this study, Schiermeier et al. [4] reported an estimated a correlation between intrapartum computerized FIGO criteria for CTG and fetal scalp pH during labor, in addition to estimates of sensitivity and specificity of this measure. This study was retrospective, and the final group of participants consisted of 370 women. They acquired a sensitivity measure of 95% and a specificity measure of only 21.8%. Further, this study reported a weak correlation between umbilical cord artery base excess and pH with CTG computerized parameters [5].

Building on this previous work, the aim of the present study is to provide an analysis of clinical significance of intrapartum electronic fetal monitoring in twins in a prospective, observational study. To investigate this relationship, we examined the connection between FIGO classification parameters and fetal heart long- or short-term variability and during labor with the perinatal status of the neonates. Our goal is to find the most valuable parameters in intrapartum CTG surveillance in twins.

MATERIAL AND METHODS

This study was carried out at the Obstetrics and Gynecology Hospital, Poznan University of Medical Sciences from April 2016 to March 2017. Throughout these 12 months in the hospital, there were 7689 infants delivered. Prior to their delivery, not all infants were monitored using a multi-station obstetric surveillance system (a Monaco System), therefore data collection in these cases was not possible. Part of the group was monitored out of the Monaco System with no backup. Nearly 30% of the monitored patients had incomplete data.

In the whole group 818 were planned C-sections. All women who were expecting twins, waiting for planned cesarean sections were excluded from the sample. Finally, 3063 women in labor with singleton and twin pregnancies were enrolled. Out of this group 58 pairs of twins qualified for inclusion in the sample. The remaining 3005 singleton deliveries formed our comparison sample [6]. These 58 twin pregnancies identified from the women in labor who had been admitted to Delivery Department. Women were also grouped according to the obstetric condition (e.g., fetal position), and whether they experienced a C-section or vaginal delivery. Indications for C-section were not analyzed further.

Our participants included women between 19–42 years of age (mean = 29.6, median = 33 and range = 19–42). Twenty-two women were multiparous and 36 were primiparous. Thirty-eight deliveries were considered premature. The average gestational period for the premature group was 33.3 weeks (median = 36 and range 25–36 weeks). The other group of women included 20 full-term pregnancies. The average gestational period in this group was 37.6 weeks, (median = 37 and range = 37–40). No differences were identified between age and parity of women delivering naturally or *via* C-section.

The features of the CTG (e.g., baseline, oscillation, decelerations, brady- or tachycardia) were grouped to create three variables that were closest to the FIGO CTG scale — "normal", "suspicious", and "pathological" [7]. Division of the CTG characteristics to three CTG FIGO patterns was carried out prior to the study. All three groups were compared according to neonatal status (Apgar score at 5 min ≥ 7 or < 7; pH value in umbilical artery ≥ 7.20, < 7.20 or < 7.10 and BE (base excess) > or ≤ –12) [8]. Fetal status and its acid–base equilibrium was compared either with long term variability (LTV), short term variability (STV), or percentage of the signal loss. Above listed estimations were calculated both for the complete delivery time and for the final 10 minutes prior to delivery, except oscillation for the last 10 minutes (technical limitation). Separate analyses were completed for the entire group of infants as well as a comparison across mature and premature neonates. These parameters were compared with those acquired for singleton pregnancies.

Due to the prospective nature of the study, all the features of the CTG printouts were analyzed and compared to Monaco System printouts by one of the team members to identify errors that may be caused by technical inaccuracies. The team members that examined these outcomes each had a minimum experience is 15 years in the field, as required by the perinatology department. The senior obstetrician examined only the Monaco System printout and the CTG printout without knowing the week of delivery, the fetal mass and the fetal overall outcome.

Group summary statistics are presented in Table 1 as mean, median, minimal- and maximal values. We used the Shapiro-Wilk test and found the data were not normally distributed. As such, Mann-Whitney U tests were used to complete group comparisons. $P \leq 0.05$ were considered statistically significant.

Because of the observational nature of the study, with no influence on the procedures applied, approval of the institutional Research Committee was not necessary.

RESULTS

Out of 58 twin pregnancies, a total of 116 babies were born. From this group, 11 deliveries were natural births, nine were spontaneous for both twin, two deliveries finished with an operation on second twin (1 — vacuum extraction and 1 — C-section), and 47 deliveries were C-sections.

For all infants included in this study, we recorded fetal mass, pH and BE values in umbilical cord artery, Apgar score, and all analyzed features of the CTG tracing. These data for the full sample, premature group and full-term group are shown in Table 1.

Among mature deliveries seven (35%) were spontaneous, whereas in one case the second twin was delivered by C-section. Only four (10.5%) deliveries were natural in the premature group.

One fetus was born deceased with a pH value 6.88, BE –18.1. The loss of CTG signal in this case was 55% for the entire delivery time and 61.4% for the final 10 minutes. This fetus was delivered at week 30 and the fetal mass was 1520 g. Weight of the co-twin was 1650 g and the signal loss for the whole trace –37.5% and 38.1% for the last 10 minutes. The delivery carried out by C-section because of fetal distress indicated by the CTG. The last Doppler flow velocimetry was completed four days earlier. The results shown no pathology for both twins. For comparison, the average signal loss for singletons was 15.5% for the entire time and 24.9% for the last 10 minutes.

Among the other twin newborns in our sample, only two yielded an Apgar score in the 5^{th} minute lower than 7 (e.g., 4 and 5), where pH and BE values in umbilical artery were 7.32; –2.5 and 7.31; –2.3, respectively. Fetal weight of the above analyzed newborns was 1015 g and 1655 g. In the full sample of the live newborns only three showed a pH value lower than 7.20 (e.g., 7.08, 7.18 and 7.19). All these babies were born in good health (Ap. 10, 8, 10 and BE –3.6, –5.6, –5.3, respectively).

None of the analyzed features (pH, BE, Apgar, CTG features except tracing length) were statistically different between groups of singleton and twin pregnancies, except percentage of C-sections. No statistical differences were found between pH or BE values in umbilical artery and the fetal status for all three categories of CTG tracing (Mann-Whitney U test).

No differences were found between STV or LTV and fetal status, nor between STV or LTV and analyzed categories of CTG tracing. This lack of difference among all the study parameters considered both the whole CTG tracing and last 10 minutes tracing.

DISCUSSION

Supervision of the multiple pregnancies seem challenging. At labor the difficulty level increases. Multiple pregnancies are commonly considered for continuous fetal monitoring through labor. If the CTG is normal or suspicious, we find low probability of hypoxia at this stage. As in singletons, when CTG is pathological we meet high probability of hypoxia, therefore urgent action is required. However, visual assessment, for years causes problems. Our goal was to improve it.

Even in good quality CTG printouts the inter-observer differences in CTG assessments are substantial. Even the most experienced obstetricians are aware that although continuous CTG surveillance may show a completely normal pattern, at times the condition of the fetus is difficult to determine. In twins, the problem is even more complex because of frequent signal loss. Moreover, some parameters such as short- or long-term variability change throughout labor [9]. Prematurity also augments these issues.

Although common, normal CTG tracing (Monaco, Phillips CTG multistation, Guardian) surveillance does not offer additional information for making healthcare decisions. This technology helps mainly in remote, central control of the fetuses, signaling danger if FHR is outside normal ranges. However, different technologies such as the INFANT (K2 Medical Systems) show new avenues for development. This decision-support software was developed to run on the Guardian system. It analyzes the quality of fetal heart signals and, if these signals are adequate, displays baseline heart rate, heart-rate variability, accelerations and the type and timing of decelerations, the quality of the signal, and contraction patterns. INFANT uses these details to make an overall assessment of the fetal status, which will indicate recommended intervention through a color-coded alert (blue represents low severity, yellow represents moderate severity, and red represents high severity [10,11]. STV alone was shown to be better than CTG analysis in predicting fetal asphyxia. Values lower than 4.5ms were good predictors of the fetal acidemia [12]. The study was limited to fetuses with growth restriction. The addition of time-interval analysis of the fetal electrocardiogram during labor did not show a significant benefit in decreasing operative intervention. There was no significant difference in neonatal outcome [13].

In our study, the main goal was to check if the CTG categorization imitating FIGO classification and STV might reflect fetal status in twins. Actual and obligatory CTG FIGO scales cannot be assessed automatically. We aimed to assess these measures the basis of the computerized CTG surveillance system. We acquired 75 variables from the database and divided the sample into group to reflect the FIGO scale. A previous study on singletons demonstrated that the most important data were selected for further analysis [6]. In order to avoid errors and manage common occurrences such as signal loss, and misdiagnoses, all printouts were analyzed.

According to the observations made by the Amorim-Costa regarding the changing patterns of CTG tracing with pregnancy advancement, we compared fetuses to up to 36 weeks' gestation and ≥ 37 weeks' gestation [14]. We did not observe higher signal-loss in preterm labor group. Compared to our control group of singleton deliveries, we found differences in signal-loss for the full delivery time (15.5 vs 18.4; $p < 0.05$) and for the final 10 minutes (24.9 vs 27.1; $p < 0.05$) for singletons and twins, respectively. From clinical perspective, these differences are surprisingly small, where LTV, STV and STV 10' did not differ significantly between singletons and twins.

To manage the influence of signal loss on results, we compared categorized CTG tracing with STV, LTV, and fetal status. This analysis did not yield any differentiation between groups. However, since we believe that it is a valuable component of the fetal surveillance, we check it in every suspicious CTG trace in the Ward. Importantly, CTG quality is not only influenced by twin pregnancies and prematurity. Acquiring good quality measures is also challenging because of the mother's and fetuses' activity, as well as unstable basal FHR [15].

Continuous CTG tracing, monitored in the three most supervised points throughout the delivery, meant that the criterion of poor neonatal outcome was met in only two cases. Therefore, we could not carry out statistical analyses to show any potential differences. One may conclude that pH < 7.20 is the approximate border in an acidosis assessment, if only three live-born fetuses showed this value lower in the umbilical artery. Only one value was below 7.10 (7.08). Border values are supported within the literature and in every day clinical practices [16].

Neither FIGO criteria nor STV or LTV were different between groups of twins with good or poor pH, BE or Apgar score. In the study group we did not group twins according to the chorionicity to avoid any group limitations. Even with the group of 58 deliveries we did not find a correlation between the study parameters and poor fetal condition. Moreover, we could expect that chorionicity may cause most of all fetal distress through the course of pregnancy, but not necessarily in fetal tracing at delivery.

One limitation of the study is the lack of indications to predict the caesarean section. Based on our analysis and expertise, this would cause division of the material to at least 10 groups what would make statistical analysis extremely challenging to interpret. As such, our aim was to analyze the effectiveness of the fetal surveillance overall. Other limitation of the study is that neither Apgar nor pH or BE values are not indicators of the “good health”, but just neonatal status. However, these indices are easy to use and comparable.

During our study one fetus was born deceased. In the last 10 years, it was the second intrapartum death in twins. It is worth noting that a decade ago an analogical situation took place on singleton fetus. This was unsuspected according to the CTG and the delivery of the deceased fetus followed. An autopsy revealed that the fetus died at least six days before delivery. In the case of the described twin fetuses, directly before commencing the CTG tracing, no ultrasonography was performed, and good flow velocimetry four days prior did not prevent this tragedy. According to the general standard of care, an ultrasound examination should be mandatory prior to commencing any CTG in a twin pregnancy to confirm the location of two individual fetal heartbeats. External FHR monitoring should always be performed with dual channel monitors. Automatic 20–30 beat separation of the two fetal heartbeats should be applied to differentiate more easily between the twins while tracing. This is a standard contemporary addition to all equipment. Later in mature pregnancies during advanced labor, a fetal scalp electrode may be recommended for twin one if cephalic, as soon as possible. However, not many maternity wards use fetal electrocardiography. Moreover, many twin deliveries are premature, which is a relative contraindication to this method. Advanced delivery with cervical dilatation, what is the condition *sine qua non*, is the other limitation present in this investigation.

Regardless of these challenges, we need to improve intrapartum fetal monitoring to detect early signs of fetal hypoxia. Clinicians should always be aware that even the most sophisticated technology cannot guarantee good neonatal outcomes. No one type of fetal surveillance allows medical professionals to change the monitoring of patients. This awareness in delivery departments is still critical for the best outcomes.

Computer-derived FHR parameters grouped to FIGO CTG categories in twin deliveries may be helpful in the surveillance of fetuses, however much larger analyses should be performed to predict outcomes. Few twin pregnancies end in natural births, meaning that recruiting a sufficient sample is incredibly difficult. Based on our findings, ultrasonography should be mandatory prior to beginning CTG tracing for both fetuses.

CONCLUSIONS

Prior to cardiotocographic tracing of twins at labor ultrasound examination should be mandatory.

Considerable loss of signal in CTG tracing in twins should provoke ultrasonographic confirmation of the fetal status.

Conflict of interest

All authors declare no conflict of interest.

REFERENCES

1. Redman C, Stanger D, Albert B. Computerised analysis of the antepartum cardiotocogram (CTG) for care of the compromised fetus. Pregnancy Hypertension. 2017; 7: 58, doi: 10.1016/j.preghy.2016.10.010.

2. Obstetric care consensus no. 1: safe prevention of the primary cesarean delivery. Obstet Gynecol. 2014; 123(3): 693–711, doi: 10.1097/01.AOG.0000444441.04111.1d, indexed in Pubmed: 24553167.

3. Spencer JA, Badawi N, Burton P, et al. The intrapartum CTG prior to neonatal encephalopathy at term: a case-control study. Br J Obstet Gynaecol. 1997; 104(1): 25–28, doi: 10.1111/j.1471-0528.1997.tb10643.x, indexed in Pubmed: 8988691.

4. Schiermeier S, Steinburg SP, Thieme A, et al. Sensitivity and specificity of intrapartum computerised FIGO criteria for cardiotocography and fetal scalp pH during labour: multicentre, observational study. BJOG. 2008; 115(12): 1557–1563, doi: 10.1111/j.1471-0528.2008.01857.x, indexed in Pubmed: 18752587.

5. Agrawal S, Doucette F, Gratton R, et al. Intrapartum computerized fetal heart rate parameters and metabolic acidosis at birth. Obstet Gynecol. 2003; 102(4): 731–738, doi: 10.1016/s0029-7844(03)00806-8, indexed in Pubmed: 14551003.

6. Tuzel J. Assessment of the relation between fetal heart rate variability during labour with the perinatal status of neonate. Doctor dissertation. Medical University, Poznan 2018: Poland.

7. Ayres-de-Campos D, Spong CY, Chandraharan E, et al. FIGO Intrapartum Fetal Monitoring Expert Consensus Panel. FIGO consensus guidelines on intrapartum fetal monitoring: Cardiotocography. Int J Gynaecol Obstet. 2015; 131(1): 13–24, doi: 10.1016/j.ijgo.2015.06.020, indexed in Pubmed: 26433401.

8. INFANT Collaborative Group. Computerised interpretation of fetal heart rate during labour (INFANT): a randomized controlled trial. Lancet. 2017; 389(10080): 1719–1729, doi: 10.1016/S0140-6736(17)30568-8, indexed in Pubmed: 28341515.

9. Annunziata ML, Tagliaferri S, Esposito FG, et al. Computerized analysis of fetal heart rate variability signal during the stages of labor. J Obstet Gynaecol Res. 2016; 42(3): 258–265, doi: 10.1111/jog.12908, indexed in Pubmed: 26787219.

10. Keith RDF, Greene KR. Development, evaluation and validation of an intelligent decision support tool for the management of labour. In: Chang AMZ, RogersMS, eds. Analysis of complex data in obstetrics. Baillieres Clin Obstet Gynaecol. 1994; 8(3): 583–605, doi: 10.1016/s0950-3552(05)80200-7, indexed in Pubmed: 7813130.

11. The INFANT collaborative group. Computerised interpretation of fetal heart rate during labour (INFANT): a randomized controlled trial. Lancet. 2017; 389(10080): 1719–1729, doi: 10.1016/SO140-6736(17)30568-8, indexed in Pubmed: 28341515.

12. Anceschi MM, Ruozi-Berretta A, Piazze JJ, et al. Computerized cardiotocography in the management of intrauterine growth restriction associated with Doppler velocimetry alterations. Int J Gynaecol Obstet. 2004; 86(3): 365–370, doi: 10.1016/j.ijgo.2004.05.012, indexed in Pubmed: 15325854.

13. Strachan B, van Wijngaarden WJ, Sahota D, et al. Cardiotocography only versus cardiotocography plus PR-interval analysis in intrapartum surveillance: a randomised, multicentre trial. Lancet. 2000; 355(9202): 456–459, doi: 10.1016/S0140-6736(00)82012-7, indexed in Pubmed: 10841126.

14. Amorim-Costa C, Costa-Santos C, Ayres-de-Campos D, et al. Longitudinal evaluation of computerized cardiotocographic parameters throughout pregnancy in normal fetuses: a prospective cohort study. Acta Obstet Gynecol Scand. 2016; 95(10): 1143–1152, doi: 10.1111/aogs.12932, indexed in Pubmed: 27238561.

15. Schiermeier S, Reinhard J, Hatzmann H, et al. Fetal short time variation during labor: a non-invasive alternative to fetal scalp pH measurements? J Perinat Med. 2009; 37(5): 529–533, doi: 10.1515/JPM.2009.089, indexed in Pubmed: 19492916.

16. Słomko Z, Drews K, Malewski Z. Kardiotokografia kliniczna. PZWL, Warszawa 2010: 285.

Table 1. Neonatal Body mass, umbilical artery blood gas analyses, Apgar score and CTG descriptive characteristics in the whole sample, time and premature deliveries

	Total group (58 deliveries; 116 babies)				Time deliveries (n = 20)				Premature deliveries (n = 38)			
	Aver.	Median	Min	Max	Aver.	Median	Min	Max	Aver.	Median	Min.	Max
Fetal mass [g]	2373	2365	1015	3570	3000	3010	2000	3570	2116	2195	1015	3000
pH value	7.29	7.31	6.58	7.42	7.31	7.31	7.23	7.38	7.29	7.31	6.58	7.42

BE value	–2.50	–2.0	–18.7	–0.7	–2.72	–2.4	–6.5	–0.5	–2.4	–1.7	–18.7	–0.7
APGAR 5’	9.4	10.0	0.0	10.0	10.0	10.0	10.0	10.0	9.1	10.0	0.0	10.0
CTG length (min)	156.6	131.0	10.0	600.0	130.5	111.0	12.0	398.0	167.4	142.0	10.0	600.0
FHR base line	138.0	136.7	117.3	156,8	133.4	131.3	119.9	155.9	140.0	140.7	117.3	156.8
FHR base line — last 10’	135.2	135.1	108.3	158,4	130.5	127.3	115.9	158.4	137.0	138.9	108.3	153.2
Accelerations (n)	21.5	14.0	1.0	102.0	26.9	23.0	1.0	102.0	19.2	13.0	2.0	72.0
Accelerations — last 10’ (n)	1.6	1.0	0.0	9.0	1.4	1.0	0.0	5.0	1.6	1.0	0.0	9.0
Decelerations (n)	1.6	0.0	0.0	15.0	1.82	0.0	0.0	8.0	1.5	0.0	0.0	15.0
Decelerations — last 10’ (n)	0.3	0.0	0.0	3.0	0.4	0.0	0.0	2.0	0.3	0.0	0.0	3.0
Oscillation — average	14.9	14.7	9.6	21.8	15.8	15.3	11.5	21.8	14.5	14.7	9.6	21.2
I° (%)	3.8	1.5	0.0	21.4	2.9	1.1	0.0	12.6	4.1	2.2	0.0	21.4
II° (%)	20.3	20.2	2.2	44.2	17.0	14.3	2.9	34.2	21.6	22.1	2.2	44.2
III° (%)	45.5	47.5	6.7	75.6	44.3	43.6	26.0	65.6	46.0	48.1	6.7	75.6
IV° (%)	8.4	5.9	0.0	26.2	11.6	10.3	0.0	23.6	7.1	5.2	0.0	26.2

Tachycardia (no. of episodes)	0.5	0.0	0.0	10.0	0,5	0.0	0.0	5.0	0.6	0.0	0.0	10.0
Bradycardia (no. of episodes)	0.0	0.0	0.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0
Signal loss (%)	18.4	13.8	0.6	60.8	14.7	9.1	0.7	52.0	19.9	14.3	0.6	60.8
Signal loss — last 10'(%)	27.1	15.4	0.0	64.6	27.1	15.4	0.0	64.6	27.1	16.6	0.0	61.4
STV (ms)	7.7	7.0	3.5	14.3	9.0	8.7	4.8	14.3	7.1	6.5	3.5	13.1
STV — last 10' (ms)	9.0	6.9	3.3	27.1	10.1	7.0	4.6	19.8	8.5	6.8	3.3	27.1
LTV (ms)	46.6	46.2	25.9	67.0	52.4	53.4	38.4	65.8	44.3	41.9	25.9	67.0
LTV last 10' (ms)	47.7	43.0	23.3	88.8	54.0	51.3	23.5	85.5	45.4	42.5	23.3	88.8