

ORIGINAL RESEARCH ARTICLE

The outcomes of pregnancies with reduced fetal movements: A retrospective cohort study

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Abstract

Introduction: The objective of this study was to examine the outcomes and interventions in pregnant women presenting with a perception of reduced fetal movements (RFM), and to determine if repeated episodes of RFM increase the risk of adverse outcomes.

Material and methods: This was a retrospective cohort study conducted in 6 NHS hospitals within the Thames Valley network region, UK and 1 neighboring hospital, an area with approximately 31 000 births annually. All women with a primary presentation of perceived RFM after 24 completed weeks of gestation during the month of October 2016 were included in the study.

Prospective records in all units were examined and individual case-notes were reviewed. Pregnancy and neonatal outcomes and their relationship with recurrent presentations with RFM were examined using relative risks with 95% CI. The main outcome measures are described. Neonatal outcomes measured were perinatal mortality, neonatal unit admission, abnormal cardiotocography at presentation, a composite severe morbidity outcome of Apgar <7 at 5 minutes or arterial pH <7.0 or encephalopathy, and birthweight. Pregnancy outcomes measured were induction of labor, cesarean section, admission and ultrasound usage rates.

Results: In all, 591 women presented with RFM during the month; using annual hospital birth figures, the incidence of RFM was estimated at 22.6% (range 14.9%-32.5%). More than 1 presentation of RFM occurred in 273 (46.2%). All 3 deaths (0.5%) were at the first presentation. More than 1 presentation was associated with higher induction rates (56.0% vs 31.9%), but no increase in any adverse outcomes including small-for-gestational-age.

Conclusions: Reduced fetal movements, and recurrent episodes, are common, and lead to considerable resource usage and obstetric intervention. We found no evidence to suggest that recurrent episodes increase pregnancy risk.

KEYWORDS

adverse outcomes, cardiotocograph, pregnancy risk, reduced fetal movements, stillbirth

1 | INTRODUCTION

Stillbirth is often a preventable tragedy. There were an estimated 2.6 million stillbirths worldwide in 2015.¹ Maternal perception of reduced fetal movements (RFM) is the presenting complaint of at least half of all stillbirths,² and in a small number there is acute fetal compromise usually manifest as an abnormal cardiotocograph (CTG). Due to this, attention has often focused on maternal education regarding reporting reduced movements in a timely manner. Management algorithms have also been developed, and have been associated with a reduction in stillbirth.³ In the UK, reporting and proactive management of RFM are key components of the "Saving Babies Lives" care bundle.⁴ The overarching aim is to deliver the potentially compromised baby before death or irreversible damage occurs from the responsible pathological process.

Nevertheless, RFM is a common symptom in pregnancy and reason for access to emergency care: approximately 8%-17% will present, and the incidence of fetal demise or compromise at presentation is low.^{3,5-7} There is, however, the capacity to do harm, either by causing increased maternal anxiety or through obstetric intervention, by using resources, or by iatrogenic preterm or early term birth. A recent large trial with data from 409 175 pregnancies demonstrated no significant reduction in perinatal mortality, and an increase in cesarean section, with a package of maternal education and standardized, proactive clinical management.⁸

Although RFM are known to be a potential presentation of fetal death or acute compromise, repeated episodes of RFM are also widely thought to increase the risk of subsequent adverse outcomes. The evidence for this is limited,⁹ but the association has prompted advice for investigation and indeed intervention.¹⁰⁻¹² "Recurrent" episodes constituted an indication for delivery from 37 weeks of gestation in the intervention package of the recent trial showing no benefit.⁸

The objectives of this study were to document the outcomes and interventions in a contemporary cohort of women presenting with RFM, and to determine if repeated episodes increased the risk of adverse pregnancy and neonatal outcomes.

2 | MATERIAL AND METHODS

This is a retrospective cohort study of all pregnancies where the mother presented with RFM in 1 of 6 hospitals in southern England, UK, October 2016. The hospitals included were Buckinghamshire National Health Service (NHS) Foundation Trust, Great Western Hospitals NHS Foundation Trust, Milton Keynes University Hospitals NHS Foundation Trust, Royal Berkshire NHS Foundation Trust, Oxford University Hospitals NHS Foundation Trust and Wexham Park Hospital (Frimley Health NHS Foundation Trust). Pregnancies were identified from assessment unit admission records, and case-notes were examined. Details of other presentations for RFM in the pregnancy were also recorded even if they were outside this time frame. All women

Key message

This study was conducted to examine the outcomes and interventions in pregnant women presenting with reduced fetal movements, and to determine if repeated episodes of reduced fetal movements increase the risk of adverse outcomes. It appears that multiple episodes of reduced fetal movements do not increase pregnancy risk.

with singleton pregnancies without a known congenital abnormality and presenting from 24⁺⁰ weeks of gestation to the maternity triage unit were analyzed, irrespective of their risk level. Reduced fetal movements were defined as: (a) the mother perceived the baby was moving less or not at all and (b) the mother presented to secondary care with this as the primary complaint. A second episode of RFM was defined as one where a woman presented >24 hours after the first, having felt movements in the interim.

Neonatal outcomes were stillbirth, early neonatal death, mean birthweight and incidence of small-for-gestational-age (SGA) (defined as <10th centile from Intergrowth charts),¹³ neonatal unit admission, and a composite severe morbidity outcome of: Apgar <7 at 5 minutes, or arterial pH <7.0, or neonatal encephalopathy. We also examined CTG to diminish the effect of a treatment paradox: defining an abnormal CTG as one where computerized criteria were not met, or where, in the absence of computerized interpretation, the attending doctor classified the CTG as not normal. Pregnancy outcomes were induction of labor, cesarean section, and prelabor cesarean section; outcomes of resource usage were the use of admission and number of ultrasound examinations.

2.1 | Statistical analyses

A core data set of all pregnancies was analyzed in SPSS STATISTICS v. 24.0 (IBM Corp., Armonk, NY, USA). An independent samples *t* test was used to compare continuous variables; categorical variables were analyzed using a chi-squared test with relative risks and 95% CI. All 6 maternity units provided written confirmation allowing access to their data. They had each agreed to a formal regional information governance protocol and data sharing to allow secure access to data. For this reason, ethical approval was not required because this was classified as a regional audit of current clinical practice.

2.2 | Ethical approval

The data presented are an amalgamation of hospital-registered clinical audits. Local information governance approvals were obtained from each individual hospital, but formal ethical approval was not considered necessary. Data-sharing protocols for each trust were coordinated by the Oxford Academic Health Science Network.

3 | RESULTS

During October 2016, 591 eligible women presented with RFM. During the year 2016 the total number of women delivering at ≥ 24 completed weeks of gestation in the region was 31 434. Assuming that the chosen month was representative, the estimated incidence of presentation with RFM was calculated using a denominator of 31 434 divided by 12, as a monthly estimate of total pregnancies. Presentations therefore comprised approximately 22.6% of pregnancies (range 14.9%-32.5%). More than 1 presentation occurred in 273 (46.2%) pregnancies; the total number of presentations of the 591 women was 1005; 115 (19.5%) presenting 3 or more times. Rates varied in different hospitals (see Supplementary material, Table S1) from 14.9% to 32.5%. Presentation was before 36 completed weeks of gestation in 378 (64%). Demographic details of the women are shown in Table 1. Women who presented more than once had slightly higher body mass indices and were slightly younger.

For presentations at ≥ 26 weeks of gestation, CTG was performed in 990 presentations (98.5%), and 536 (54.1%) were computerized. Neonatal outcomes of pregnancies are documented in Table 2. One woman delivered at another unit, so outcome data were available on 590 of 591 pregnancies. There were 3 deaths, all stillbirths (0.5%), all diagnosed at the first presentation and after 36 weeks; 2 other babies were delivered with low Apgar scores and/or pH by cesarean soon after presentation with an abnormal CTG, 1 before and 1 after 36 weeks of gestation, but both made a full recovery. The other 23 "abnormal" CTGs either did not meet Dawes Redman criteria and/or were not considered abnormal enough to warrant immediate delivery. There were no significant differences in any neonatal outcomes between pregnancies where there had been 1 presentation and those where there had been >1 presentation of RFM.

Investigations and interventions are shown in Table 3. Of all women presenting with RFM, 254 (43%) were induced and a further 68 (11%) had a prelabor cesarean section. Induction of labor was

TABLE 1 Demographics of women presenting with reduced fetal movements (including number of presentations). Demographic and pregnancy risk factors for multiple presentations

	n (%)/Mean (SD)			RR (95% CI)/P value ^a
	All women	1 episode	2+ episodes	
Total	591	318	273	
Age (mean)	28.7 (5.7)	29.6 (5.4)	27.6 (5.8)	<0.001
Nulliparity	315 (53.3)	162 (50.9)	153 (56.0)	1.23 (0.89-1.70)
Body mass index	27.0 (6.4)	26.2 (6.4)	27.9 (6.4)	0.003
Smoker	59 (10.0)	28 (8.8)	31 (11.3)	1.23 (0.89-1.70)
Non-Caucasian	127 (21.5)	75 (23.6)	52(19.0)	0.76 (0.51-1.14)

Note: ^aRisk for pregnancies with recurrent reduced fetal movements relative to the risk for those with 1 episode only.

TABLE 2 Neonatal outcomes according to number of presentations of reduced fetal movements

Outcome	n (%)/ Mean (SD)			RR (95% CI)/P ^a
	All women	1 episode	>1 episodes	
Total	590	318	272	
Mortality	3 (0.5)	3 (0.9)	0	—
Gestation mean	277 (10)	277 (11)	277 (9)	P = 0.30
Gestation <37 ⁰ wk	22 (3.7)	19 (6.0)	3 (1.1)	0.17 (0.05-0.60)
NNU admission	43 (7.3)	24 (7.5)	19 (7.0)	0.90 (0.48-1.69)
Birthweight mean	3382 (500)	3391 (533)	3372 (459)	P = 0.63
Birthweight <10th centile ^b	27 (4.6)	16 (5.1)	11 (4.0)	0.79 (0.36-1.73)
Low Apgar scores ^c	15 (2.5)	11 (3.5)	4 (1.5)	0.42 (0.13-1.32)
Severe morbidity ^d	13 (2.2)	9 (2.9)	4 (1.5)	0.50 (0.15-1.66)
Abnormal CTG ^e	25 (4.2)(2.5)e	14 (4.4)(4.4)	9 (3.3) (1.3) ^a	0.75 (0.33-1.70)

Note: Abbreviation: CTG, cardiotocography; NNU, neonatal unit.

^aRisk for pregnancies with recurrent RFM relative to the risk for those with 1 episode only.

^bIntergrowth 21st charts.

^cApgar at 5 min <7.

^dArterial pH <7.0, or Apgar at 5 min <7 or neonatal encephalopathy.

^ePer presentation.

TABLE 3 Pregnancy interventions according to number of presentations of reduced fetal movements

Outcome	n (%) / Mean (SD)			RR (95% CI)/P ^a
	All women	1 episode	2 episodes	
Total	590	318	272	
Admissions (total)	77 (13.0)	36 (11.3)	41 (15.0)	1.38 (0.86-2.24)
Ultrasounds/woman	1.18 (1.41)	0.7 (1.11)	1.72 (1.5)	P < 0.001
Ultrasounds (total)	696	227	469	P < 0.001
Induction of labor	254 (43.1)	101 (31.9)	153 (56.0)	2.73 (1.95-3.82)
Cesarean	164 (27.8)	92 (29.0)	72 (26.5)	0.88 (0.61-1.27)
Prelabor cesarean	68 (11.5)	44 (13.9)	24 (8.8)	0.60 (0.35-1.01)

Note: ^aRisk for pregnancies with recurrent reduced fetal movements relative to the risk for those with 1 episode only.

more frequent and more ultrasound examinations were performed in women with >1 episode of RFM.

4 | DISCUSSION

This study suggests that about a fifth of all pregnant women are presenting with RFM and that nearly half of these women present at least twice. More than half of the cases either had an induction of labor or a prelabor cesarean section. The vast majority of women in this cohort had healthy babies, but there were 3 deaths; all diagnosed at first presentation. Moreover, in a further 2 babies, delivery was expedited after the finding of an abnormal CTG. We find no evidence to support the notion that women with repeated episodes are at increased risk of adverse outcomes.

The incidence of RFM is relatively high; particularly, the proportion of women who present more than once (46%), which is higher than what has been previously reported.^{5,6} It is possible that this is in part a result of a current and ongoing national awareness campaign in the UK.⁴

There was considerable variation among hospitals, which we were unable to explain although surprisingly, the unit with the lowest rate was the regional tertiary referral unit. It is accepted that SGA babies are over-represented among pregnancies with RFM. The latter can be a presentation of fetal demise, for which SGA is a major risk factor.^{8,14} Without a control group, we cannot confirm this in our cohort of pregnancies. Our finding that SGA is not more common in women with recurrent RFM is at odds with O'Sullivan et al,⁹ and with Scala et al, who found a far higher (44.2% vs 9.8%) proportion of SGA (unstated reference chart) babies in the multiple episodes group.⁶ Despite this, using an overlapping but larger cohort, Binder et al demonstrated no difference in birthweight centile or incidence of SGA between pregnancies with single or multiple episodes.⁵ They did record however, a small increase (5.9%-7.8%) in a low (<5th centile) cerebroplacental ratio and a decrease in cerebroplacental ratio multiples of the median in women with multiple episodes. SGA is a poor surrogate for fetal compromise and we do not have data on cerebroplacental ratio so cannot exclude a difference in more subtle markers of placental function.

However, all 3 of the deaths in this study occurred at first presentation, and we did not detect an increase in clinical adverse neonatal outcomes in women with recurrent episodes. This is at odds with O'Sullivan et al, who, using a cohort of 203 women with RFM, showed that when compared with 1 episode, women with 2 or more episodes had an increased odds ratio (OR 1.92; 95% CI 1.21-3.02) of their adverse pregnancy outcome.⁹

The contradictions over SGA could be related to case ascertainment in large data sets. It is also possible that repeated episodes of RFM have previously been analyzed together with a "continued" episode: where a woman re-presents, still feeling no fetal movements. Such an episode is very different from a second presentation of RFM after a period of normal movements, and the former is likely to represent greater risk.

Perception of fetal movements is affected by multiple influences; equally, the perception of RFM is very common.⁷ These, together with the very modest risks of markers of placental dysfunction in women with repeated episodes,⁵ and the contradictory data on birthweight, suggest that recurrent RFM is likely to be a poor discriminator of pregnancy risk. This is pertinent when multiple established risks factors, such as poor obstetric history, hypertension, SGA, abnormal uterine artery Doppler or cerebroplacental ratio already exist.

The high rates of intervention, in the form of induction of labor and cesarean section, and of use of resources, in the form of admission and ultrasound, are clear. The AFFIRM study showed similar prelabor cesarean section rates and induction rates that were nearly as high.⁸ Less than 40% of women with recurrent RFM in our cohort have a spontaneous onset of labor, reflecting current advice in the UK in the Royal College of Obstetricians and Gynaecologists, Greentop Guideline 2011.¹⁰

Maternal perception of RFM may be a preterminal event, as in a baby dying of placental insufficiency or a feto-maternal hemorrhage. CTG is the mainstay of identifying acute fetal compromise and the immediate management of the presentation is crucial. Any association between recurrent RFM and adverse outcomes would suggest that the compromised baby may also have an earlier, more chronic, reduction or altered pattern of movements. There are few physiological data to inform this; we have found no evidence to support it. It seems likely that the current concern over recurrent RFM, or

perception of the risks in a baby who has normal CTG, particularly if the baby is once again moving normally, is exaggerated. This could contribute to the negative findings of the AFFIRM study,⁸ and lead to over-intervention and infant morbidity or even mortality by iatrogenic preterm or early term birth.¹⁵

The main limitations of the study were its retrospective design, the relatively small numbers, and the limited ultrasound data on placental function, and longer-term data on neonatal outcome. Our definition of SGA (Intergrowth) was different from other series, but its incidence was similar to equivalent populations in the West.¹³ It is possible that not all women with fetal demise were identified in the triage units, or that not all women with RFM were seen within the normal care pathway. The absence of a control group prevents comparisons of women with 1 episode with those who had none, but this was not the remit of this study. It is also possible that the high frequency of, and therefore low threshold for, presentation means that our cohort is less high risk. It is also possible that a “treatment paradox” exists: that intervention prevented associations of interest. This is why we used abnormal CTG as an outcome, although we acknowledge the subjectivity of our classification. The strengths include a complete, defined cohort of presentations over a set time period, the clear definition of RFM based on the common presenting symptom, maternal perception, and of recurrent RFM, and the broad geographical area encompassing 6 different maternity units making the results generalizable.

5 | CONCLUSION

We found no evidence that multiple episodes of RFM are associated with increased pregnancy risk.

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CONFLICT OF INTERESTS

None.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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