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Full length article

Fetal heart rate variation after corticosteroids for fetal maturation

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ABSTRACT

Introduction: Several studies report a decrease of fetal heart rate (FHR) short-term variation (STV) after corticosteroids for improvement of fetal maturity and advice not to deliver a fetus for low STV within 2–3 days after corticosteroids. However, literature is not unanimous in this respect. This study intends to asses STV longitudinally after corticosteroid administration.

Material and methods: A retrospective cohort study in a tertiary perinatal centre from 2009 to 2015 included all women who had been treated with corticosteroids at gestational age of 26–34 weeks, had a computerized cardiotocography (cCTG) before and after medication and did not deliver within 48 h. FHR and STV were stratified over 12-h periods and compared before and after corticosteroids. Women with imminent preterm labour (including PPROM) and women with placental problems (fetal growth restriction (FGR) or preeclampsia) (PE) were analysed separately. The effect of co-medication and gestational age was assessed.

Results: The study included 406 women, 211 with imminent preterm labour, 195 with FGR-PE. After corticosteroids STV increased 1–2 ms (median 1.4; IQR 0.1–3.1) during the first 36 h after start of corticosteroids. Thereafter a small decrease of less than 1 ms (median −0,6; IQR −1.6 to 0.3) compared to before CC was seen.

Conclusions: The most conspicuous effect of corticosteroids is a short term increase of STV and decrease of FHR. A slight decrease after 48–71 h is possible, but abnormally low values should be considered as a sign of fetal distress. The clinical guidance, given by some, not to intervene because of a low STV after corticosteroids appears invalid.

Introduction

Most studies of fetal heart rate (FHR) variation after corticosteroids for fetal maturation in women with a high risk for preterm birth reported a decrease of FHR variation after 2–3 days [1]. For this reason, some have warned against a decision for delivery based on low FHR variation during the first days after corticosteroids because it may be a false-positive finding that does not indicate fetal distress in these fetuses [2,3]. Based on these reports the study protocol of the recent TRUFFLE study, that investigated the use of ductus venosus Doppler measurement in early fetal growth restriction (FGR), specified not to deliver on low FHR short term variation (STV) shortly after corticosteroids when this was the only sign of possible fetal distress [4].

The objective of the current study is to assess FHR variation after corticosteroids in a larger population including women with spontaneous preterm labour (SPL; including pre-labour preterm ruptured membranes (PPROM)) and women with preterm preeclampsia (PE) or FGR, where it was expected that preterm delivery was indicated by fetal or maternal condition. The hypothesis of the current study is that the decrease of STV after corticosteroids as described in literature may be caused by indication bias, may depend on gestational age, or may depend on FGR or antihypertensive treatment.

Methods

All women with a singleton pregnancy without congenital abnormality, who were treated with corticosteroids for fetal maturation at a gestational age of 26 to 34 weeks in the period from 1-10-2009 to 1-10-2015 in the Academic Medical Centre, Amsterdam, were included. Corticosteroids were indicated for these women because preterm delivery was expected either spontaneous or indicated by fetal or maternal condition. For proper

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analysis of FHR variation over time, we excluded women who delivered within 48 h after corticosteroids or were discharged, were transferred or had fetal death within that time span. A computerized cardiotocography (cCTG) before the administration of corticosteroids had to be available and at least three cCTG's thereafter. As it is customary in the Netherlands to refer women with impending preterm delivery or fetal distress before 30–32 weeks to a perinatal centre with neonatal intensive care facilities a major proportion of the included women were referred from other hospitals. Women with preterm labour were often given tocolytics and corticosteroids before referral, which pre-empted their inclusion in this study.

The included women were divided in two groups. In the first group (SPL) treatment was indicated by preterm labour, preterm pre-labour rupture of membranes (PPROM), vaginal bleeding, or maternal disease (except hypertensive morbidity). The second group (PE-FGR) comprised women with PE or FGR where it was expected that preterm delivery was indicated on short term due to fetal or maternal condition. PE was defined by a diastolic blood pressure of 90 mmHg or higher in combination with either proteinuria of 300 mg/24 h or the presence of clinical signs and symptoms of PE. FGR was defined by birthweight below the 10th centile [5]. As an additional measure of FGR the last umbilical artery Doppler was used. An abnormal umbilical artery Doppler was defined by a pulsatility index (PI) Z-score higher than 2 or the absence or reversal of end-diastolic flow (ARED flow) [6]. For reference of birthweight multiples of the median (MoM) were calculated. The 50th percentile weight from a local fetal growth chart, adjusted for gestational age and infant sex, was used as normal median fetal weight [5].

All cCTG's were recorded digitally at a sample frequency of 4 Hz and stored on a server. The duration of a cCTG should be at least 30 min or longer if variation was low. STV and FHR were calculated off-line by one of the authors (HW) especially for the current study, using software (FetalHrt) that was programmed following the description for STV calculation by Dawes [7,8] This software was used during the past 20 years for research and clinical application.

By protocol, betamethasone 11.4 mg (Celestone chronodose®) was given IM in two dosages 24 h apart, unless a severe clotting deficiency precluded IM injections in which case Dexamethasone sodium phosphate 6 mg 12 hourly for 4 doses was given IV. During 2011–2012 Celestone chronodose was temporarily unavailable due to a production problem at the manufacturer and dexamethasone was used.

The preferred treatment for preterm uterine contractions was nifedipine with a maximum of 80 mg/day. In some women atosiban was used, either because this was started already before referral or because this was used as study medication. Tocolytics

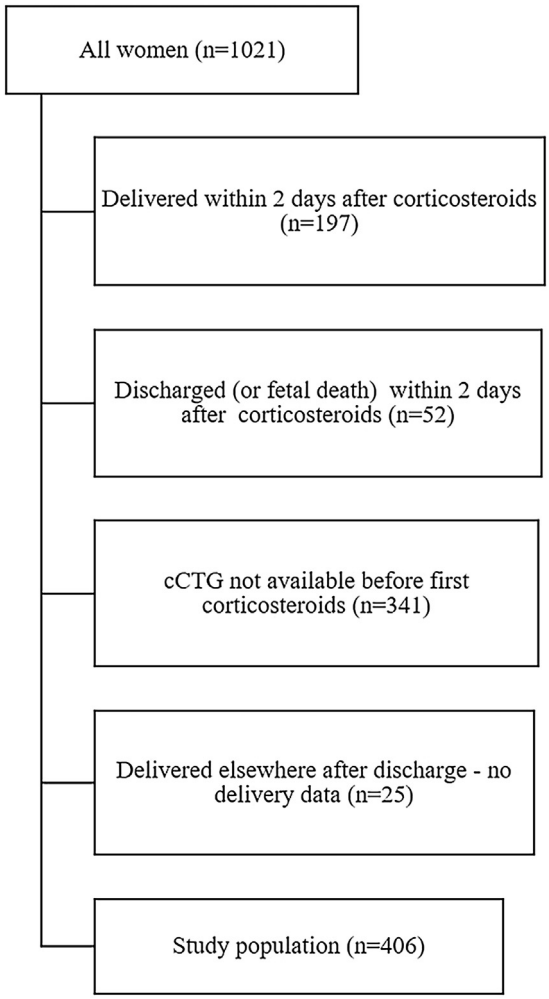

Fig. 1. Flowchart showing the selection of women in the study cohort, admitted with a singleton pregnancy between 1-10-2009 to 1-10-2015 and treated with corticosteroids for fetal maturation between 26 and 34 weeks; congenital fetal abnormalities excluded.