Risk factors for poor neonatal outcome in pregnancies with decreased fetal movements

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Abstract

Introduction: The incidence of Swedish stillbirths has varied little in the past 40 years, with a reported frequency of 400-450 stillbirths/y (approximately 4‰), despite increased information about fetal movement in the media and awareness among healthcare providers. The objectives of this project were to describe the outcome of pregnancies with reduced fetal movement in a Swedish context and to investigate factors associated with poor neonatal outcome in this group.

Material and methods: A retrospective cohort study was performed at Soder Hospital, Stockholm, Sweden. All single pregnancies at the hospital from January 2016 to December 2017 presenting with reduced fetal movement after 22 gestational weeks were included in the study. A composite neonatal outcome was constructed: 5-minute Apgar score ≤7, arterial pH in the umbilical cord ≤7.10, transfer to neonatal care unit for further care or intrauterine fetal death.

Results: For women seeking care for reduced fetal movement, the occurrence of composite poor neonatal outcome ranged from 6.2% to 18.4% within different groups. The highest risk for poor neonatal outcome (18.4%) was found in the group of women with a small-for-gestational-age fetus. Another high-risk group (12.8%) was the one comprising women with normal birthweight/large-for-gestational-age fetuses with an in vitro fertilization pregnancy.

Conclusions: The highest incidence of poor neonatal outcome among women with reduced fetal movement was found in the groups with small-for-gestational-age fetuses in nulliparous and multiparous women. A routine ultrasound assessment for fetal growth in third trimester is supposedly most efficient to identify undiagnosed small for gestational age.

Keywords

adverse neonatal outcomes, pregnancy risk, reduced fetal movements, stillbirth
1 | INTRODUCTION

One of the most feared complications of pregnancy is stillbirth. Despite efforts to prevent this complication, the incidence of stillbirths remains high, with an estimated 2.6 million deaths globally each year. According to the World Health Organization, Sweden is ranked 12th highest of the high-income countries for stillbirth incidences (and the highest among the Scandinavian countries). The incidence of Swedish stillbirths has varied little in the past 40 years, with a reported frequency of approximately 4‰ (400-450 stillbirths/y of 115 000 births) despite increased information about fetal movement in the media and awareness among healthcare providers.

Fetal movement monitoring is used as a reassurance of fetal wellbeing during pregnancy. Self-reported fetal movements vary throughout pregnancy, with a gradual increase from week 16 to week 36 and a small decrease during the last month of pregnancy, but only 33%-88% of the movements that were seen on ultrasound were perceived by the mothers. The movements vary during pregnancies and maternal perception of fetal movements may be affected by the quantity of amniotic fluid, position of the fetus, maternal medication and wellbeing of both mother and fetus. The perception of fetal movements is also affected by maternal stress and anxiety, medication, smoking, localization of placenta and maternal position. Reduced fetal movements (RFM) might also be a sign of pregnancy complications such as preterm birth, oligohydramnios, fetal growth restriction and stillbirth. Study of women who experienced RFM during pregnancy showed that they had an increased risk of late stillbirth compared with women that experienced normal movements.

It is of great importance to differentiate the women at risk for poor fetal outcome from the heterogeneous group of pregnancies with RFM, as most of these pregnancies and deliveries are uncomplicated. An accurate risk assessment for this group will help to find a balance between unwanted interventions/over-investigation and maintaining good neonatal outcome. The aim of this study was to describe the outcome of pregnancies with RFM in a Swedish context and to investigate factors associated with poor neonatal outcome in this group.

2 | MATERIAL AND METHODS

This retrospective cohort study was performed at Soder Hospital, Stockholm, Sweden. This hospital is the second largest maternity clinic in Sweden and a secondary referral center in the center of Stockholm, with nearly 8000 deliveries per year. All single pregnancies at the hospital from January 2016 to December 2017 presenting with RFM after 22 gestational weeks were included in the cohort. Each visit in the department is given a diagnostic code and the cases were identified after the code for RFM.

Pregnant woman presenting with RFM at the clinic were managed in accordance with local clinical guidelines. A cardiotocography (CTG) registration and an ultrasound to assess the amount of amniotic fluid and fetal movement were routinely performed. In cases where the CTG assessment (computerized analyses according to Dawnes-Redman criteria until 32 weeks of gestation and human analysis after that) was normal but no fetal movements were identified sonographically after repeated examinations, an additional ultrasound for fetal biometry or induction of labor was offered depending on gestational age (commonly after 40 weeks of gestation) of the pregnancy.

Data on maternal characteristics, such as body mass index (weight in kg/height m²) at the beginning of pregnancy, parity, age, previous cesarean section, past illnesses, complications of pregnancy and data on pregnancy outcome, were collected from the maternal medical records. Information regarding the newborn, such as gender, birthweight, Apgar scores at delivery, admission to neonatal ward and umbilical cord pH were retrieved from the delivery charts (Obstetrix, Cerner, Sverige AB, Lund, Sweden). The women included in the study were delivered during the study period or at the beginning of 2018. The majority were delivered at our clinic, but a small percentage were delivered in other hospitals in Stockholm.

A composite for poor neonatal outcome was constructed and described as one or more of following: 5-minute APGAR score ≤7, arterial pH in the umbilical cord ≤7.10, transfer to neonatal ward for further care, intrauterine fetal death (IUFD).

All Swedish pregnancies are dated by an ultrasound examination in the first or second trimester using the biparietal diameter and femur length. The definition of small for gestational age (SGA) and large for gestational age were based on the Swedish reference curve and defined as 2 SD below or above the expected weight for gestational age and gender. The intrauterine expected weight was calculated according to the formula of Marsal et al as previously described by Lindqvist et al. Stillbirth is defined based on the Swedish national guidelines as intrauterine death at ≥22 weeks of gestation.

2.1 | Statistical analyses

Histograms were initially used to assess data distribution. As some of the data were not normally distributed and there were no differences in clinical significance between the mean and median values, we chose to present all continuous variables as medians with min and max values. Other maternal and fetal characteristics are presented as frequencies. Maternal, pregnancy and outcome characteristics were compared between the groups (women with RFM and...
women with no RFM) using the Chi-square test. For the outcomes the relative risk with 95% confidence interval (CI) was calculated. For non-normally distributed values the comparison was performed by the Mann-Whitney U test. Subgroup analyses were performed for groups of clinical relevance. Patients were divided per number of visits for RFM.

The risk factors for achieving composite poor fetal outcome were divided into maternal, pregnancy and neonatal characteristics. The variables were chosen among known risk factors for poor neonatal outcome: maternal body mass index, smoking, maternal age, in vitro fertilization (IVF), pregnancy complications, parity. Unconditional logistic regression was used to investigate possible risk factors for poor neonatal outcome. Initially, the association for each individual factor with a poor neonatal outcome was studied as a crude association. One additional multivariable model was built in which the statistically significant factors from the univariable analysis were used. The interactions between the statistically significant variables were tested in a three-step analysis, with each interaction tested individually in the final multivariable model. The interaction was significant if \( P < .05 \). Due to an interaction between parity and IVF, a new dummy variable was constructed: no IVF multipara (reference), no IVF nullipara, IVF nullipara and IVF multipara. The results of the analyses are presented as odds ratios (ORs) with 95% CIs. OR was used as a proxy for relative risk.

Furthermore, we used the Hosmer-Lemeshow model of goodness of fit to examine whether the adjusted model adequately fit the data, \( P > .05 \) indicating a good fit. Finally, we used the Chi-square automatic interaction detection analysis to build the classification tree, which helped us to identify factors associated with poor neonatal outcome according to the composite neonatal outcome in the group of women experiencing RFM. The statistical analyses were performed using SPSS software version 23.0 (IBM Corp.).

### 2.2 Ethical approval

The study was approved by the independent regional Research Ethics Committee, Karolinska Institutet, Stockholm, Sweden (2018/2624-31/5). The study complied with the World Medical Association Declaration of Helsinki regarding ethical conduct of research involving human subjects.

### 3 RESULTS

During the same period, the obstetrical clinic at Soder Hospital had 14 815 singleton deliveries with 34 IUFDs (2.3/1000). Baseline data are presented in Table 1. Newborn children of women with RFM had a higher frequency of low Apgar score at 5 minutes and low pH in umbilical cord blood, and the labor was induced more often (Table 2).

The incidence of presentation with RFM during the study period was 21.9%. Of the women seeking help for RFM, nulliparous women

| TABLE 1 Baseline data for group with reduced fetal movements (RFM) (n = 3243) and the group with no RFM (n = 11 944) at Soder Hospital |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
|                            | Pregnancies with RFM  n = 3243 | Pregnancies without RFM n = 11 944 | \( P \) value* |
| Maternal characteristics    |                            |                            |                      |
| Age (y)                     | 31 (15-54)                 | 33 (16-52)                 | <.01                 |
| BMI                         | 23.5 (14.9-58.0)           | 23.1 (14.8-53.9)           | <.01                 |
| Smokers (%)                 | 411 (13.4)                 | 1021 (9.2)                 | <.01                 |
| History of psychiatric disease (%) | 544 (18.2)                 | 1431 (12.6)                | <.01                 |
| IVF                         | 229 (7.1)                  | 732 (6.1)                  | .06                  |
| Nullipara (%)               | 1850 (57.1)                | 5066 (44.6)                | <.01                 |
| Complications of pregnancy (%) | 180 (5.6)                  | 851 (7.1)                  | .15                  |
| Number of visits for RFM    |                            |                            |                      |
| Single visit (%)            | 2677 (82.7)                | 0 (0)                      |                      |
| Multiple visits (%)         | 559 (17.3)                 | 0 (0)                      |                      |
| Onset of labor (%)          |                            |                            |                      |
| Spontaneous                 | 2100 (64.8)                | 8294 (69.5)                | <.01                 |
| Induced                     | 761 (23.5)                 | 1973 (16.5)                |                      |
| Planned cesarean            | 382 (11.8)                 | 1677 (14)                  |                      |
| Method of delivery (%)      |                            |                            |                      |
| Spontaneous vaginal         | 2373 (73.2)                | 8849 (74.1)                | .20                  |
| Vacuum                      | 203(6.3)                   | 597 (5.0)                  |                      |
| Cesarean (ES + A5)          | 667 (20.6)                 | 2498 (20.9)                |                      |
| Fetal characteristics       |                            |                            |                      |
| Gestational age (d)         | 281 (164-303)              | 279 (160-300)              | <.01                 |
| Birthweight (g)             | 3570 (535-5590)            | 3540 (315-5670)            | .05                  |
| Length (cm)                 | 50 (28-58)                 | 50 (25-58)                 | .01                  |
| Female gender (%)           | 1610 (49.6)                | 5831 (48.8)                | .41                  |
| SGA (%)                     | 125 (3.9)                  | 387 (3.3)                  | .12                  |

Note: The continuous variables are presented as median with min-max. Abbreviation: A5, acute cesarean section; ES, elective cesarean section; SGA, small for gestational age.

*\( P \) value significant if \(< .05\).

Gestational diabetes, preeclampsia, hypertension or cholestasis of pregnancy.
were most common (57.1% vs 44.6%; \( P < .01 \)). There was a fivefold higher risk of stillbirth among women with RFM (21/3243 [6.5%] vs 13/11 944 [1.1%]; \( OR = 5.5, 95\% CI 2.81-10.85 \)).

The percentage of stillbirths was significantly higher in the group where the fetus was SGA than in those with normal growth (4.8% vs .4%; \( OR = 10.4, 95\% CI 3.9-27.4 \)). Fifteen of the 21 stillbirths (71.4%) sought help for RFM for the first time when the stillbirth was established. One of the stillbirths was a trisomy 18 with a heart malformation and one was a SGA fetus with pathological flow in the umbilical artery and CTG signs of asphyxia, where the woman did not follow the recommendation of cesarean delivery. Twenty-one (61.7%) of the women with stillbirths sought care for RFM at least once during the pregnancy. Of these, 15 were diagnosed with stillbirth at first visit and four had recurrent RFM episodes.

In the group with recurrent RFM there was a statistically significant higher percentage of nulliparous women (62.6% vs 55.9%, \( P = .04 \)) and IVF pregnancies (9.1% vs 6.6%, \( P = .04 \)), and a higher percentage of women with history of psychiatric disease (22.7% vs 17.2%, \( P < .01 \)). There were no statistical significant differences regarding SGA, Apgar, pH, stillbirth rate, neonatal ward or composite outcome between the group with recurrent RFM and the group with single episodes.

At the clinic, 64.8% (2100/3243) of the women seeking help for RFM had a spontaneous onset of labor, 23.5% (761/3243) were induced and 11.8% (382/3243) were delivered with an elective cesarean section before the onset of labor. Further, 8.8% (285/3243) were delivered by emergency cesarean section during ongoing labor (Table 1). In the group with recurrent RFM there was a statistically significant higher rate of induction of labor compared with the group with single episodes of RFM (30.9% vs 21.9%, \( P < .01 \)). The prevalence in our background population was 69.5% for spontaneous start and 16.5% for induction of labor.

At delivery, 3.3% (106/3243) had an Apgar score ≤7 at 5 minutes, 5.9% (150/3243) had a pH ≤7.10, and 2.9% (92/3243) were transferred to the neonatal ward. Furthermore, 3.9% (125/3228) of the neonates were SGA at delivery. The respective frequencies in the background population were 2.1%, 4.4%, 5.0% and 3.3%, respectively. The mean gestational age at delivery was 281 days (164-303 days) Table 3.

Maternal body mass index, history of psychiatric disorders and smoking were not associated with increased incidence of composite neonatal outcome and therefore were not included in the multivariable analysis. In the nulliparous group with RFM, there was almost a twofold increased risk of having a poor neonatal outcome (OR 1.8, 95% CI 1.4-2.3) compared with the multiparous group with RFM. The risk of delivering an affected newborn was increased threefold among the neonates diagnosed as SGA (OR 3.0, 95% CI 1.8-5.1) compared with the normal weight neonates. Pregnancies with assisted reproduction (IVF) and RFM had a 1.7 times increased risk of having a poor neonatal outcome (OR 1.7, 95% CI 1.2-2.6). In the adjusted model, one of the highest risks of delivering a newborn with a poor outcome was still correlated with the weight of the fetus. A pregnancy with an SGA fetus had a 2.3 times increased risk of a poor neonatal outcome (OR 1.8, 95% CI 1.4-3.7) when all significant factors were included.

The classification tree analysis shows that the occurrence of composite poor neonatal outcome ranged from 6.2% to 18.4% within the different groups (Figure 1). The results showed that the highest risk for poor neonatal outcome (18.4%) was found in the group with an SGA fetus. Another high-risk group for composite poor fetal outcome (12.8%) was women with normal birthweight/macrosomia fetuses and an in vitro fertilization pregnancy.

4 | DISCUSSION

The purpose of antenatal care is to identify risk pregnancies and to prevent, if possible, an adverse maternal or fetal outcome. The results of this study showed that the risk of delivering a stillborn among women experiencing RFM seeking care and having a normal checkup at the women’s clinic at Soder Hospital was 1.2/1000 in singleton deliveries. This risk is lower than the total Swedish national incidence of IUFD, which was 3.7/1000 deliveries and Stockholm’s incidence of 3.1/1000 deliveries in 2016-2017, but similar to the Soder Hospital background population. We must bear in mind that even if the percentage of stillbirths was significantly higher in the group with RFM, 15 of the 21 women with stillbirths sought help for RFM for the first time when the stillbirth was established. No statistically significant difference was found regarding the neonatal outcome when the frequency of seeking care for RFM (once or multiple times) was analyzed. In this study, we confirmed an association between SGA and poor neonatal outcome in the group with RFM.

At the women's clinic at Soder Hospital, approximately 2000 pregnant women seek care annually due to decreased fetal movements.

### TABLE 2 Neonatal outcomes for the group with reduced fetal movements (RFM) (n = 3243) and the group with no RFM (n = 11 944) at Soder Hospital

| Poor neonatal outcome score | Pregnancies with RFM n = 3243 | Pregnancies without RFM n = 11 944 | RR (95% CI) |
|----------------------------|-------------------------------|------------------------------------|------------|
| Apgar ≤7 at 5 min (%)      | 106 (3.3)                     | 249 (2.1)                          | 1.56 (1.25-1.96) |
| Arterial pH ≤7.10 (%)      | 150 (5.9)                     | 411 (4.4)                          | 1.34 (1.12-1.61) |
| Neonatal ward (%)         | 92 (2.9)                      | 600 (5.0)                          | 0.57 (0.46-0.70) |
| Stillbirth (%)             | 21 (.65)                      | 13 (.11)                           | 5.53 (2.81-10.85) |
| Composite outcome (%)     | 275 (8.5)                     | 1058 (8.9)                         | 0.95 (0.84-1.08) |

*Risk for pregnancies with RFM relative to the risk for those with no RFM.

*Not available on all neonates (n = 2542 in the RFM group and n = 9336 in the control group).
### TABLE 3  Variables related to increased risk of poor neonatal outcome\(^a\) among women with reduced fetal movements (RFM) (n = 3243)

|                      | Total number and percent | With poor neonatal outcome | Crude odds ratio | Adjusted odds ratio\(^b\) |
|----------------------|--------------------------|---------------------------|-----------------|--------------------------|
|                      | n = 3243 | %                                    | n = 3228 | 95% CI | n = 3213 | 95% CI |
| **Age**              |           |                                       |                 |          |           |        |
| <19                  | 25        | 12.0                                  | 1.3             | (0.4-4.5) | 1.2       | (0.3-3.9) |
| 20-30                | 1416      | 9.3                                   | 1.0             | Ref      | Ref       |         |
| 31-40                | 1641      | 7.8                                   | 0.8             | (0.6-1.0) | .9        | (0.7-1.2) |
| >40                  | 140       | 8.6                                   | 0.9             | (0.5-1.7) | .8        | (0.4-1.6) |
| **Nullipara**        |           |                                       |                 |          |           |        |
| No                   | 1391      | 6.1                                   | 1.0             | Ref      |           |         |
| Yes                  | 1850      | 10.2                                  | 1.8             | (1.4-2.3) |           |         |
| **IVF**              |           |                                       |                 |          |           |        |
| No                   | 3007      | 8.0                                   | 1.0             | Ref      |           |         |
| Yes                  | 229       | 13.1                                  | 1.7             | (1.2-2.6) |           |         |
| **Birthweight**      |           |                                       |                 |          |           |        |
| Normal growth        | 2938      | 7.9                                   | 1.0             | Ref      | Ref       |         |
| LGA                  | 178       | 10.0                                  | 1.8             | (0.9-3.4) | 1.4       | (0.7-2.4) |
| SGA                  | 125       | 18.4                                  | 3.0             | (1.8-5.1) | 2.3       | (1.4-3.7) |
| **IVF*Parity**       |           |                                       |                 |          |           |        |
| No IVF, Multipara    | 1332      | 5.6                                   | Ref             |          |           |         |
| No IVF Nullipara     | 1675      | 10.0                                  | 1.8             | (1.3-2.4) |           |         |
| IVF Nullipara        | 175       | 12.0                                  | 2.2             | (1.3-3.7) |           |         |
| IVF Multipara        | 53        | 15.1                                  | 3.1             | (1.4-6.9) |           |         |
| **BMI**              |           |                                       |                 |          |           |        |
| <18.5                | 71        | 7.0                                   | 0.8             | (0.3-2.1) |           |         |
| 18.5-24.9            | 1891      | 8.4                                   | 1.0             | Ref      |           |         |
| 25-30                | 754       | 8.5                                   | 1.0             | (0.7-1.4) |           |         |
| >30                  | 329       | 10.6                                  | 1.3             | (0.8-1.9) |           |         |
| **Smoking**          |           |                                       |                 |          |           |        |
| No                   | 2679      | 8.5                                   | 1.0             | Ref      |           |         |
| Yes                  | 412       | 8.7                                   | 1.0             | (0.7-1.4) |           |         |
| **History of mental health problems** | | | | | | |
| No                   | 2455      | 8.0                                   | 1.0             | Ref      |           |         |
| Yes                  | 544       | 8.6                                   | 1.1             | (0.8-1.6) |           |         |
| **Number of visits for RFM** | | | | | | |
| 1                    | 2677      | 8.3                                   | 1.0             | Ref      |           |         |
| >1                   | 559       | 8.4                                   | 1.0             | (0.8-1.5) |           |         |
| **Pregnancy complications\(^c\)** | | | | | | |
| No                   | 3061      | 8.3                                   | 1.0             | Ref      |           |         |
| Yes                  | 180       | 10.6                                  | 0.7             | (0.4-1.2) |           |         |
| **Gender**           |           |                                       |                 |          |           |        |
| Girl                 | 1610      | 8.9                                   | Ref             |          |           |         |
| Boy                  | 1633      | 8.0                                   | .9              | (0.7-1.2) |           |         |

Abbreviation: LGA, large for gestational age.

\(^a\)Poor neonatal outcome = at least one of pH ≤7.10, Apgar 5 min ≤7, transfer to neonatal intensive care unit and/or IUFD.

\(^b\)Adjusted for birthweight groups, age and a dummy variable of parity and IVF (ref).

\(^c\)Gestational diabetes, hypertonia in pregnancy, preeclampsia, cholestasis of pregnancy.
Among these women, the possibility of identifying the risk of a future IUFD must be considered limited according to the clinical guidelines used. The methods used in Sweden today (CTG registration and an ultrasound examination for assessment of fetal movements and amniotic fluid) only provide information regarding the current fetal status. This may give a misleading reassurance to pregnant women. An improved ability to identify at-risk pregnancies among the normal ones must be regarded as a priority in future research.

In the project, a composite fetal outcome was constructed to help us investigate whether fetuses in the group with RFM were born with a worse outcome, even if not stillborn. The data showed that there is an increased risk of having a poor fetal outcome in pregnancies where the mother seeks help due to RFM compared with those with normal fetal movements. The group with no RFM had a higher rate of admissions to the neonatal ward, which can be explained partially by a higher premature delivery rate (5.2% vs 3.8%, \( P < .01 \)). Two high-risk combinations could be identified: women with SGA fetuses and women with an IVF pregnancy. The incidence of presentation with RFM at the hospital was 21.4%, which is similar to newly published data from the UK \(^{17}\) but considerably higher than previous studies. \(^{18,19}\) This may be due to increased awareness both in pregnant women and in the healthcare givers.

Similar to our findings, a recent published study from UK showed no association between recurrent RFM episodes and increased adverse neonatal outcome, but an association with higher induction rates. \(^{17}\) Furthermore, a liberal induction policy starting from 37 weeks for the women with recurrent RFM showed no benefit. \(^{20}\)

Several large projects such as "Each Baby Counts" and the AFFIRM study are trying to improve information and knowledge about IUFD but have not been successful in preventing it. \(^{21,22}\)

A Norwegian project is described as one of the most successful regarding RFM and stillbirth. The project reduced the incidence of IUFD by 50% (from 4.2% to 2.4%) among the RFM group and from 3.0% to 2.0% in the overall population. Strict standardized information is given to the women regarding RFM. The project performed CTG and ultrasound to assess fetal well-being; ultrasound was the most important (86%) in detecting abnormalities in fetal health (11.6%). \(^{23}\) Late routine ultrasound screening has been shown to triple detection of SGA fetuses (to 57%), a group which is at an 18-fold increased risk of newborn morbidity. \(^{24}\) A Swedish cohort study reported a sixfold reduced risk of IUFD among identified vs non-identified SGA pregnancies. \(^{15}\) In agreement with those finding, a Cochrane report on third trimester ultrasound reported large difference in IUFD risk among those with vs those without 34-36 weeks’ ultrasound (0/1447 vs 9/1455, OR = 0.05, 95% CI 0.0-0.9). \(^{25}\)

Thus signs of growth restriction seem to be a major risk factor for stillbirth and other severe adverse outcomes in women with and without RFM. \(^{10,26,27}\) Ultrasound fetometry seem to increase the in utero identification of SGA. A late routine ultrasound with the aim to identify signs of growth restriction would thus probably be an effective measure to reduce the stillbirth rate.

Following fetal growth during pregnancy is important, and symphysis-fundal height (SFH) is the metric used in every Swedish maternity clinic for identifying SGA fetuses. However, it has been shown already in 1995 that ultrasound is superior. \(^{28}\) Furthermore, a Cochrane review from 2015 showed that there is insufficient evidence that SFH is effective at detecting SGA. \(^{29}\)

According to our composite morbidity score, the second highest risk of a poor fetal outcome was found among multiparous women seeking care for RFM with an IVF pregnancy. A previous study from Canada concluded that IVF pregnancies have a significantly increased risk of intraterine growth restriction. \(^{30}\) However, this is the first time a correlation between RFM among multiparous women with an IVF pregnancy and poorer fetal outcome has been shown. Our opinion is that RFM pregnancies may benefit from more vigilant antenatal surveillance.

**FIGURE 1** Risk factors for poor neonatal outcome in the group with reduced fetal movements (RFM). IVF, in vitro fertilization; LGA, large for gestational age; SGA, small for gestational age
One of the strengths of this study is that all single pregnancies with reported RFM at the clinic during the 2-year period were included. The sample size was large, and only 10% were lost to follow up.

There are also some limitations of this study. Soder Hospital is a large city hospital in Stockholm and the women included in the study were older and probably better educated than the national average in Sweden, which may have some influence on the findings. Furthermore, the retrospective study design used is prone to selection bias and the quality of the data is dependent on the accuracy of the medical data registered. Another limitation is that our study included only one hospital, which could make it difficult to generalize the results. However, our results can be applied in similar settings with similar routines.

5 | CONCLUSION

The low incidence of adverse neonatal outcome in this study may be explained by the easy access and proximity to obstetric care in Stockholm, well-informed patients, good compliance of caregivers with the local guidelines, and the provision of free medical care for all pregnant women. There was no difference in the neonatal outcome between the group with recurrent RFM and the that with single episodes. We found the highest incidence of poor neonatal outcome among nulliparous and multiparous women with RFM whose fetuses were diagnosed as SGA. This suggests that a routine ultrasound assessment for fetal growth in late pregnancy could be beneficial, especially in women with RFM. By better selection of at-risk patients within the group with RFM, we can hopefully minimize the intervention rate while improving the neonatal outcome.

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CONFLICT OF INTEREST

The authors have stated explicitly that there are no conflicts of interest in connection with this article.

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