INTRODUCTION — Maternal perception of fetal movement is reassuring for pregnant women, while decreased fetal movement (DFM) is a common reason for concern. While an active fetus is a reassuring sign that the fetus is alive and in good condition, the use of fetal kick counting as a fetal surveillance tool has not achieved widespread acceptance. This is, in part, because optimal methods of diagnosis, evaluation, and management of DFM have not been determined. This topic will review normal fetal movement and provide the author’s approach to diagnosis, evaluation, and management of DFM.

NORMAL FETAL MOVEMENT — Sonographically, fetal activity can be noted as early as 7 to 8 weeks of gestation [1]. Maternal perception of fetal movement typically begins in the second trimester at around 16 to 20 weeks of gestation and occurs earlier in parous women than nulliparous women [2]. The mother's first perception of fetal movement, termed "quickening," is often described as a gentle flutter [3].

In the second and third trimesters, sonography reveals a wide range of movements of the fetal trunk (eg, bending, startle, hiccup, breathing, rotation), limbs (eg, stretch, hand to face, opening and closing of hands), and face and head (eg, head rotation, suck, yawn, tongue protrusion). When sonographically detected movements were correlated with maternal perception, approximately 50 percent of isolated limb movements were perceived by the mother, whereas 80 percent of movements involving both the trunk and limb were perceived in one study [1]. In a literature review, mothers perceived 33 to 88 percent of sonographically visualized fetal movements [4].

Fetal movement increases throughout day, with peak activity late at night [5]. The frequency of fetal movement in normal pregnancy is probably constant throughout the third trimester [6]; however, the quality of perceived movements changes. Although some studies report that fetal activity normally decreases near term, this is likely due to counting during fetal quiet cycles, which become longer with advancing gestation, or inclusion of high-risk pregnancies.

PREVALENCE OF DECREASED FETAL MOVEMENT — At least 40 percent of pregnant women become concerned about DFM one or more times during pregnancy [7]. Most cases are transient. Four to 15 percent of pregnant women will contact their care provider because of persistent DFM in the third trimester [8-11].

PATHOPHYSIOLOGY AND SIGNIFICANCE — Normal quantity and quality of fetal movement and other types of fetal biophysical activity (breathing movements, tone) virtually ensures functional integrity of fetal regulatory systems. When these regulatory systems are subjected to mild hypoxemia, DFM is believed to represent a compensatory fetal behavioral response, analogous to the compensatory physiological response of redistribution of blood flow to essential organs. As hypoxemia becomes more severe and prolonged, compensatory responses may fail to protect the fetus, eventually leading to fetal injury or death.

Maternal perception of DFM is an indicator for pregnancies at increased risk of adverse outcomes. In a prospective, population-based registry of 2313 women with third trimester singleton pregnancies with DFM who presented to healthcare facilities in Norway, many of these fetuses were dead at presentation, and mortality among those who presented with a live fetus was higher than that of the general obstetrical population: 8.2/1000 births versus 2.9/1000 births [8]. In addition to death, 22 percent of third trimester DFM
has been associated with poor outcomes, including impaired fetal growth, preterm birth, neonatal depression, and emergency delivery [12,13]. Fetal growth restriction appears to be a major factor contributing to the increased risk of adverse neonatal outcome in pregnancies with DFM [14-16].

Early recognition of DFM may provide an opportunity for identifying fetuses that may be compromised and could benefit from intervention, usually delivery, and thereby prevent possible progression to fetal/neonatal injury or death.

**DIAGNOSIS OF DECREASED FETAL MOVEMENT** — Although there is no consensus on diagnosis of DFM, we consider qualitative (subjective) maternal perception of a reduction of fetal movement diagnostic. The best diagnostic criteria are controversial because the level of fetal movement that reliably distinguishes a healthy fetus from a fetus at increased risk of adverse outcome has not been determined [17]. Furthermore, there is no evidence that any quantitative alarm limit is more effective than qualitative maternal perception of DFM for identifying fetuses at risk of adverse outcome. This is due to wide biologic variation in normal fetal movement among healthy fetuses, as well as the wide variation in maternal perception of fetal activity. A 2015 systematic review of randomized trials of fetal movement counting for assessment of fetal well-being found no conclusive evidence of a benefit of this intervention [18]. Formal rather than discretionary fetal movement counting appeared to identify fetuses at risk for intrauterine growth restriction or death, but this did not lead to a reduction in perinatal mortality because of other falsely reassuring fetal assessment tests and clinical error. Nonrandomized studies of interventions to enhance maternal awareness of decreased fetal movement tend to report reductions in perinatal death compared with standard care [19].

**Our approach** — Our approach reflects the clinical practice guideline for the management of women who report decreased fetal movements consensus document developed by Mater Research, The Stillbirth Foundation, the Perinatal Society of Australia and New Zealand, and the International Stillbirth Alliance [20]. It is intended for management of women with singleton pregnancies in the third trimester:

- **Recommendation 1:** All pregnant women should routinely be provided verbal and written information regarding normal fetal movements during the antenatal period, including a description of normal wake and sleep cycles, the changing patterns and types of movement as the fetus develops, and factors that may modify their perception of fetal movement, such as obesity and placental position. This information helps women understand their baby's normal movement patterns.

- **Recommendation 2:** All women should be regularly advised to contact their health care provider if they have any concerns about DFM movements and should not wait until the next day.

- **Recommendation 3:** After discussion, women who remain unsure whether movements are decreased should be given guidance on counting fetal movements, i.e., count while lying down on her side and concentrating on fetal movements. As a rule, if she perceives fewer than 10 movements in two hours, she should contact her health care provider. However, maternal concern of DFM over-rides any specific definition of DFM.

Some patients and providers prefer to use a form for documenting daily movements. Forms provide an ongoing record of fetal movement for day-to-day and week-to-week comparisons [21].

In the second trimester, the prevalence and significance of DFM are largely unknown. We believe a prudent and pragmatic approach is for women over 24 weeks of gestation to contact their provider if they perceive a significant and persistent reduction in fetal movement from baseline, similar to the approach in the third trimester. If a woman presents with DFM before 24 weeks of gestation, she should undergo routine antenatal evaluation, including auscultation for the fetal heartbeat [22].

**Kick counts** — Kick counts are a quantitative alternative to our qualitative approach to assessment of fetal activity. The minimum number of maternally perceived fetal movements consistent with fetal well-being has
been termed the "alarm limit." Various methods for defining an alarm limit have been proposed [6,23-28]. The following are four examples of thresholds for reassurance of fetal well-being:

- Perception of at least 10 fetal movements (FMs) over up to two hours when the mother is at rest and focused on counting ("count to 10" method)
- Perception of at least 10 FM during 12 hours of normal maternal activity
- Perception of at least 4 FM in one hour when the mother is at rest and focused on counting
- Perception of at least 10 FM within 25 minutes in pregnancies 22 to 36 weeks and 35 minutes in pregnancies 37 or more weeks of gestation

The “count to 10” method is the only alarm limit derived from a population study and subsequently evaluated as a screening test in the same population [23]. In this study, the mean time interval to detect 10 FMs was 20.9 +/- 18.1 minutes. Failure to meet the 10 FM threshold within two hours prompted intervention, leading to a threefold increase in intervention for DFM and a reduction in fetal mortality among patients with DFM (from 44 per 1000 to 10 per 1000). This method has a high compliance and acceptance rate among women because it is easy to perform, convenient, and does not take much time [29]; it is also clinically practical. However, a prospective cohort study of “time to count 10 fetal movements” in a Norwegian population did not demonstrate significant differences in the mean time to count 10 FMs between pregnancies with suboptimal outcomes and those with normal outcomes, indicating more research is needed on the optimum method for assessing DFM [30].

DIFFERENTIAL DIAGNOSIS — Transient decreases in fetal activity can be due to fetal sleep states, maternal medications that cross the placenta (eg, sedatives), or maternal smoking. Fetal sleep is a common and benign cause of DFM. Sleep cycles may last up to 40 minutes [31]. In a study that observed late preterm fetuses from uncomplicated pregnancies for 100 minutes, quiet sleep (no eye movements, no somatic movements except for the occasional startle, and a fetal heart rate pattern with little baseline variability) occurred at least once in 30 percent of fetuses, but 96 percent of the fetuses cycled between quiet sleep and active states during the period of observation [32].

Poor maternal perception of fetal activity is another reason for maternal report of DFM. It may be due to early gestational age, decreased/increased amniotic fluid volume, maternal position (sitting or standing versus lying), fetal position (anterior position of the fetal spine), anterior placenta, obesity, maternal physical activity, or the mother just being mentally distracted [2,4,8,33,34].

In a study of fetal movements before confirmation of fetal death, some women interpreted contractions as fetal movement [35].

Because these entities cannot be differentiated from pathologic causes of DFM without further evaluation, a sudden decrease in fetal movement should be evaluated as a potential marker of fetal compromise [36].

EVALUATION — Randomized trials have not compared approaches for the evaluation and management of women with DFM. Clinical approaches described in observational studies include: physical examination, nonstress or contraction stress tests, ultrasound examination (biophysical profile [BPP]), umbilical artery Doppler, testing for fetomaternal hemorrhage (eg, Kleihauer-Betke test), and amniocentesis [10,37]. The wide range of diagnostic approaches reflects efforts to detect acute and chronic fetal hypoxemia and other fetal pathologies (eg, infection, neuromuscular disease) associated with DFM.

The presentation of a woman with DFM should prompt a thorough evaluation of the current complaint and maternal, obstetric, and fetal risk factors for adverse outcome. The goal of the evaluation is to rule out imminent fetal demise and to try to determine the cause of DFM, such as fetal growth restriction with decreasing placental function. A plan of care is formulated based on the results of the evaluation.

Initial evaluation — We suggest the following basic initial evaluation:
Fetal viability should be determined by documenting the fetal heart rate. After fetal demise, the mother may attribute passive intrauterine motion or intestinal activity to fetal movement.

The prenatal record should be reviewed for maternal medical or obstetrical conditions and characteristics that place the fetus at increased risk of adverse outcome.

A nonstress test (NST) is performed and provides immediate information about fetal well-being. In a series of 2313 women with DFM in a Norwegian database, the NST was nonreactive or showed other nonreassuring patterns in 4 percent [8,10]. (See "Nonstress test and contraction stress test".)

**Additional testing**

**Ultrasound examination** — If the NST is reactive, we believe that ultrasound examination is a valuable additional tool for assessment of pregnancies complicated by persistent DFM, and is reassuring for mothers [38]. Ultrasound examination is performed within 24 hours to reassess fetal well-being unless the patient reports that the fetus is active and “back to normal” after a reactive nonstress test. Ultrasound examination should include assessment of fetal activity, breathing, tone, and amniotic fluid volume, as well as fetal growth and anatomic survey if not recently performed [39]. Growth restriction has been associated with a decrease in the number, quality, strength, and duration of fetal movements and repeated episodes of DFM at term [40,41]. This is not surprising since the fetus depends on the placenta for both oxygen and nutrients, thus chronic placental insufficiency can affect both fetal oxygenation and fetal growth.

In Norwegian series, women randomly assigned to perform fetal movement counting had slightly higher detection of fetal growth restriction than women who received usual care (20 of 23 fetuses [87.0 percent] versus 12 of 20 fetuses [60.0 percent], respectively; relative risk 1.5, 95% CI 1.0-2.1) [42]. Ultrasound examination detected an abnormality (eg, fetal growth restriction, oligohydramnios, polyhydramnios, congenital anomaly, low biophysical profile score) in 12.6 percent of all consultations for DFM [8,10] and the population of pregnancies affected by DFM had birth weight percentiles skewed downwards at all gestational ages.

**Doppler velocimetry** — Doppler velocimetry is restricted to pregnancies in which fetal growth restriction has been identified on ultrasound examination, as no benefit has been demonstrated with routine examination of all pregnancies with DFM [43]. In a series from Norway, Doppler demonstrated a pathological pattern in 1 percent of the 1151 cases evaluated at hospitals that performed Doppler on most patients [8]. Most of these abnormalities were associated with growth restricted fetuses. When small for gestational age infants (birth weight less than the 10th percentile) and cases with nonreactive NSTs or abnormal ultrasound examination were excluded, Doppler velocimetry was abnormal in only 1 of 940 cases.

**Testing for fetomaternal transfusion** — We suggest performing a maternal assay (Kleihauer-Betke stain or flow cytometry) to detect fetomaternal hemorrhage as part of the evaluation of the pregnant woman who presents with both DFM and signs of fetal anemia, such as a sinusoidal fetal heart rate pattern, unexplained fetal tachycardia, or fetal hydrops on ultrasound examination associated with elevated middle cerebral artery Doppler velocity.

A large fetomaternal transfusion (FMT) is estimated to occur in 0.3 percent of pregnancies and is a significant contributor to stillbirth [44]. Although testing for FMT in all cases of DFM has been suggested, DFM due to a large FMT is rare. One review described 134 cases of large FMT (>50 mL) of which 78 were detected antepartum and 21 survived [45]. Thirty-three women had DFM as their only symptom. Fetal movement was absent in 17 cases for a period ranging from 24 hours to 7 days. In this group, six infants survived, five were stillborn, and five died in the neonatal period. However, the number of mothers who experienced DFM in this series was not well-documented. Subsequent case reports of severe and spontaneously occurring FMT detected antenatally included 13 cases which presented with DFM and one that did not [46-52]. (See "Massive fetomaternal hemorrhage".)
PREGNANCY MANAGEMENT — Findings at the initial evaluation guide our approach to subsequent management, which is based on data from observational studies of pregnancies with DFM and pregnancies with medical or obstetrical complications associated with a high risk of adverse outcome. No data from randomized trials are available to guide practice recommendations for management of DFM [53].

- **Nonreactive nonstress test, low biophysical profile score, fetal growth restriction** – These abnormal findings are managed according to usual clinical standards. (See "Nonstress test and contraction stress test" and "The fetal biophysical profile" and "Fetal growth restriction: Evaluation and management", section on ‘Pregnancy management’.)

- **Return of normal fetal activity and normal evaluation** – Women who experience a brief period of DFM followed by resumption of normal fetal activity during fetal evaluation and a normal evaluation can resume routine prenatal care. They are instructed to continue to monitor fetal movement and call their provider if they perceive recurrent persistent DFM. In addition, we suggest a follow-up phone call to the patient to inquire if she has ongoing concerns about fetal movement.

- **Persistent DFM and normal fetal evaluation** – No studies have evaluated the optimal frequency and method of follow-up of pregnancies complicated by persistent DFM in which the antepartum evaluations discussed above are normal. Our approach depends on whether the pregnancy has reached term and whether additional maternal or fetal risk factors for adverse outcome are present.

  In view of the high number of adverse outcomes despite normal findings observed in Norwegian studies of DFM [8,11] and the fact that reassurance from antenatal testing is time limited, we believe repeated evaluation or delivery is important in managing pregnancies with persistent DFM and an initially normal evaluation (including objective observation of fetal activity equivalent to a biophysical profile score ≥8). For pregnancies <37 weeks of gestation, we perform nonstress testing and ultrasound examination twice weekly and instruct patients to call their provider if they perceive a further decrease or absence of fetal movement.

  The increasing risk of sudden unexplained intrauterine death after 37 weeks of gestation [54], the diminishing hazard of induction at this gestational age, and the possibility that delivery may be beneficial are considered in deciding management of women with persistent DFM and normal fetal test results at term. Counseling women about monitoring fetal activity is problematic if they have poor perception of fetal movement. We discuss the advantages and disadvantages of continued antepartum evaluation but suggest induction after 37 weeks, especially if there are additional risk factors for adverse outcome. There are no randomized trials demonstrating the efficacy and hazards of this approach.

EFFICACY — We have implemented the counseling and evaluation strategy described above as a quality improvement project in Eastern Norway. After instituting this intervention, the stillbirth rate in women with DFM fell from 4.2 to 2.4 percent (odds ratio [OR] 0.51, 95% CI 0.32-0.81), without a significant increase in the number of women presenting for evaluation due to concerns about DFM (6.3 versus 6.6 percent after the intervention) [11]. The stillbirth rate in the overall study population fell from 3.0/1000 to 2.0/1000 (OR 0.67, 95% CI 0.48-0.93).


SUMMARY AND RECOMMENDATIONS

- We base the diagnosis of decreased fetal movement (DFM) on qualitative (subjective) maternal perception of a reduction of fetal movement. Patients are instructed to contact their healthcare provider within 12 hours for further evaluation if they perceive a significant and persistent reduction in fetal
movement and never to wait longer than two hours if there is absent fetal movement. If the woman is in doubt about what constitutes DFM, we instruct her in the kick count method of assessing fetal activity and ask that she call her provider if she counts fewer than 10 kicks over two consecutive hours at times when the fetus is usually active and she is lying on her side (not supine) and focused upon counting. (See 'Diagnosis of decreased fetal movement' above.)

- Our basic evaluation of pregnancies complicated by DFM includes review of the prenatal record for risk factors for adverse pregnancy outcome and a nonstress test. We obtain an ultrasound examination within 24 to 48 hours to reassess fetal well-being unless the patient reports that the fetus is active and "back to normal" after a reactive nonstress test. Ultrasound examination should include assessment of fetal activity, breathing, tone, and amniotic fluid volume, as well as fetal growth and anatomic survey if not recently performed. We also make a follow up phone call to the patient to enquire if she has ongoing concerns about fetal movement. (See 'Ultrasound examination' above.)

- Doppler velocimetry is restricted to pregnancies suspected of fetal growth restriction or fetal anemia. (See 'Doppler velocimetry' above.)

- Testing for fetomaternal hemorrhage is restricted to pregnancies with signs of fetal anemia. (See 'Testing for fetomaternal transfusion' above.)

- Management of patients with persistent DFM depends on the gestational age and the presence of other identifiable risk factors for stillbirth. If no cause for persistent DFM is determined, we suggest monitoring pregnancies <37 weeks of gestation with nonstress testing and ultrasound examination twice weekly. Given the diminishing hazard of induction after 37 weeks of gestation and the possibility that delivery may be beneficial, we suggest labor induction of these pregnancies when the cervix is favorable (Grade 2C). (See 'Pregnancy management' above.)

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