

Sexual Activity Recommendations in High-Risk Pregnancies: What is the Evidence?



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ABSTRACT

Background: While sexual activity in normal, healthy pregnant women is safe, concern regarding elements of the sexual act have led to restrictions in pregnancies experiencing complications that are frequently insufficiently addressed in clinical practice.

Aim: To comprehensively review the literature for evidence that supports or refutes specific sexual activity restrictions in high-risk pregnancy conditions.

Methods: A search of PubMed, MEDLINE, Ovid, UpToDate, Google Scholar, and Google for relevant publications related to any aspect of sexual activity affecting high-risk pregnancies complicated by history of preterm delivery, shortened cervix, presence of cerclage, pre-mature rupture of membranes, placenta abruption, placenta previa, multiple gestation, or history of classical cesarean section was performed.

Outcomes: The scientific evidence on the pathophysiology of sexual activity and specific high-risk pregnancies, and their interaction.

Results: Despite expert opinion restricting sexual acts or intercourse, there are minimal published data that specifically address sexual activity in high-risk pregnancies.

Conclusions: Clinicians need to engage in conversations regarding specific sexual activity for patients experiencing complications in pregnancy. Recommendations for or against restricting sexual activity should be based on evidence-based guidelines. Significant advances in this area of obstetrics are necessary to make validated recommendations. **MacPhedran S. Sexual Activity Recommendations in High-Risk Pregnancies: What is the Evidence? *Sex Med Rev* 2018;6:343–357.**

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Key Words: Sexual Activity; Coitus; Prostaglandins; Orgasm; Preterm Birth; High Risk; Pregnancy

INTRODUCTION

The majority of patients desire information from their clinician regarding the safety of sexual activity during pregnancy but fail to receive adequate counseling. Depending on the study, anywhere from 15–30% of patients may receive limited counseling regarding sexual activity during the antepartum period.^{1,2} Most of the information women obtain is therefore through friends, family, or the Internet.^{1–4} If women do receive information from their obstetric provider, most feel the advice is insufficient. There are many reasons why this is the case including lack of provider knowledge, lack of data, and lack of

comfort in discussing. Providers are not given much guidance as the expert opinions of those writing obstetric textbooks, clinical management guidelines, and other common resources have minimal specific recommendations or do not comment on sexual activity.^{5–7}

When the clinician initiates sexual activity recommendations during pregnancy, it is almost always regarding pregnancies experiencing complications.² Pregnancies complicated by a high-risk diagnosis are almost exclusively counseled to restrict sexual activity or abstain completely. However, the restriction is most commonly “pelvic rest,” which is not defined in terms of what specific sexual acts are to be avoided or are permissible. In particular, pelvic rest does not address whether orgasm needs to be limited in pregnancy. This vague restriction on all sexual activity leaves patients confused and disappointed.

Expectant couples seek intimacy but concerns of harming the pregnancy can affect the sexual and physical well-being of the relationship. There is a gradual decline in intercourse and other sexual habits as gestation progresses. While patient and partner

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fear and patient physical discomfort are major reasons for the decrease, approximately 50–75% of couples are still having intercourse in the last trimester of pregnancy and 30% in the last month.^{1,8–10} Whether the couple or the provider place restrictions on sexual activity, patients are still engaging in or want to engage in sexual activities with their partners or alone. Even if couples abstain from coitus, patients participate in oral sex (30%), manual stimulation (20–40%), and other stimulation (30% of the time) in the last 2 months of pregnancy.^{1,9}

Sexual activity in pregnancy is a topic insufficiently addressed in clinical practice and in the literature. Many studies evaluating sexual activity during pregnancy were performed decades ago. Further, many of these studies have limitations and study design shortcomings such as small sample size, retrospective data, incomplete sexual histories, and recall bias and typically only included healthy, uncomplicated pregnancies. In addition, the results are inconsistent among the published research. There is even less scientific evidence to provide substantiated recommendations in high-risk pregnancies. Many of the restrictive recommendations that obstetricians provide are based on conjecture of hypothetical pathophysiologic processes or perpetuation of previous mentor's comments and are not based on clinical guidelines or data. Further, as less than 15–30% of providers inquire about sexuality in pregnancy, it is unlikely that the expert opinion cited in the literature is based on significant patient data.^{1,2}

There are many reasons a pregnancy may be considered high-risk but not all high-risk pregnancy diagnoses carry the same concerns with sexual activity. The sexual activity restrictions most providers would give for a pregnancy complicated by the presence of a placenta previa would likely differ from the restrictions for a pregnancy complicated by twin gestation.^{6,11,12} The unfortunate truth is that the data are limited in both of these diagnoses and most other high-risk conditions.

In addition to the paucity of data surrounding sexual activity in high-risk pregnancies, there is even less information regarding safety of specific sexual acts in complicated pregnancies. The implications that a specific aspect of sexual activity leads to complications in pregnancy are based on pathophysiologic theory or extrapolated from non-sexual acts. Intercourse with or without orgasm compared to non-penetrative activities with or without orgasm may have different effects during pregnancy. The degree of uterine contractions from endogenous oxytocin release, exogenous or endogenous prostaglandin (PG) effects, or direct trauma by these processes can vary between different sexual acts and from woman to woman.^{13–19} Additionally, in many instances more than 1 of these processes occurs with the specific sexual activity, making it difficult to ascertain which process would be the main detrimental culprit (Figure 1).

In this article, a comprehensive review of the literature and summary of the available data regarding recommendations for “sex, coitus, intercourse” or specific sexual acts in various obstetric complications was performed. The high-risk pregnancy

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| <p>1-PROSTAGLANDINS—Exogenous prostaglandins F2α and E2 in semen and endogenous prostaglandin from direct contact with the cervix may result in cervical ripening</p> <p>2-OXYTOCIN RELEASE/UTERINE CONTRACTIONS--The release of endogenous oxytocin can occur with genital and/or nipple stimulation with or without female orgasm and from direct contact on the cervix and vaginal tissues-The Ferguson reflex. All of which may cause uterine contractions.</p> <p>3-DIRECT CONTACT CAUSING TRAUMA—Contact on the cervix or lower uterine segment may result in injury or stress on compromised pelvic organs.</p> |
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Figure 1. Proposed pathophysiologic mechanisms.

diagnoses reviewed here are not exhaustive but are focused on common conditions in which a clinician may be concerned that continued sexual activity is unsafe for the pregnancy and may cause undue risk including: history of pre-term birth (PTB), shortened cervix, presence of cerclage, pre-mature rupture of membranes, placenta abruption, placenta previa, multiple gestation, and history of classical cesarean section. For high-risk pregnancy diagnoses for which no evidence is available to support a recommendation, a discussion is provided of the scientific evidence that may support the recommendation for or against sexual activity in general or specific sexual acts. Finally, specific recommendations are provided in each category of high-risk diagnosis and the level of evidence to support the recommendation.

METHODS

Search Strategy

A literature search of PubMed, MEDLINE, Ovid, UpToDate, Cochrane Library, Google Scholar, and Google was performed with no restrictions on publication date. Any publication related to the high-risk pregnancy categories and sexual activity, coitus, orgasm, intercourse, semen, or pelvic rest was included. The specific high-risk pregnancy diagnoses included in the review were the result of a consensus among the maternal-fetal medicine faculty at the institution. The search was limited to those publications in the English language. Additional articles were identified from the relevant references obtained in the literature search. Duplicate articles were removed. The abstracts and full texts were then reviewed. For topics that no articles could be found, searches were performed on hypothetical mechanisms of action using any related terminology.

Study Selection

Any articles that addressed sexual activity regarding pregnancy complications were included. The studies included were observational studies, cohort studies, randomized controlled trials, meta-analysis, reviews, and case reports. Also included were studies in which sexual activity and the association with pregnancy complications was the primary, secondary, or tertiary analytic outcome.

Study Quality Assessment

The level of evidence for recommendations is provided in each of the subcategories of high-risk pregnancies when available based on the method outlined by the U.S. Preventive Services Task Force.

- Level I: evidence obtained from at least 1 properly designed randomized controlled trial.
- Level II-1: evidence obtained from well-designed controlled trials without randomization.
- Level II-2: evidence obtained from well-designed cohort or case-control analytic studies, preferably from more than 1 center or research group.
- Level II-3: evidence obtained from multiple time series designs with or without the intervention. Dramatic results in uncontrolled trials might also be regarded as this type of evidence.
- Level III: opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.¹⁹

DISCUSSION

Sexual Activity Concerns

Among mammals, very few females continue to seek intercourse during gestation, with the exception of human women. Could this be an evolutionary protective mechanism to help perpetuate the species, implying potential harm from coitus or just the cessation of sex pheromones?²⁰ There are many facets of sex that raise the possibility of concern during pregnancy. Early perinatal network data, observational studies, retrospective studies, and case reports had concerns of poor obstetrical outcomes related to pre-mature delivery and amniotic infections.^{21–23} Since then, there have been a handful of studies every decade with conflicting results but predominantly concluding more safety than harm.^{10,24–27} However, there are very few reports that address specific high-risk pregnancy conditions and sexual activity. Even fewer dissect the sexual act into the individual aspects that may contribute such as PGs, uterine contractions from oxytocin release, and direct contact. The Cochrane Library has a series of reviews that note the safety of these sexual activity variables at term.^{28,29} Similarly, Masters and Johnson¹⁴ noted that complications from orgasmic coitus at term were extremely rare. The question remains: are women with certain high-risk pregnancy issues inherently different than these low-risk women, and therefore more susceptible to risk from the effects of sexual activity?

Below are reviewed the 3 main pathophysiologic ways in which sexual activity could potentially cause pregnancy complications, meaning changes leading toward labor or an indication for delivery.

Prostaglandins

PGs, especially PGEs and PGFs, have been shown to: (1) increase at the onset of labor in amniotic fluid, maternal placenta,

myometrium, and blood; (2) stimulate myometrial activity; and (3) induce labor.^{30–33} PGEs and PGFs are also found in semen and are produced by female pelvic organs after intercourse. Exogenous PGs from semen could theoretically cause induction of labor in 2 ways: direct contact with the cervix could cause cervical ripening, and absorption through the vaginal mucosa into maternal circulation could cause contractions.¹⁷ Semen levels of PGEs are on average 73 μg PGE/mL, 267 μg 19-OH PGE/mL in fertile men and can be found in the vagina up to 12 hours after intercourse.^{34–36} This is much higher than the dose used in manufactured cervical ripening agents. However, the Cochrane Library systematic review of sexual intercourse for cervical ripening and induction of labor found 1 article that specifically evaluated the presence of semen on change in Bishop score and timing of delivery, with the conclusion that semen had no bearing on cervical change or expediting delivery.²⁸ In addition, other studies with many confounding variables and limitations have had inconclusive findings or similar findings that intercourse does not cause cervical ripening or reduce time to delivery.^{37–40} Thus, the PGs in semen alone have questionable impact.

Intercourse also involves direct contact with the cervix that causes endogenous PG release and may result in cervical ripening and uterine contractions.³⁶ The concept that direct manipulation of the cervix in the absence of semen induces serum PG levels is observed after vaginal exam, particularly “stripping membranes” and after cerclage placement.^{41,42} However, there are no studies examining female, amniotic, or serum PG levels after intercourse. Similarly, there are no studies evaluating coitus with or without condoms in the literature to assist in differentiating the effects of exogenous PGs from semen vs the endogenous PGs from cervical contact. Determining if PG levels stimulate uterine contractions or if uterine contractions stimulate the increase in PGs would give insight into whether PGs from semen or the contractions from intercourse play a more significant role. Goodlin et al²² indirectly evaluated the effects of semen compared to semen with women’s orgasm on uterine contractions after intercourse and found less women reported painful contractions with presence of semen alone and none of these women experienced labor at term or pre-term.

Oxytocin

Release of endogenous oxytocin occurs with many sexual activities, and in turn oxytocin causes uterine contractions.¹⁵ This led to the hypothesis that sexual activity may cause labor. Recent studies show that this may not be the case, specifically in term patients.^{37–40} Dissecting the specific sexual act that is the major contributor to oxytocin release is challenging, as foreplay (genital or nipple stimulation), penetration, and women’s orgasm can cause release of oxytocin. It is also unclear whether the levels of oxytocin are different with each type of sexual activity and the effect this may have on the pregnant uterus.

Foreplay

The majority of data on nipple stimulation stems from contraction stress test (CST) studies. Nipple stimulation (CST) compared to oxytocin both produce similar uterine contraction patterns and intensity.⁴³⁻⁴⁵ Despite nipple stimulation being able to induce uterine contractions, the Cochrane Library systematic review of 2005 concluded there were insufficient data to support nipple stimulation as a method of labor induction at term.²⁹ There are no data regarding whether there is a difference in level of oxytocin released with nipple stimulation at term vs pre-term. Of note, the uterine contractions with CST are limited, less intense than labor contractions, and resolve typically within 15–90 minutes.^{44,46} Many studies utilizing the CST confirmed its safety in pregnancies complicated by high-risk diagnoses.⁴⁶ Braly et al⁴⁷ showed the overall safety of the CST with nipple stimulation in these patients, specifically that it did not increase the risk of pre-term delivery. In addition, there are reports of rare events of hyperstimulation of the uterus after CST.^{29,44} Since the CST-induced contractions resolve in 90 minutes and the majority of couples have foreplay for 7 minutes or less in pregnancy, it would be likely that the duration of genital or nipple stimulation during sexual intimacy would be comparable or considerably less than the CST.²

Women's Orgasm

Uterine contractions from the release of endogenous oxytocin occurs during women's orgasm.¹³⁻¹⁵ Several authors have commented on the physiological similarities between labor and women's orgasm noting a uterine contraction pattern identical except for strength.^{48,49} A case report performed with 1 patient at term evaluated the uterine tension related to women's orgasm during vulvar or vaginal stimulation and noted similar contraction patterns after either type of orgasm.⁵⁰ In this particular case report the uterine contractions ceased within 15 minutes of the last orgasm. The effects of women's orgasm on uterine activity vary and not all women's orgasms lead to uterine contractions. Chayen et al⁵¹ evaluated uterine activity during coitus at term in 3 couples and found an increase in uterine frequency after some women's orgasms, but not all. The female orgasm is complex; it can vary from type of stimulation, from one episode to the next, and from one woman to another.⁵²⁻⁵⁴ There is controversy regarding orgasm in the third trimester; some patients report more intense or painful orgasms while others develop difficulty in achieving orgasm.^{1,2,9} Masters and Johnson¹⁴ also conclude that women's orgasm in late pregnancy is safe. Masters and Johnson¹⁴ noted the highest intensity of uterine contractions with orgasm from external, clitoral masturbation. However, even the most intense uterine contractions as a result of orgasm from masturbation are likely not as intense as those of labor or persist sufficiently long enough to induce labor since anywhere from 20–45% of couples still engage in masturbation in the last 2 months of pregnancy and the pre-term delivery rate is only 10%.^{9,55} In view of the vast variability of orgasms and their

ability to induce uterine contractions, evaluating the implications for high-risk pregnancies is multi-faceted. Since individual women's responses to sexual stimuli are varied, the degree of limitations placed on sexual activity needs to be individualized.

Penetration

The Ferguson reflex—direct pressure via vaginal or anal penetration (penile or other) on the cervix and vaginal tissues—provokes uterine contractions and release of endogenous oxytocin.¹⁶ With respect to the isolated issue of uterine contractions from direct contact, the separation between endogenous release of PGs and uterine contractions from direct contact is impossible to achieve. As previously mentioned, the predominant factor in coitus leading to painful uterine contractions appears to be the presence of women's orgasm rather than the actual penetration or men's ejaculation.²²

Oral Sex

There are no studies evaluating the impact of oral sex or cunnilingus on high-risk pregnancies. However, since oral sex involves genital stimulation and may lead to orgasm inducing uterine contractions, it merits a brief discussion. It is universally quoted that air blown in the vagina during oral sex has the potential for fatal or near fatal air embolus and is strongly cautioned against.^{5,6,56} In addition, there are 2 case reports of oral pathogens isolated from amniotic fluid of women with chorioamnionitis who reported oral sex during pregnancy.^{57,58} Despite their only being a handful of cases, high-risk pregnancies where there is an increased concern for infection may warrant discussion of oral sex practices.

“It is postulated that coitus is equivalent to an unmonitored contraction stress test” (from Chayen et al,⁵¹ 1986).

Direct Contact/Trauma

The concept that coitus may cause harm in pregnancy is often deeply seated in the minds of patients and their partners due to fear of harming the fetus or reported physical pain after intercourse.^{1,2} Despite early case reports of increased risk of chorioamnionitis and fetal bradycardia after intercourse or women's orgasm, many studies have since proven the safety of intercourse during pregnancy.^{21-26,50,51} The fear of pain appears valid as the majority of women report discomfort or pain after intercourse.²² However, the post-coital pain does not translate into harm or trauma to most women.

The evidence that sexual activity involving penetration leads to physical change or damage of the female pelvic organs is more conceptual than exact cause and effect. Ultrasound imaging of coitus during the sixth month of pregnancy reveals the direction of the penis in the space between the cervix and the vagina not in or touching the cervix.⁵⁹ The Huffington Post (an online reporting site) references this article and compares the impact of

penetrative intercourse as “no more of a jostle than...if the pregnant woman were to run up a set of stairs or to exercise.”⁶⁰ The increased incidence of bleeding after intercourse later in pregnancy suggests that an injury has occurred. However, studies evaluating bleeding after intercourse in late pregnancy in uncomplicated pregnancies report that amount of bleeding is typically transient and has not been associated with actual injury to the vagina, cervix, or uterus.⁶¹

The cervix and lower uterine segment in low-risk patients appear to be able to tolerate the impact of penetration with sexual activity. However, in women with underlying pathology of the cervix or lower uterine segment, repetitive contact and direct pressure could foreseeably have negative consequences. The potential pathologic role of penetration in these specific high-risk pregnancies will be reviewed below.

High-Risk Pregnancy Concerns

Approximately 1 in 10 pregnancies in the United States ends in a PTB. PTB is one of the most common causes for neonatal morbidity and mortality.⁵⁵ Unfortunately, the reasons for any 1 pregnancy ending in a pre-term delivery are often multi-faceted and overlapping. It is impossible to delineate 1 true cause or mechanism for PTB in any 1 patient. There are likely structural, inflammatory, infectious, or genetic differences among the various reasons why some patients are pre-disposed to deliver pre-term.^{7,62} Here I seek to characterize spontaneous PTB, as opposed to induced or medically indicated, into general categories and review the evidence for safety of sexual activity for each type of patient.

Prior PTB

The concern that sexual activity may be a risk factor for women with a history of PTB likely stems from older data that found association with coitus and PTB. Many early studies reported controversial findings regarding coitus with or without orgasm as a risk factor for pre-term delivery but overall concluded that coitus late in pregnancy did not increase the risk of PTB and possibly decreased the risk of PTB in women engaging in masturbation.^{9,25–27,63,64} Interestingly, women with a history of PTB were excluded from the studies, thus making authors hesitant to apply conclusions from these studies on women with a history of PTB.

Women with a history of PTB are generally at increased risk for recurrent spontaneous PTB.⁶⁵ For simplicity, there was no differentiation made between a history of PTB due to pre-term labor (PTL) or pre-term pre-mature rupture of membranes (PPROM). After review of the literature, there is only 1 article that specifically addresses the risk of sexual activity in women with a prior spontaneous delivery at 16–36 weeks. Yost et al⁶⁶ performed a secondary analysis of a multi-center, blinded observational study of women with a prior spontaneous PTB <32 weeks and concluded that women engaging

in coitus in early pregnancy did not have an increased risk of recurrent PTB. This study has several limitations. It is of small sample size and there was no correlation between time of sexual activity and time of delivery, and the study is based upon the presumption that asking patients about their sexual practices in early pregnancy is representative of their practices throughout the pregnancy, which may not be true. Additionally, as with many studies regarding sexual activity in pregnancy, there is no clarification regarding specific types of sexual activity. This is important because, as previously discussed, there are sexual acts other than intercourse that may impact the risk for pre-term delivery, such as nipple stimulation, presence of semen, and the presence or absence of orgasm.⁶⁶

Most authors and clinical guidelines addressing the prevention of recurrent PTB do not provide guidance on sexual activity restrictions.^{65,67} Despite the limited evidence, expert opinion extracted from UpToDate states, “A small subgroup of susceptible women may develop PTL with sexual activity because both prostaglandins in semen and orgasm can increase myometrial activity. For this reason, we tell patients with an arrested episode of PTL that they should consider avoiding sexual activity if they experience an increased frequency or intensity of contractions after sexual intercourse.”⁶⁸ PTL leading to PTB can be difficult to exclusively define. Historically it has been defined as uterine contractions that cause cervical change. Not all women with signs and symptoms of PTL go on to have a spontaneous PTB. In fact, 30% of these cases resolve spontaneously and 50% of women hospitalized for PTL go on to deliver at term.⁵ Experts in the field theorize that 1 mechanism for at-risk women is that their cervix or uterus is pre-disposed to respond to the inflammatory pathway differently than women not at risk.^{7,62,69} Hypothetically, semen or any sexual contact that directly or indirectly increases local PGs may stimulate the pre-disposed pelvic organs toward PTL. However, determining what subset of at-risk women this applies to is currently not available. To date, there are no data to suggest that the presence of PGs in semen affects women with an increased risk of pre-term delivery any differently than women at term. Similarly, there is no evidence that the level of endogenous PGs produced after coitus is different in high-risk patients compared to women who deliver at term. In fact, there is 1 article that evaluates the levels of PG in amniotic fluid in labor and states there is no difference in the PG levels comparing women at term vs PTL.⁷⁰ The level of oxytocin released and the degree of uterine contractility in pregnancy with any sexual stimulation with or without orgasm compared to spontaneous term or PTL is uncertain.⁷¹ Data from a prospective study of 15 women investigated uterine contraction frequency in pre-term gestations after coitus and found that women they deemed “high-risk for premature delivery” had an increase in uterine activity post-coital for up to 2–3 hours.⁷² This article does not delineate whether coitus with orgasm resulted in more intense or longer contractions nor does it state if the high-risk patients actually delivered pre-term. However, the significance

of that finding is in question as a large perinatal network population study concluded that contraction frequency among women with a history of PTB had a very low positive predictive value for subsequent PTB.⁷³

Recommendations

- Level II-2: sexual activity of any type should not be discouraged in women with a history of PTB.
- Level III: sexual activity of any type should not be discouraged in women with a history of PTB until they have an episode of PTL. After this, sexual activity of any type that causes an increase in frequency or intensity of uterine contractions should be avoided.
- The evidence to support or refute the safety of penetrative or non-penetrative sexual activity with or without orgasm is limited.
- Author's opinion:
 - Individualize recommendations based on consideration of obstetric history and comorbidities as well as patient and partner fears and emotional needs.
 - Women with a history of PTB in the absence of a short cervix or other obstetrical risks need not be discouraged from sexual activity of any type.
 - Further research is needed to make validated recommendations.

Short Cervix

Another risk factor for PTB is a shortened cervix in the current pregnancy. Shortened cervix is defined as a cervical length (CL) measured by transvaginal approach less than 25 mm between 16–24 weeks' gestational age.⁷⁴ There is an inverse relationship between CL and gestational age at delivery. In severe situations, once the CL is immeasurable the risk of PTB is imminent.^{75,76} Despite the fact that women with a shortened CL are often given restrictions on sexual activity by providers during pregnancy, there is a paucity of data on the subject. After review of the literature 1 article was found on this topic, and it is commonly cited as evidence for the risk of sexual activity with known short CL. Grobman et al⁷⁷ published a secondary analysis of a randomized control trial of the use of hydroxyprogesterone caproate for prevention of PTB. The study was performed in nulliparous women with short CL and found that significantly more women had PTB who were placed on restriction of "any type." Limits of this study include that the survey looked at the sexual practices reported by women at 1 time during pregnancy, which may not extrapolate to the entire gestation; there was no attempt to quantify time passed between sexual activity and delivery; and there was not clarification of what type of activity restriction the patient was advised to follow or the definition of pelvic rest. Given the significant limitations of this study it is unclear how to interpret the results despite a potential beneficial effect when pelvic rest was not recommended.⁷⁷ Interestingly, a multi-center

cohort study evaluating interventions for women with a history of PTB and shortened CL specifically restricted physical activity but not intercourse or any sexual activity, except for women with a cerclage. Even though sexual activity restrictions were not a measured outcome, the authors reported no difference in results among the interventions.⁷⁸

As reviewed in women with a history of PTB, the short cervix is yet another subgroup of women at risk for which the cervix or uterus is different compared to a woman deemed not at risk. In contrast to the previous studies that did not restrict sexual activity in women with a short CL, UpToDate states, "In our practice, we advise women with both a prior preterm birth and a short cervix to avoid coitus."⁷⁹ Is there an inherent pathologic pre-disposition of a short cervix that makes it weaker and thus more susceptible to the traumatic forces of intercourse? Even though the penis does not enter the cervical canal the pressure on the vaginal fornices is still abutting the weakened cervix. In addition, since vaginal and anal penetrative acts both directly have impact on the cervix, restrictions must include both. Similarly, the effects of PGs in semen or the intensity of uterine contractions with orgasm on a compromised cervix are unknown. Presumably any sexual activity that results in intense or painful uterine contractions is of concern. Further, the degree of cervical shortening also heightens the concern and should be a factor in counseling.

Recommendation

- Level III: women with both a prior PTB and a short cervix should avoid coitus.
- Level III: limited data suggest that women with a short cervix need not be discouraged from sexual activity of any type.
- The evidence to support or refute the safety of penetrative or non-penetrative sexual activity with or without orgasm is limited.
- Author's opinion:
 - Individualize recommendations based on consideration of obstetric history and comorbidities as well as patient and partner fears and emotional needs.
 - Women with a short cervix need not be discouraged from sexual activity of any type unless experiencing bleeding, increase in baseline uterine contraction frequency/intensity, or worsening in CL. After this, vaginal penetration and any non-penetrative sexual activity with or without orgasm that causes patient perceived uterine contractions or painful contractions should be avoided.
 - Further research is needed to make validated recommendations.

Cerclage

Women who undergo surgical placement of a cerclage on average deliver pre-maturely. The American Congress of Obstetricians and Gynecologists (ACOG) practice bulletin states the

indications for cerclage placement are: history indicated, physical exam indicated, or ultrasound indicated. The pathophysiology of these 3 groups may be different, and the cerclage timing ranges anywhere from 13–23 weeks' gestation depending upon the indication.⁸⁰ It is difficult to generalize this group of patients, as the individual patient risk is likely different based upon the cerclage indication. A woman with a prophylactic cerclage placed for history of prior PTB may have a different pathophysiology than a woman with a rescue cerclage placed for a very short CL in current pregnancy. Furthermore, women who have had a cerclage placed abdominally prior to conception likely have yet another set of risk factors.

A review of the literature yielded no articles that specifically address sexual activity of any type in pregnancy with a current cerclage. Expert opinion extracted from authors well published on cerclage placement recommend, “pelvic rest, described as abstinence from any sexual activity involving penetration of the vagina; no use of tampons; and no douching.”^{78,81} Similarly, authors of UpToDate transvaginal cervical cerclage state, “Although there is no evidence that coitus adversely affects perinatal outcome, we ask patients to maintain pelvic rest for at least one week after an elective procedure, and to use condoms thereafter. Women who have had a non-history-indicated cerclage are managed more conservatively; we typically limit physical activity and coitus until a favorable gestational age is reached, usually 32 to 34 weeks of gestation, although there is no high quality evidence that decreasing physical activity improves outcome.”⁸² Despite lack of empirical evidence, there is fear that intercourse causes harm.

The theoretical risk of PTB with a cerclage may be due to potential infection risk. The highest risk of infection is immediately after surgery, but this would be expected to wane with time as the surgical site heals. To date, the overall consensus of past research is that coitus does not increase the risk of infection, specifically chorioamnionitis.⁸³ The combination of intercourse with a foreign object in the cervix, the cerclage, raises concern for the increased risk of intrauterine infection. Interestingly, a similar theory existed surrounding the increased risk of intrauterine infection due to the intrauterine device/intrauterine implant strings passing thru the cervix. Scientific evidence has since dismissed this theory.^{84,85} As mentioned previously, the PGs in semen are not likely sufficient enough to induce term or PTL but the effects of PGs on the cervix in need of a cerclage are unknown. However, semen does induce the production of proinflammatory agents and stimulate influx of granulocytes and macrophages.⁸⁶ There is a significant body of research focused on the association of PTB and the activation of specific inflammatory pathway markers, in particular on the success or failure of cerclage placement.^{87,88} The potential inflammatory effects of semen may serve as a secondary insult in an already compromised environment. As for penetrative risk, on one hand the cervix requiring a cerclage is inherently weaker and possibly more susceptible to impact. On the other hand, the cervix that has a

cerclage regardless of the reason could be stronger once sutured closed and perhaps more resilient to contact. The extent that uterine contractions from orgasm or other stimulation affects the cervix with a cerclage is unknown. The muscular contractions during orgasm can incorporate the lower uterine segment putting mechanical stress on the tissue and suture.^{16,18,53} In addition, uterine activity is frequently increased post-cerclage, which makes it difficult to assess if added contractions from orgasm are contributory.

Recommendation

- Level III: vaginal penetration should be avoided.
- Level III: after prophylactic cerclage placement, pelvic rest for 1 week and use condoms with coitus thereafter. After rescue cerclage, abstain from coitus until 32–34 weeks of gestation.
- There is no evidence to support or refute the safety of penetrative or non-penetrative sexual activity with or without orgasm.
- Author's opinion:
 - Individualize recommendations based on consideration of obstetric history and comorbidities as well as patient and partner fears and emotional needs.
 - Penetrative acts should be avoided for a minimum of 2 weeks post-procedure.
 - Prophylactic cerclage: in the absence of bleeding or increased baseline uterine contraction frequency/intensity, non-penetrative sexual activity with or without orgasm need not be discouraged. After discussion with the patient and partner, modified penetrative sexual activity with or without orgasm is permissible.
 - Rescue cerclage: the individual characteristics of the patient and cerclage indication need to be considered in making recommendations. Once deemed stable, in the absence of bleeding or increased baseline uterine contraction frequency/intensity non-vaginal penetration sexual activity with or without orgasm need not be discouraged.
 - Further research is needed to make validated recommendations.

Pre-mature Rupture of Membranes

PPROM refers to chorioamniotic membrane rupture before the onset of uterine contractions (also known as pre-labor rupture of membranes) before 37 weeks of gestation. It is responsible for, or associated with, approximately one third of PTB and the single most common identifiable factor associated with pre-term delivery.^{6,89} Similar to the discussion of PTB, the notion that intercourse may be harmful in women with PPRM presumably originates from remote studies showing an increased risk of chorioamnionitis associated with sex, particularly men's superior position and women's orgasm.^{21,90}

Upon review of the literature, no articles were found specifically addressing whether intercourse or any sexual activity needs

to be eliminated in women with PPRM in their current pregnancy. Expert opinion and obstetric textbooks endorse, “strict pelvic rest” but do not clarify what this means.^{7,69,91} Is this nothing in the vagina or are the patients to completely avoid any sexual acts that stimulate the pelvic organs directly or indirectly? While most patients are managed in the hospital, outpatient management is acceptable in women who experience PPRM before fetal viability.⁹² Addressing sexual activity in hospitalized patients is important as many women may continue to masturbate unless specifically instructed otherwise. For stable PPRM patients remote from term who are expectantly managed at home, a conversation defining “strict pelvic rest” is also necessary.

Patients with PPRM are at an increased risk of PTB usually because of infection/chorioamnionitis, progression of PTL, or abruption from the change in intrauterine pressure with loss of amniotic fluid, all of which may be affected by sexual activity. PPRM results in about half of women delivering within a week and 75% within a month after PPRM.⁹¹ The increased risk of infection in women with PPRM is a result of exposed membranes to the bacteria within the genitourinary tract.^{89,91,93} Evidence confirms a strong relationship between the time of first vaginal examination until delivery and maternal infection due to disruption of and ascending vaginal flora.⁹⁴ Therefore, any vaginal penetration may ensue similar risk of infection. As mentioned earlier, it has been proposed that oral pathogens ascend in the vagina with oral sex, leading to chorioamnionitis in women without PPRM.^{57,58} Thus, women with PPRM should refrain from receiving oral sex. As previously discussed, the theory that a subset of women has a cervix or uterus that is pre-disposed toward PTL may also be the cause of PPRM and thus be an additive concern. PPRM is considered a delicate state and is subject to any trigger that tips the balance toward pre-term delivery. According to ACOG, PPRM is a relative contraindication to nipple stimulation CST because of concern that the induced contractions may lead to the progression of PTL or placental abruption.⁹⁵ Comparably, orgasm or other sexual stimuli that cause uterine contractions may result in similar consequences in women with PPRM.

Recommendation

- Level III: patients with PPRM, regardless of gestational age, should adhere to strict pelvic rest.
- There is no evidence to support or refute the safety of non-penetrative sexual activity with or without orgasm or anal penetration.
- Author’s opinion:
 - Individualize recommendations based on consideration of obstetric history and comorbidities as well as patient and partner fears and emotional needs.
 - Vaginal penetration may increase the risk of infection and thus should be avoided.

- Patients with PPRM in non-viable gestations or stable PPRM in viable gestations after the latency period without evidence of infection, bleeding, or increased baseline uterine contraction frequency/intensity need not be discouraged from non-penetrative sexual activity with or without orgasm or anal penetration.
- Further research is needed to make validated recommendations.

Placenta Previa

Placenta previa is an important cause of bleeding in the second half of pregnancy and in labor. With placenta previa, transvaginal ultrasonography evaluates the degree the placenta covers or encroaches on the cervix. The characteristics of the placenta previa are categorized: placenta previa—complete or partial, placenta accreta, vasa previa, marginal previa, and low-lying placenta.⁹⁶ Each classification carries varying degrees of risk, making it impossible to make generalized recommendations. For simplicity, the discussion will pertain to complete previa using the term “previa.” The patient with a placenta previa typically presents with painless bleeding. The first episode of bleeding, sentinel event, usually does not necessitate delivery.⁶ The bleeding in pregnancies complicated by a previa usually occurs when the lower uterine segment develops and there is mechanical separation of the placenta from the lower uterine segment. The mean gestational age for bleeding with a placenta previa is 29–32 weeks.⁹⁷

According to *Williams Obstetrics*, “Until placenta previa is confirmed in the second trimester, typically after 28 weeks, the need for sexual activity restrictions is usually not indicated.”⁶ There are no studies or case reports that intercourse or any specific sexual act causes bleeding in women with a placenta previa to support this recommendation, nor is there evidence to support any recommendations after 28 weeks. The risk of bleeding or more catastrophic events with sexual activity in pregnancies complicated by a previa is based on extrapolation of non-sexual acts. Anecdotal experiences with the vaginal exam performed in the presence of a placenta previa theorized that this contact might open thrombosed sinuses and aggravate bleeding. Thus, the recommendation is to avoid vaginal or rectal manipulation of the cervix.⁹⁸ It was inferred that coitus carried the same risk. Initial concern that the transvaginal probe could prompt the same potential bleeding as the vaginal exam has since been dispelled. A study examining the angle of the cervix related to the transducer concluded that transvaginal ultrasound was safe because the probe does not enter the cervical canal.⁹⁹ Some authors suggest that it may be possible to extrapolate from this study that the penis could not enter the cervical canal as well and thus draw similar conclusions.¹² Magnetic resonance imaging and ultrasound studies of coitus in varying positions shows that the penis is in direct contact with either the anterior fornix in missionary position or the posterior fornix with rear-entry

position but not inside the cervix.^{59,100} Even though the penis is unable to penetrate the cervix and disturb the placenta previa, intercourse regardless of position impacts the lower uterine segment. In addition, Schaffner and Schanzer¹⁰¹ noted the onset of asymptomatic cervical dilation, defined as 2–3 cm, early in the third trimester in 18% of uncomplicated low-risk women was a variation within the normal range. Therefore, in the late second trimester and early third trimester as the lower uterine segment begins to develop, contact via penetration will put pressure on the lower uterine segment and may cause mechanical stretch and thus bleeding.

There is no evidence demonstrating safety or harm of non-penetrative sexual activity. However, any sexual acts that result in uterine contractions in patients with a previa are concerning. Expert opinion from UpToDate recommends, “We advise women with placenta previa after 20 weeks of gestation (earlier if they have experienced vaginal bleeding) to avoid any sexual activity that may lead to orgasm. The rationale is that this activity, especially if orgasm occurs, may be associated with transient uterine contractions, which, in turn, may provoke bleeding. Additionally, there is concern that vaginal intercourse (or putting any object deep into the vagina) might cause direct trauma to the previa, resulting in bleeding. There are no published studies that either support or refute this recommendation.”¹⁰² According to ACOG, placenta previa is another relative contraindication to the CST because this condition is associated with an increased risk of uterine bleeding.⁹⁵ From 15–20% of patients with placenta previa that present with bleeding also report uterine contractions.¹⁰³ It is unclear if bleeding from the placenta previa causes contractions or if uterine contractions are the cause of the bleeding. 1 Recent report of 89 women with a placenta previa evaluated the risk of hemorrhage leading to delivery in association with cervical shortening and uterine contractility. The authors noted a significant increased risk of bleeding when accompanied by cervical shortening and significantly more uterine contractility when the cervix is shorter. In addition, all patients whose CL was >3 cm had no episodes of bleeding and delivered at term.¹⁰⁴ In terms of non-penetrative sexual activity, any process that induces uterine contractions either from endogenous oxytocin production from genital or nipple stimulation or orgasm may be comparable to a CST and increase the risk of bleeding in these women. Since individual women’s responses to sexual stimuli are varied, the degree of limitations placed on sexual activity need to be individualized.

Recommendations

- Level III: until placenta previa is confirmed in the second trimester, typically after 28 weeks, the need for sexual activity restrictions is usually not indicated.
- Level III: abstain from any sexual activity that may lead to orgasm after 20 weeks of gestation (earlier if they have experienced vaginal bleeding).

- There is no evidence to support or refute the safety of penetrative or non-penetrative sexual activity with or without orgasm at any gestational age.
- Author’s opinion:
 - Individualize recommendations based on consideration of obstetric history and comorbidities as well as patient and partner fears and emotional needs.
 - Sexually activity of any type need not be restricted until the CL is <3 cm, after the sentinel bleeding episode or the baseline uterine contraction frequency/intensity increases. If the CL is between 3 cm and 2.5 cm, recommendations for sexual activity of any type need to be individualized.
 - After the sentinel bleeding episode, penetrative sexual acts and any sexual activity leading to patient perceived uterine contractions or painful contractions should be avoided.
 - Non-penetrative sexual activity that does not result in patient perceived uterine contractions or painful contractions need not be restricted after the sentinel bleeding episode.
 - Further research is needed to make validated recommendations.

Placental Abruption

Placental abruption is the separation of the placenta from the uterine wall before delivery. Abruption is the most common cause of serious vaginal bleeding in pregnancy, occurring in 1% of pregnancies.⁵ Approximately 50% of placental abruptions occur before 36 weeks’ gestation with many resulting in PTB.¹⁰⁵ The presentation can vary from severe, with fetal death and maternal instability, to an incidental finding on ultrasound.¹⁰⁶ The causal relationship between placental abruption and sex is limited. There have been 5 publications, dating back to the 1980s, that alluded to an association with coitus or other sexual stimulation and abruption.^{107–111} 2 Were prospective studies evaluating the effects of coitus and placental abruption.^{107,111} However, neither of the studies comments on the specifics of the sexual acts, or the presence or absence of women’s orgasm. In addition, both have methodological flaws regarding the timing of last sexual intercourse and the exclusion of other etiologies of abruption. In terms of specific sexual acts related to placental abruption, there are only 2 case reports following nipple stimulation (one during the CST, the second during breast-feeding) and 1 case report following intercourse.^{108–110}

Currently, there are no recommendations regarding sexual activity of any variety in the presence of an existing placental abruption. Many authors remark that because the presentation is widely variable, management must be individualized on a case-by-case basis.¹⁰⁶ Review articles from clinical expert series do not mention any type of activity restrictions, let alone sexual activity restrictions in women with stable chronic abruptions that are discharged home.¹⁰⁶ It is unlikely that the presence of semen alone or direct contact with the cervix or adjacent structures would provoke an existing abruption in the absence of a placenta previa or low-lying placenta. However, the degree of uterine

contractions from cervical contact is unknown. It is more likely that sexual stimulation leading to painful or patient-perceived contractions could be a cause for concern. As previously discussed, any sexual activity leading to uterine contractions may cause mechanical stress on a compromised placenta resulting in worsening of the abruption. However, there is a huge range of stability and baseline uterine contractility among chronic placental abruptions. In addition, since individual women's responses to sexual stimuli are varied, the degree of impact on the compromised placenta may vary as well. Women with a chronic placental abruption stable enough for home monitoring have to be individualized as to their personal response to sexual stimuli.

Recommendations

- The literature did not provide any data or expert opinion on sexual activity recommendations with an existing placental abruption.
- Author's opinion:
 - Sexual activity recommendations in women with a chronic placental abruption stable enough for home monitoring need to be individualized.
 - Individualize recommendations based on consideration of obstetric history and comorbidities as well as patient and partner fears and emotional needs.
 - In women with a stable, chronic abruption, sexual stimulation and penetrative acts with or without the presence of orgasm need not be limited unless frequent, intense, or painful uterine contractions occur.
 - In women with a stable, chronic abruption, any sexual activity that result in bleeding should be avoided.
 - Further research is needed to make validated recommendations.

Multiple Gestation

Greater than 50% of twin pregnancies, and more for higher-order multiples, result in PTB.^{7,112} The concern that sexual activity will increase this risk of PTB is speculated because of reports noting early cervical dilation or shortening in these pregnancies.^{113,114} It is hypothesized that the dilated cervix in twin or higher-order multiple pregnancies is more susceptible to the effects of sexual activity.

To date, there are 2 studies that specifically address the issue of safety of sexual activity in twin pregnancies.^{115,116} The initial prospective cohort study by Neilson and Mutambira¹¹⁵ from 1989 concluded that coitus was not an important precipitant of PTL in twin pregnancies and, further, that coitus should not be prohibited in these women. However, there was no discussion on the proximity of last sexual act to delivery, nor any specific data regarding the sexual acts (presence or absence of women's orgasm, presence or absence of ejaculation within the vagina).¹¹⁵ A more recent study, also a prospective cohort, of 50 patients with twin pregnancies not complicated by any other high-risk diagnosis found no

association between sexual activity and PTB. When women with or without PTB before 34 weeks were compared, risk factors for pre-term delivery were found to be equally distributed between the 2 groups. This article evaluated the temporal relationship between last sexual intercourse and the onset of labor and found no correlation. Specific data regarding the sexual acts were also assessed, specifically whether women's orgasm was present and whether vaginal ejaculation occurred. Again, the results showed no difference in either of those sexual factors and PTB. One of the major limitations of this publication is the small sample size and the ability to draw reliable conclusions.¹¹⁶ In terms of specific sexual acts, nipple stimulation presumably is safe since CSTs performed in twin gestation reported no complications.¹¹⁷

There is no preceding literature evaluating sexual activity in higher-order multiple gestations other than twins. Presumably the same concern over the potentially compromised cervix and risk of PTB would be present. In the absence of other obstetric complications, the data from the twin studies could be extrapolated to higher-order multiples. This suggests that intercourse with or without the presence of women's orgasm or semen would not increase the risk of pre-term delivery over the already inherent increased risk. Similarly, the safety of genital or nipple stimulation or even the direct contact on the vagina and cervix would convey similar effects as in twin gestations.

Recommendation

- Level II-2: sexual activity of any type should not be discouraged in twin gestation.
- The literature did not provide any data or expert opinion on sexual activity recommendations in higher-order multiple gestations.
- Author's opinion:
 - In the absence of other obstetric risk factors, sexual activity of any type need not be restricted in twin or higher-order multiple gestations.
 - Individualize recommendations based on consideration of obstetric history and comorbidities as well as patient and partner fears and emotional needs.
 - Further research is needed to make validated recommendations.

Prior Classical Cesarean Section

The safety of coitus or any other sexual acts in women with a classical cesarean section has not been studied directly. In the United States there are on average 200–300 classical cesarean sections performed annually, approximately 1% of all cesarean sections. While the risk of uterine rupture pre-labor is only 2%, this dramatically increases to 6% during labor.¹¹⁸ Hypothetically, any sexual stimulation leading to contractions would be of concern for posing a risk of uterine rupture, since the majority of uterine ruptures in women with a history of a prior classical cesarean section occur during labor.⁵

To date, there is only 1 case report of uterine rupture in a woman with a history of a classical cesarean section after intercourse.¹¹⁹ The uterine rupture occurred at 15 weeks' gestation immediately following intercourse. This article does not discuss any specifics of the sexual act or describe whether the patient had experienced orgasm or felt uterine contractions after intercourse. Thus, the hypothesis that coitus induced uterine contractions resulting in uterine rupture was not clearly delineated. In addition, there are only 3 other case reports of uterine rupture related to intercourse in women with prior cesarean sections.^{120–122}

According to the ACOG Guidelines on Antepartum Fetal Surveillance, a history of extensive uterine surgery or classic cesarean delivery is a relative contraindication to the CST because this condition is associated with an increased risk of uterine rupture.⁹⁵ If inducing uterine contractions by nipple stimulation is a relative contraindication in women with a prior classical cesarean section due to the risk of uterine rupture then any type of sexual stimulation leading to uterine contractions may be contraindicated. Chayen et al⁵¹ in 1985 stated, "It is postulated that coitus is equivalent to an unmonitored contraction stress test." A 2017 review of characteristics of uterine ruptures concluded that hyperstimulation should be avoided.¹²³ To date, there are only isolated events or case reports of hyperstimulation as a result of women's orgasm, coitus, or nipple stimulation in pregnancy compared to the vast majority of women who do not experience a uterine contraction pattern with hyperstimulation.²⁹

Since there are no current recommendations against intercourse or any other specific sexual act in patients with a prior classical cesarean section, it is unlikely that most of these women are abstaining from coitus. If sexual activity were increasing the risk of uterine rupture, then there would likely be higher reporting of antepartum uterine ruptures in non-laboring patients. However, women with a prior classical cesarean section typically have other comorbidities as the etiology for which resulted in the classical cesarean section that may need to be considered when reviewing the safety of sexual practices in these women.

Recommendations

- The literature did not provide any data or expert opinion on sexual activity recommendations with a history of classical cesarean section.
- Author's opinion:
 - In the absence of other obstetric risk factors, a history of a classical cesarean section alone would not necessitate sexual activity restrictions of any type.
 - Women who experience very painful or intense, prolonged uterine contractions following any sexual activity should limit that specific sexual activity.
 - Individualize recommendations based on consideration of obstetric history and comorbidities as well as patient and partner fears and emotional needs.

- Further research is needed to make validated recommendations.

CONCLUSION

Restricting sexual activity in women with high-risk pregnancies has far-reaching implications. Pregnancy is a time of bonding, sharing, and intimacy. For many couples, sexual activity and intimacy lose priority over the safety of the baby and mother, sometimes creating distance between partners. Other at-risk couples seek to maintain some kind of physical connectedness as a coping mechanism. To completely restrict the intimacy impacts the health of the relationship physically and emotionally and further increases stress and fear.^{124–126}

While the data are sparse, it is important for clinicians to educate themselves on what information does exist regarding the risks that specific sexual acts may incur on complicated pregnancies to be more comfortable initiating a conversation. Recommendations of pelvic rest or strict pelvic rest are insufficient. Patients need an explicit discussion of the specifics of what is safe and what is not.^{124–126}

Careful consideration of what specific aspects of sex are concerning may aid in formulating recommendations. Is it the concern of what the PGs in semen will do to a compromised cervix? Is it the concern that contraction intensity and duration from genital stimulation with or without orgasm will lead to labor? Or is it the concern that direct contact with vaginal or anal penetration will put damaging pressure on a vulnerable cervix or lower uterine segment? Another important factor is that not all women have similar responses to sexual stimuli, thus allowing some women to safely continue to experience orgasm with minimal to no physical consequences. In some situations, it may be necessary to restrict all of these elements, as in coitus. While most of these couples will accept the restrictions given, intimacy can still be recommended by encouraging patients to be physically close by kissing, hugging, and cuddling. It is important to recognize the need to balance restrictions, in light of limited data, with the impact that restrictions have on the couple, and the personal stress and health of the woman.

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REFERENCES

1. von Sydow K. Sexuality during pregnancy and after childbirth: a metacontent analysis of 59 studies. *J Psychosom Res* 1999;47:27-49.
2. Gökyıldız S, Beji NK. The effects of pregnancy on sexual life. *J Sex Marital Ther* 2005;31:201-215.
3. Bartellas E, Crane JM, Daley M, Bennett KA, Hutchens D. Sexuality and sexual activity in pregnancy. *BJOG* 2000;107:964-968.
4. Foux R. Sex education in pregnancy: does it exist? A literature review. *Sex Relation Ther* 2008;23:271-277.
5. Simhan HG, Iams J, Romero R. Preterm labor and birth. In: Gabbe SG, Niebyl JR, Simpson JL, et al., eds. *Obstetrics: normal and problem pregnancies*. 7th ed. Philadelphia, PA: Elsevier; 2016.
6. Cunningham FG, Williams JW. *Williams obstetrics*. 23rd ed. New York, NY: McGraw-Hill, Medical; 2010.
7. Creasy RK, Resnik R, Iams JD. *Creasy and Resnik's maternal-fetal medicine: principles and practice*. 6th ed. Philadelphia, PA: Saunders/Elsevier; 2009.
8. Solberg DA, Butler J, Wagner NN. Sexual behavior in pregnancy. *N Engl J Med* 1973;288:1093-1103.
9. Perkins RP. Sexual behavior and response in relation to complications of pregnancy. *Obstet Gynecol* 1979;134:498-505.
10. Klebanoff M, Nugent R, Rhoads G. Coitus during pregnancy: is it safe? *Lancet* 1984;324:914-917.
11. Johnson CE. Sexual health during pregnancy and the postpartum. *J Sex Med* 2011;8:1267-1284.
12. Jones C, Chan C, Farine D. Sex in pregnancy. *Can Med Assoc J* 2011;183:815-818.
13. Newton N. The role of the oxytocin reflexes in three interpersonal reproductive acts: coitus, birth and breastfeeding. *Clin Psychoneuroendocrinol Reprod* 1978;22:411-418.
14. Masters WH, Johnson VE. *Human sexual response*. Boston, MA: Little, Brown and Co; 1966.
15. Carmichael MS, Humbert R, Dixen J, Palmisano G, Greenleaf W, Davidson JM. Plasma oxytocin increases in the human sexual response. *J Clin Endocrinol Metab* 1987;64:27-31.
16. Ferguson JKW. A study of the motility of the intact uterus at term. *Surg Gynecol Obstet* 1941;73:359-366.
17. Kelly RW. Prostaglandins in semen: their occurrence and possible physiological significance. *Int J Androl* 1978;1:188-200.
18. Bohlen JG, Held JP, Sanderson MO, Ahlgren A. The female orgasm: pelvic contractions. *Arch Sex Behav* 1982;11:367-386.
19. Houston TP, Elster AB, Davis RM, Deitchman SD. The US Preventive Services Task Force guide to clinical preventive services, AMA Council on Scientific Affairs. *Am J Prev Med* 1998;14:374-376.
20. Solberg AD, Butler J, Wagner NN. Sexual behavior in pregnancy. In: Lopiccio J, Lopiccio L (eds). *Handbook of sex therapy. Perspectives in Sexuality*. Springer Boston: 1978. p. 361-362.
21. Naeye RL, Ross S. Coitus and chorioamnionitis: a prospective study. *Early Hum Dev* 1982;6:91-97.
22. Goodlin RC, Keller DW, Raffin M. Orgasm during late pregnancy: possible deleterious effects. *Obstet Gynecol* 1971;38:916-920.
23. Naeye RL. Coitus and associated amniotic-fluid infections. *N Engl J Med* 1979;301:1198-1200.
24. Pugh WE, Fernandez FL. Coitus in late pregnancy: a follow-up study of the effects of coitus on late pregnancy, delivery, and the puerperium. *Obstet Gynecol* 1953;2:636-642.
25. Sayle AE, Savitz DA, Thorp JM, Hertz-Picciotto I, Wilcox AJ. Sexual activity during late pregnancy and risk of preterm delivery. *Obstet Gynecol* 2001;97:283-289.
26. Mills J, Harlap S, Harley E. Should coitus late in pregnancy be discouraged? *Lancet* 1981;318:136-138.
27. Rayburn WF, Wilson EA. Coital activity and premature delivery. *Am J Obstet Gynecol* 1980;137:972-974.
28. Kavanagh J, Kelly AJ, Thomas J. Sexual intercourse for cervical ripening and induction of labor. *Cochrane Database Syst Rev* 2001;2:CD003093.
29. Kavanagh J, Kelly AJ, Thomas J. Breast stimulation for cervical ripening and induction of labor. *Cochrane Database Syst Rev* 2005;32:323-324.
30. Embrey MP. The effect of prostaglandins on the human pregnant uterus. *BJOG* 1969;76:783-789.
31. Olson DM. The role of prostaglandins in the initiation of parturition. *Best Pract Res Clin Obstet Gynaecol* 2003;17:717-730.
32. Keirse MJ, Turnbull AC. E prostaglandins in amniotic fluid during late pregnancy and labor. *J Obstet Gynaecol Br Commonw* 1973;80:970-973.

33. Keirse MJ, Flint AP, Turnbull AC. F prostaglandins in amniotic fluid during pregnancy and labor. *J Obstet Gynaecol Br Commonw* 1974;81:131-135.
34. Templeton AA, Cooper I, Kelly RW. Prostaglandin concentrations in the semen of fertile men. *J Reprod Fertil* 1978;52:147-150.
35. Bendvold E, Gottlieb C, Svanborg K, Bygdeman M, Eneroth P. Concentration of prostaglandins in seminal fluid of fertile men. *Int J Androl* 1987;10:463-469.
36. Platz-Christensen JJ, Pernevi P, Bokström H, Wiqvist N. Prostaglandin E and F₂α concentration in the cervical mucus and mechanism of cervical ripening. *Prostaglandins* 1997;53:253-261.
37. Tan PC, Yow CM, Omar SZ. Effect of coital activity on onset of labor in women scheduled for labor induction: a randomized controlled trial. *Obstet Gynecol* 2007;110:820-826.
38. Schaffir J. Sexual intercourse at term and onset of labor. *Obstet Gynecol* 2006;107:1310-1314.
39. Kafaei Atrian M, Sadat Z, Rasolzadeh Bidgoly M, Abbaszadeh F, Asghari Jafarabadi M. The association of sexual intercourse during pregnancy with labor onset. *Iran Red Crescent Med J* 2015;17:e16465.
40. Tan PC, Andi A, Azmi N, Noraihan MN. Effect of coitus at term on length of gestation, induction of labor, and mode of delivery. *Obstet Gynecol* 2006;108:134-140.
41. Mitchell M, Flint A, Bibby J, et al. Rapid increases in plasma prostaglandin concentrations after vaginal examination and amniotomy. *Obstet Gynecol Surv* 1978;33:385.
42. Novy MJ, Ducsay CA, Stanczyk FZ. Plasma concentrations of prostaglandin F₂ alpha and prostaglandin E₂ metabolites after transabdominal and transvaginal cervical cerclage. *Am J Obstet Gynecol* 1987;156:1543.
43. Chayen B, Scott E, Cheng CC, Perera C, Schiffer MA. Contraction stress test by breast stimulation as part of antepartum monitoring. *Acta Obstet Gynecol Scand* 1985;64:3-6.
44. Lemke RR, Nemes JM. Use of nipple stimulation to obtain contraction stress test. *Obstet Gynecol* 1984;63:345-348.
45. Chayen B, Tejani N, Verma U. Induction of labor with an electric breast pump. *J Reprod Med* 1986;31:116-118.
46. Huddleston J, Sutliff G, Robinson D. Contraction stress test by intermittent nipple stimulation. *Obstet Gynecol* 1984;63:669-673.
47. Braly PS, Freeman RK, Garite TJ, Anderson GG, Dorchester W. Incidence of premature delivery following the oxytocin challenge test. *Am J Obstet Gynecol* 1981;141:5-8.
48. Pranzarone GF. Sexuoerotic stimulation and orgasmic response in the induction and management of parturition-clinical possibilities. In: *Proceedings of First International Conference on Orgasm*. Bombay, India: Vrp Publishers; 1991. p. 105-119.
49. Baxter S. Labor and orgasm in primiparae. *J Psychosom Res* 1974;18:209-216.
50. Goodlin RC, Schmidt W, Creevy DC. Uterine tension and fetal heart rate during maternal orgasm. *Obstet Gynecol* 1972;39:125.
51. Chayen B, Tejani N, Verma U, Gordon G. Fetal heart rate changes and uterine activity during coitus. *Acta Obstet Gynecol Scand* 1986;65:853-855.
52. Meston CM, Levin RJ, Sipski ML, Hull EM, Heiman JR. Women's orgasm. *Annu Rev Sex Res* 2004;15:173-257.
53. Singer J, Singer I. Types of female orgasm. *J Sex Res* 1972;8:255-267.
54. King R, Belsky J, Mah K, Binik Y. Are there different types of female orgasm? *Arch Sex Behav* 2011;40:865-875.
55. March of Dimes. 2016 Premature birth report card. Available at: <https://www.marchofdimes.org/materials/premature-birth-report-card-united-states.pdf>. Accessed October 10, 2017.
56. Brown HL. Air embolism during pregnancy. *Obstet Gynecol* 2008;111:481-482.
57. Garnier F, Masson G, Bedu A, et al. Maternofetal infections due to *Eikenella corrodens*. *J Med Microbiol* 2009;58:273-275.
58. Jeppson KG, Reimer LG. *Eikenella corrodens* chorioamnionitis. *Obstet Gynecol* 1991;78:503-505.
59. Buisson O, Foldes P, Jannini E, Mimoun S. Coitus as revealed by ultrasound in one volunteer couple. *J Sex Med* 2010;7:2750-2754.
60. Hotchkiss J. Revealed: can a man poke the baby in the head during sex with his pregnant partner? Available at: https://www.huffingtonpost.com/jon-hotchkiss/revealed-can-a-man-poke-t_b_3625787.html. Accessed October 10, 2017.
61. Casey PM, Long ME, Marnach ML. Abnormal cervical appearance: what to do, when to worry? *Mayo Clin Proc* 2011;86:147-151.
62. Mercer BM, Macpherson CA, Goldenberg RL, et al. Are women with recurrent spontaneous preterm births different from those without such history? *Obstet Gynecol* 2006;194:1176-1184.
63. Read JS, Klebanoff MA. Prematurity study group. Sexual intercourse during pregnancy and preterm delivery: effects of vaginal microorganisms. *Am J Obstet Gynecol* 1993;168:514-519.
64. Wagner NN, Butler JC, Sanders JP. Prematurity and orgasmic coitus during pregnancy: data on a small sample. *Fertil Steril* 1976;27:911-915.
65. Spong CY. Prediction and prevention of recurrent spontaneous preterm birth. *Obstet Gynecol* 2007;110:405-415.
66. Yost NP, Owen J, Berghella V, et al. Effect of coitus on recurrent preterm birth. *Obstet Gynecol* 2006;107:793-797.
67. American College of Obstetricians and Gynecologists. Practice bulletin no. 130: prediction and prevention of preterm birth. *Obstet Gynecol* 2012;120:964-973.
68. Robinson JN, Norwitz ER. Preterm birth: risk factors and interventions for risk reduction. Available at: <https://www.uptodate.com/contents/preterm-birth-risk-factors-and-interventions-for-risk-reduction>. Accessed October 10, 2017.

69. Mercer BM. Preterm premature rupture of the membranes: diagnosis and management. *Clin Perinatol* 2004;**31**:765-782.
70. Tambyraja RL, Salmon JA, Karim SMM, Ratnam SS. F prostaglandin levels in amniotic fluid in premature labor. *Prostaglandins* 1977;**13**:339-348.
71. Christensson K, Nilsson BA, Stock S, Matthiesen AS, Uvns-Moberg K. Effect of nipple stimulation on uterine activity and on plasma levels of oxytocin in full term, healthy, pregnant women. *Acta Obstet Gynecol Scand* 1989;**68**:205-210.
72. Brustman LE, Raptoulis M, Langer O, Anyaegbunam A, Merkatz IR. Changes in the pattern of uterine contractility in relationship to coitus during pregnancies at low and high risk for preterm labor. *Obstet Gynecol* 1989;**73**:166-168.
73. Iams JD, Newman RB, Thom EA, et al; National Institute of Child Health and Human Development Network of Maternal-Fetal Medicine Units. Frequency of uterine contractions and the risk of spontaneous preterm delivery. *N Engl J Med* 2002;**346**:250-255.
74. Gilner J, Biggio J. Management of short cervix during pregnancy: a review. *Am J Perinatol* 2016;**33**:245-252.
75. Iams JD, Goldenberg RL, Meis PJ, et al; National Institute of Child Health and Human Development Maternal Fetal Medicine Unit Network. The length of the cervix and the risk of spontaneous premature delivery. *N Engl J Med* 1996;**334**:567-572.
76. Vaisbuch E, Romero R, Mazaki-Tovi S, et al. The risk of impending preterm delivery in asymptomatic patients with a nonmeasurable cervical length in the second trimester. *Am J Obstet Gynecol* 2010;**203**:446.e1-446.e9.
77. Grobman WA, Gilbert SA, Iams JD, et al. Activity restriction among women with a short cervix. *Obstet Gynecol* 2013;**121**:1181.
78. Alfirevic Z, Owen J, Carreras Moratonas E, Sharp AN, Szychowski JM, Goya M. Vaginal progesterone, cerclage or cervical pessary for preventing preterm birth in asymptomatic singleton pregnant women with a history of preterm birth and a sonographic short cervix. *Ultrasound Obstet Gynecol* 2013;**41**:146-151.
79. Berghella V. Cervical insufficiency. Available at: <https://www.uptodate.com/contents/cervical-insufficiency>. Accessed October 10, 2017.
80. American College of Obstetricians and Gynecologists. ACOG practice bulletin no 142: cerclage for the management of cervical insufficiency. *Obstet Gynecol* 2014;**123**:372-379.
81. Owen J, Hankins G, Iams J, et al. Multicenter randomized trial of cerclage for preterm birth prevention in high-risk women with shortened midtrimester cervical. *Am J Obstet Gynecol* 2009;**201**:375.e1.
82. Norwitz ER. Transvaginal cervical cerclage. Available at: <https://www.uptodate.com/contents/transvaginal-cervical-cerclage>. Accessed October 10, 2017.
83. Kurki T, Ylikorkala O. Coitus during pregnancy is not related to bacterial vaginosis or preterm birth. *Obstet Gynecol* 1993;**169**:1130-1134.
84. Eisenberg DL, Tyson N, Espey E. Clinical challenges of long-acting reversible contraceptive methods. *Obstet Gynecol* 2016;**128**:E77.
85. Hubacher D, Grimes DA, Gemzell-Danielsson K. Pitfalls of research linking the intrauterine device to pelvic inflammatory disease. *Obstet Gynecol* 2013;**121**:1091-1098.
86. Robertson SA, Mau VJ, Tremellen KP, Seamark RF. Role of high molecular weight seminal vesicle proteins in eliciting the uterine inflammatory response to semen in mice. *J Reprod Fertil* 1996;**107**:265-277.
87. Lee SE, Romero R, Park C, Jun JK, Yoon BH. The frequency and significance of intraamniotic inflammation in patients with cervical insufficiency. *Obstet Gynecol* 2008;**198**:633.e8.
88. Romero R, Espinoza J, Erez O, Hassan S. The role of cervical cerclage in obstetric practice: can the patient who could benefit from this procedure be identified? *Am J Obstet Gynecol* 2006;**194**:1-9.
89. American College of Obstetricians and Gynecologists. ACOG practice bulletin no 172: premature rupture of membranes. *Obstet Gynecol* 2016;**128**:934-936.
90. Ekwo EE, Gosselink CA, Woolson R, Moawad A, Long CR. Coitus late in pregnancy: risk of preterm rupture of amniotic sac membranes. *Am J Obstet Gynecol* 1993;**168**:22-31.
91. Mercer BM. Preterm premature rupture of the membranes. *Obstet Gynecol* 2003;**101**:178-193.
92. Dinsmoor MJ, Bachman R, Haney EI, Goldstein M, MacKendrick W. Outcomes after expectant management of extremely preterm premature rupture of the membranes. *Obstet Gynecol* 2004;**190**:183-187.
93. Waters TP, Mercer B. Preterm PROM: prediction, prevention, principles. *Clin Obstet Gynecol* 2011;**54**:307-312.
94. Lewis D, Major C, Towers C, Asrat T, Harding J, Garite T. Effects of digital vaginal examinations on latency period in preterm premature rupture of membranes. *Obstet Gynecol* 1992;**80**:630-634.
95. American College of Obstetricians and Gynecologists. ACOG practice bulletin no 9: antepartum fetal surveillance. *Obstet Gynecol* 1999;**9**:32-34.
96. Oyelese Y, Smulian JC. Placenta previa, placenta accreta, and vasa previa. *Obstet Gynecol* 2006;**107**:927-941.
97. Silver R, Depp R, Sabbagha RE, Dooley SL, Socol ML, Tamura RK. Placenta previa: aggressive expectant management. *Am J Obstet Gynecol* 1984;**150**:15-22.
98. Johnson HW. The management of placenta previa: a review of 201 cases with emphasis on conservatism. *Obstet Gynecol* 1950;**59**:1236-1242.
99. Timor-Tritsch IE, Yunis RA. Confirming the safety of transvaginal sonography in patients suspected of placenta previa. *Obstet Gynecol* 1993;**8**:742-744.
100. Faix A, Lapray JF, Calde O, Maubon A, Lanfrey K. Magnetic resonance imaging (MRI) of sexual intercourse: second experience in missionary position and initial experience in posterior position. *J Sex Marital Ther* 2002;**28**:63-76.
101. Schaffner F, Schanzer SN. Cervical dilatation in the early third trimester. *Obstet Gynecol* 1966;**27**:130-133.

102. Lockwood CJ, Russo-Stieglitz K. Placenta previa: management. Available at: <https://www.uptodate.com/contents/placenta-previa-management>. Accessed October 10, 2017.
103. Mabie WC. Placenta previa. *Clin Perinatol* 1992;19:425-435.
104. Stafford IA, Dashe JS, Shivvers SA, Alexander JM, McIntire DD, Leveno KJ. Ultrasonographic cervical length and risk of hemorrhage in pregnancies with placenta previa. *Obstet Gynecol* 2010;116:595-600.
105. Rasmussen S, Irgens LM, Bergsjø P, Dalaker K. The occurrence of placental abruption in Norway 1967–1991. *Acta Obstet Gynecol Scand* 1996;75:222-228.
106. Oyelese Y, Ananth CV. Placental abruption. *Obstet Gynecol* 2006;108:1005-1016.
107. Naeye RL. Coitus and antepartum hemorrhage. *BJOG* 1981;88:765-770.
108. Brink AL, Odendaal HJ. Risk factors for abruptio placentae. *S Afr Med J* 1987;72:250-252.
109. Taylor RN, Green JR. Abruptio placentae following nipple stimulation. *Am J Perinatol* 1987;4:94-97.
110. Westgate SE. Breastfeeding and placental abruption. *J Obstet Gynaecol* 1997;17:164-165.
111. Aziken ME. Abruptio placenta following sexual intercourse: case report. *Niger Postgrad Med J* 2003;10:113-114.
112. National Collaborating Center for Women's and Children's Health (UK). Multiple pregnancy: the management of twin and triplet pregnancies in the antenatal period (NICE clinical guidelines, no. 129), preterm birth. London, United Kingdom: RCOG Press; 2011.
113. Imseis HM, Albert TA, Iams JD. Identifying twin gestations at low risk for preterm birth with a transvaginal ultrasonographic cervical measurement at 24 to 26 weeks' gestation. *Am J Obstet Gynecol* 1997;177:1149-1155.
114. Neilson JP, Verkuyl DA, Crowther CA, Bannerman C. Preterm labor in twin pregnancies: prediction by cervical assessment. *Obstet Gynecol* 1988;72:719-723.
115. Neilson JP, Mutambira M. Coitus, twin pregnancy, and preterm labor. *Am J Obstet Gynecol* 1989;160:416-418.
116. Stammli-Safar M, Ott J, Weber S, Krampfl E. Sexual behavior of women with twin pregnancies. *Twin Res Hum Genet* 2010;4:383-388.
117. Knuppel RA, Rattan PK, Scerbo JC, O'Brien WF. Intrauterine fetal death in twins after 32 weeks of gestation. *Obstet Gynecol* 1985;65:172-175.
118. Chauhan SP. Prior classical cesarean delivery counseling and management. *Contemporary OB/GYN* 2012;57.
119. Endres LK, Barnhart K. Spontaneous second trimester uterine rupture after classical cesarean. *Obstet Gynecol* 2000;96:806-808.
120. Tan TL, Kolhe S, Shafik A. Spontaneous uterine rupture following intercourse in a scarred uterus. *J Obstet Gynaecol* 2005;25:392.
121. Tsai HF, Song HL, Chen WC, Chang CM, Chang CH, Lee IW. Delayed uterine rupture occurred 4 weeks after cesarean section following sexual intercourse: a case report and literature review. *Taiwan J Obstet Gynecol* 2013;52:411-414.
122. Nassar A, Usta I, Finianos A, Kaspar H. Spontaneous uterine rupture following intercourse. *Acta Obstet Gynecol Scand* 2004;83:114-115.
123. Vlemminx M, de Lau H, Oei S. Tocogram characteristics of uterine rupture: a systematic review. *Arch Gynecol Obstet* 2017;295:17-26.
124. Polomeno V. Sex and pregnancy: a perinatal educator's guide. *J Perinat Educ* 2000;9:15-27.
125. Johnston SH, Kraut DA. Pregnancy bedrest: a guide for the pregnant woman and her family. New York, NY: Henry Holt and Co; 1990.
126. Lyerly AD, Mitchell LM, Armstrong EM, et al. Risk and the pregnant body. *Hastings Cent Rep* 2009;39:34-42.