

## American College of Radiology ACR Appropriateness Criteria®

**Clinical Condition:**                      **Assessment of Gravid Cervix**

**Variant 1:**                                      **Patient not at risk for preterm delivery: 16-24 weeks gestation; cervix <3 cm long or suggestion of funneling by transabdominal ultrasound examination.**

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
US pregnant uterus (transvaginal or transperineal) report minimum cervical length in mm or cm	9	Assess for cervical change several times over a 10-minute period.	None
US pregnant uterus (transvaginal or transperineal) report endocervical diameter in mm (if no residual cervical length)	9		None
US pregnant uterus (transvaginal or transperineal) cervical stress test	6	Performed only in settings with provisions for labor and delivery.	None
<b><u>Rating Scale:</u> 1=Least appropriate, 9=Most appropriate</b>			<b>*Relative Radiation Level</b>

**Variant 2:**                                      **Patient at risk for preterm delivery (history of prior preterm birth or multiple gestations): 16-24 weeks gestation: cervix ≤3 cm long by transabdominal or transvaginal ultrasound examination.**

Radiologic Procedure	Rating	Comments	<a href="#">RRL*</a>
US pregnant uterus (transvaginal or transperineal) report minimum cervical length in mm or cm	9	Assess for cervical change several times over a 10-minute period.	None
US pregnant uterus (transvaginal or transperineal) report endocervical diameter in mm (if no residual cervical length)	9		None
US pregnant uterus (transvaginal or transperineal) cervical stress test	7	Performed only in settings with provisions for labor and delivery.	None
<b><u>Rating Scale:</u> 1=Least appropriate, 9=Most appropriate</b>			<b>*Relative Radiation Level</b>

## ASSESSMENT OF GRAVID CERVIX

Expert Panel on Women's Imaging: Teresita L. Angtuaco, MD<sup>1</sup>; Nidhi Gupta, MD<sup>2</sup>; Rochelle F. Andreotti, MD<sup>3</sup>; Susanna I. Lee MD, PhD<sup>4</sup>; Sandra O. DeJesus Allison, MD<sup>5</sup>; Mindy M. Horrow, MD<sup>6</sup>; Marcia C. Javitt, MD<sup>7</sup>; Anna S. Lev-Toaff, MD<sup>8</sup>; Leslie M. Scouff, MD<sup>9</sup>; Carolyn Zelop, MD.<sup>10</sup>

### **Summary of Literature Review**

The term *cervical incompetence* was first introduced in 1948 by Palmer and Lacomme [1]. This condition, which is characterized by painless midtrimester cervical dilatation, has a reported incidence of 1% and may be responsible for as many as 20% of second trimester miscarriages [2].

As a result of recent investigations that recognize features shared by women with cervical incompetence and those with premature labor, the concept of cervical incompetence as an "all or none" phenomenon has been challenged [3,4]. Cervical incompetence is believed to represent a continuum that relates to cervical length and pregnancy history [5,6].

Regardless of the precise definition for this condition, there is no debate that preterm birth (<37 weeks of gestation) continues as the leading cause of perinatal morbidity and mortality. Consequently, it remains a major obstetrical challenge. Various methods for diagnosing preterm cervical dilatation have been proposed.

### **Digital Examination**

Initial assessment is usually clinical and is based on digital palpation of the cervix. This examination can detect changes in cervical texture such as softening (which occurs as a precursor to delivery), and it can appreciate distensibility of the external os. These findings occur relatively late in the process of cervical dilatation, however, and in some cases are found too late to be reversed. Further, some physicians question the accuracy of digital measurements, which consistently underestimate measurements made by transperineal or transvaginal ultrasound (US) [7-13]. Most likely, this inaccuracy is due to the anatomic configuration of the

cervix because the portion of cervix that lies above the anterior fornix or above the bladder base is hidden from the examiner's fingers. The digital examination has other limitations: 1) it is a subjective assessment; 2) the internal cervical os, which reflects initial changes associated with premature cervical dilatation, is beyond the examiner's reach; and 3) there are potential side effects that include risk of infection and ruptured membranes [8].

Nonetheless, if a patient is clinically at risk for preterm delivery, or if the US examination detects a short cervical length, some obstetrician-gynecologists may perform a digital cervical examination. Once the patient is near term (>37 weeks), and early delivery is no longer an issue, this examination can be omitted, unless clinically indicated for other reasons. To optimize the results and patient management, it is important to correlate the findings of the US examination with the digital examination.

### **Sonographic Examination**

Unlike digital examination, sonographic measurement of cervical length generates an image that may be reviewed and standardized, thus overcoming subjectivity.

*Normal-appearing cervix:* During pregnancy, the length of the cervix does not elongate appreciably. Most authorities consider 3.0 cm in length as the lower limit of normal. In one large prospective, multicenter study, 4.0 cm was reported as the 75th percentile, 3.5 cm as the 50th percentile, 3.0 cm as the 25th percentile, and 2.6 as the 10th percentile [5].

*Transabdominal evaluation:* Although most obstetrical sonographic examinations are done transabdominally, it is the least reliable imaging method for evaluating the cervix. Using this approach, bladder overdistension as well as myometrial contractions can change the appearance of the lower uterine segment and cervix, creating a deceptively normal appearance in women with cervical effacement, shortening, or frank dilatation. Furthermore, an underdistended bladder may preclude adequate cervical visualization for any one of a variety of reasons: acoustic shadowing from the pubic symphysis, refractive shadowing from the bladder-uterine interface, and loss of the acoustic window provided by the urinary bladder and/or amniotic fluid, or an inability to manually displace the fetal head or other presenting part superiorly away from the lower uterine segment. Even when visible on a transabdominal scan, the cervical image is usually suboptimal. Because the external os is often not clearly identified, a technically correct cervical length measurement may not be possible. Therefore, if a patient has a clinical history or sonographic findings suspicious for cervical pathology, consideration should be given to cervical scanning using either a transperineal or transvaginal approach.

*Transperineal/transvaginal evaluation:* These approaches are the most accurate for assessing the cervix, although bladder distension and myometrial contractions may still

<sup>1</sup>Principal Author, University of Arkansas Medical Sciences, Little Rock, Arkansas.

<sup>2</sup>Research Author, University of Arkansas Medical Sciences, Little Rock, Arkansas.

<sup>3</sup>Panel Chair, Vanderbilt University Medical Center, Nashville, Tennessee.

<sup>4</sup>Panel Vice-chair, Massachusetts General Hospital, Boston, Massachusetts.

<sup>5</sup>Georgetown Hospital, Washington, District of Columbia.

<sup>6</sup>Albert Einstein Medical Center, Philadelphia, Pennsylvania.

<sup>7</sup>Walter Reed Army Medical Center, Washington, District of Columbia.

<sup>8</sup>Thomas Jefferson University Hospital, Philadelphia, Pennsylvania.

<sup>9</sup>Yale University School of Medicine, New Haven, Connecticut.

<sup>10</sup>St. Francis Hospital and Medical Center, Hartford, Connecticut, American College of Obstetrics and Gynecology.

The American College of Radiology seeks and encourages collaboration with other organizations on the development of the ACR Appropriateness Criteria through society representation on expert panels. Participation by representatives from collaborating societies on the expert panel does not necessarily imply society endorsement of the final document.

Reprint requests to: Department of Quality & Safety, American College of Radiology, 1891 Preston White Drive, Reston, VA 20191-4397.

give a falsely normal cervical appearance. When the cervix is well visualized, transperineal US can predict preterm delivery as accurately as transvaginal US [14]. Cervical length is determined as the distance between the internal and external os. The internal os is normally at the level where the cervical canal meets the amniotic sac. The external os is often more difficult to define precisely because of acoustic shadowing from rectal gas. This problem can be minimized by either scanning the patient in a lateral decubitus position or elevating the hips and buttocks on a thick pad or pillow [15,16].

In patients at risk for cervical shortening or incompetence, some investigators suggest performing a cervical “stress test” by either applying transfundal pressure while scanning transvaginally or examining the patient while she is standing [17,18]. Because some patients will initially have a completely normal-appearing cervix, these important maneuvers may identify additional women who may require treatment for preterm cervical dilatation. If the cervix is already dilated or short, the cervical stress test may not be necessary because it may compound the problem by inducing further dilatation and shortening.

*Abnormal-appearing cervix:* Although the clinical presentation varies, from an imager's point of view cervical changes are essentially identical in patients in term labor, preterm labor, or cervical incompetence. In each of these clinical situations, cervical dilatation begins proximally, at the level of the internal os, and progresses distally. As the internal os dilates, membranes and amniotic fluid invaginate into the proximal endocervical canal. The most accepted terminology for these changes is *funneling*, although *wedging* or *beaking* have also been used [5,19-21]. The disruption of the internal os, as documented by funneling, is a significant risk factor for adverse perinatal outcome. Cervical funneling is best described as a categorical variable (present or absent) [22]. In fact in a large series of 1,958 patients, the mean gestational age at delivery was significantly lower in the group with funneling compared with the group without funneling [23].

Eventually the entire endocervical canal becomes filled with fluid, and if the membranes remain intact, they may be visible bulging into the vagina. Concurrent with dilatation, the cervix becomes effaced and shortened. Dilatation and effacement typically progress simultaneously, although, in a given patient, one or the other event may appear to predominate. Investigators have recommended quantifying these cervical changes using a variety of measuring techniques, but the simplest and most reproducible measurement in sensitivity and predictive value appears to be the residual closed length of the cervix [5]. This calculation, which takes into account both dilatation and effacement, can be obtained by measuring from the distal apex of endocervical funneling at the internal os to the external os. Analysis by Dilek et al [24] of low-risk pregnancies studied with transvaginal US indicates that using a cutoff value for cervical length of 33.15 mm yields an 80% sensitivity for predicting preterm delivery. This cutoff value resulted in

a 12.7% false positive rate. Another multicenter observational study done for cervical length on transvaginal US from 16-24 weeks gestation categorized short cervical lengths as less than 25 mm, 25-29 mm, and 30 mm or greater. In both, the less than 25 mm group and 25-29 mm group, the incidence of spontaneous midtrimester birth (<26 weeks) was higher than the incidence of later (26-34 weeks) preterm birth (<25 mm group: 37% vs 19%; 25-29 mm group: 16% vs 3%, respectively) as compared with women with a longer cervical length of 30 mm or greater, who had rates of 1% and 9% respectively (P<.0001). Similarly, women who had an initial cervical length 30 mm or less and those who shortened their cervix to 30 mm or less before 22 weeks were also more likely to experience a midtrimester than later preterm birth. On the other hand, women whose cervix has shortened to 30 mm or less after 24 weeks or maintained a length greater than 30 mm had lower rates of midtrimester birth (P<.0001) [25].

If a woman is clinically at risk for preterm delivery (such as prior preterm birth and multifetal gestation), or if a short cervix is detected by sonography, the precise length of the cervix should be measured and reported (this measurement is based on transperineal or transvaginal scans). Endocervical canal dilation of 2-4 mm during second-trimester endovaginal sonography has been associated with an increased risk of recurrent preterm delivery independent of cervical length [26]. Studies have shown that serial transvaginal surveillance of cervical length in patients followed by cervical cerclage only when cervical changes are encountered appears to reduce the cerclage rate without compromising pregnancy outcome [27,28]. In addition, in cases with visible dilatation, the sonologist should report the maximal endocervical diameter. The percent of “effacement” based on sonographic images is not reliable, because it is not possible to determine the location of the internal os once dilatation becomes apparent.

False negative diagnoses can occur during transperineal or transvaginal scanning if a cervical stress test is omitted. Some of the most challenging patients to evaluate are those in whom the appearance of the cervix changes during the sonographic examination [29-31]. These transient but important observations underscore the need to observe the appearance of the cervix several times during a single obstetrical sonographic study, and suggest that a single image of the cervix may be insufficient for thorough cervical evaluation. A study dynamic cervical change on 10-minute real-time US showed that minimum cervical length was a better predictor of preterm delivery than was initial cervical length [32]. Gibson et al [33] demonstrated that on transvaginal US assessment of cervical length performed at 18, 24, 28 and 32 weeks gestation, shortening of cervical length  $\geq 2.5$  mm per week between 18 and 28 weeks' gestation also predicted preterm delivery. This is particularly the case in women at risk for preterm delivery, or those in whom a short cervix is detected by sonography. When a woman has transitory cervical changes, the minimal length of residual cervix

should be reported, and the patient should be considered at risk. Clinical follow-up of these women reveals that 61%-74% have preterm labor or deliver prematurely [29,31].

### Safety Issues

#### Ultrasound

US is generally considered safe during pregnancy. As in any imaging procedure, the ALARA (as low as reasonably achievable) principle should be followed. Cardiac activity may be documented in real time, or M-mode imaging. Because of higher energy levels, pulsed and color Doppler of the embryo should be avoided if possible. Pulsed and color Doppler may be extremely useful for other first trimester issues, including retained products of conception and adnexal masses [34].

### Summary

Transperineal and transvaginal sonography provides unique information about the cervix that is otherwise not readily available. These examinations are easy to perform, have been shown to predict the risk for preterm delivery and, in the appropriate clinical setting, should become an integral part of the obstetrical sonographic study.

### Relative Radiation Level Information

Potential adverse health effects associated with radiation exposure are an important factor to consider when selecting the appropriate imaging procedure. Because there is a wide range of radiation exposures associated with different diagnostic procedures, a relative radiation level (RRL) indication has been included for each imaging examination. The RRLs are based on effective dose, which is a radiation dose quantity that is used to estimate population total radiation risk associated with an imaging procedure. Additional information regarding radiation dose assessment for imaging examinations can be found in the ACR Appropriateness Criteria® [Radiation Dose Assessment Introduction](#) document.

Relative Radiation Level Designations	
Relative Radiation Level	Effective Dose Estimate Range
None	0
Minimal	< 0.1 mSv
Low	0.1-1 mSv
Medium	1-10 mSv
High	10-100 mSv

### Supporting Document(s)

- [ACR Appropriateness Criteria® Overview](#)
- [Evidence Table](#)

### References

1. Palmer R, Lacomme M. La béance de l'orifice interne, cause d'avortements à répétition? Une observation de déchirure cervico-isthmique réparée chirurgicalement, avec gestation à term consécutive. *Gynec et Obst* 1948; 47:905-906.
2. Ludmir J. Sonographic detection of cervical incompetence. *Clin Obstet Gynecol* 1988; 31(1):101-109.
3. Ayers JW, DeGroot RM, Compton AA, Barclay M, Ansbacher R. Sonographic evaluation of cervical length in pregnancy: diagnosis

- and management of preterm cervical effacement in patients at risk for premature delivery. *Obstet Gynecol* 1988; 71(6 Pt 1):939-944.
4. Buckingham JC, Buethe RA, Jr., Danforth DN. Collagen-Muscle Ratio In Clinically Normal And Clinically Incompetent Cervices. *Am J Obstet Gynecol* 1965; 91:232-237.
5. Iams JD, Goldenberg RL, Meis PJ, et al. The length of the cervix and the risk of spontaneous premature delivery. National Institute of Child Health and Human Development Maternal Fetal Medicine Unit Network. *N Engl J Med* 1996; 334(9):567-572.
6. Iams JD, Johnson FF, Sonek J, Sachs L, Gebauer C, Samuels P. Cervical competence as a continuum: a study of ultrasonographic cervical length and obstetric performance. *Am J Obstet Gynecol* 1995; 172(4 Pt 1):1097-1103; discussion 1104-1096.
7. Andersen HF, Nugent CE, Wanty SD, Hayashi RH. Prediction of risk for preterm delivery by ultrasonographic measurement of cervical length. *Am J Obstet Gynecol* 1990; 163(3):859-867.
8. Gomez R, Galasso M, Romero R, et al. Ultrasonographic examination of the uterine cervix is better than cervical digital examination as a predictor of the likelihood of premature delivery in patients with preterm labor and intact membranes. *Am J Obstet Gynecol* 1994; 171(4):956-964.
9. Iams JD, Paraskos J, Landon MB, Teteris JN, Johnson FF. Cervical sonography in preterm labor. *Obstet Gynecol* 1994; 84(1):40-46.
10. Jackson GM, Ludmir J, Bader TJ. The accuracy of digital examination and ultrasound in the evaluation of cervical length. *Obstet Gynecol* 1992; 79(2):214-218.
11. Lim BH, Mahmood TA, Smith NC, Beat I. A prospective comparative study of transvaginal ultrasonography and digital examination for cervical assessment in the third trimester of pregnancy. *J Clin Ultrasound* 1992; 20(9):599-603.
12. Mahony BS, Nyberg DA, Luthy DA, Hirsch JH, Hickok DE, Petty CN. Translabial ultrasound of the third-trimester uterine cervix. Correlation with digital examination. *J Ultrasound Med* 1990; 9(12):717-723.
13. Sonek JD, Iams JD, Blumenfeld M, Johnson F, Landon M, Gabbe S. Measurement of cervical length in pregnancy: comparison between vaginal ultrasonography and digital examination. *Obstet Gynecol* 1990; 76(2):172-175.
14. Yazici G, Yildiz A, Tiras MB, Arslan M, Kanik A, Oz U. Comparison of transperineal and transvaginal sonography in predicting preterm delivery. *J Clin Ultrasound* 2004; 32(5):225-230.
15. Hertzberg BS, Bowie JD, Weber TM, Carroll BA, Kliewer MA, Jordan SG. Sonography of the cervix during the third trimester of pregnancy: value of the transperineal approach. *AJR* 1991; 157(1):73-76.
16. Hertzberg BS, Kliewer MA, Baumeister LA, McNally PB, Fazekas CK. Optimizing transperineal sonographic imaging of the cervix: the hip elevation technique. *J Ultrasound Med* 1994; 13(12):933-936; quiz 1009-1010.
17. Guzman ER, Rosenberg JC, Houlihan C, Ivan J, Waldron R, Knuppel R. A new method using vaginal ultrasound and transfundal pressure to evaluate the asymptomatic incompetent cervix. *Obstet Gynecol* 1994; 83(2):248-252.
18. Wong G, Levine D, Ludmir J. Maternal postural challenge as a functional test for cervical incompetence. *J Ultrasound Med* 1997; 16(3):169-175.
19. Iams JD. Cervical ultrasonography. *Ultrasound Obstet Gynecol* 1997; 10(3):156-160.
20. Timor-Tritsch IE, Boozarjomehri F, Masakowski Y, Monteagudo A, Chao CR. Can a "snapshot" sagittal view of the cervix by transvaginal ultrasonography predict active preterm labor? *Am J Obstet Gynecol* 1996; 174(3):990-995.
21. Ziliani M, Azuaga A, Calderon F, Pages G, Mendoza G. Monitoring the effacement of the uterine cervix by transperineal sonography: a new perspective. *J Ultrasound Med* 1995; 14(10):719-724.
22. Rust OA, Atlas RO, Kimmel S, Roberts WE, Hess LW. Does the presence of a funnel increase the risk of adverse perinatal outcome in a patient with a short cervix? *Am J Obstet Gynecol* 2005; 192(4):1060-1066.
23. de Carvalho MH, Bittar RE, Brizot Mde L, Bicudo C, Zugaib M. Prediction of preterm delivery in the second trimester. *Obstet Gynecol* 2005; 105(3):532-536.

24. Dilek TU, Gurbuz A, Yazici G, et al. Comparison of cervical volume and cervical length to predict preterm delivery by transvaginal ultrasound. *Am J Perinatol* 2006; 23(3):167-172.
25. Owen J, Yost N, Berghella V, et al. Can shortened midtrimester cervical length predict very early spontaneous preterm birth? *Am J Obstet Gynecol* 2004; 191(1):298-303.
26. Yost NP, Owen J, Berghella V, et al. Second-trimester cervical sonography: features other than cervical length to predict spontaneous preterm birth. *Obstet Gynecol* 2004; 103(3):457-462.
27. Groom KM, Bennett PR, Golar M, Thalon A, Shennan AH. Elective cervical cerclage versus serial ultrasound surveillance of cervical length in a population at high risk for preterm delivery. *Eur J Obstet Gynecol Reprod Biol* 2004; 112(2):158-161.
28. To MS, Palaniappan V, Skentou C, Gibb D, Nicolaides KH. Elective cerclage vs. ultrasound-indicated cerclage in high-risk pregnancies. *Ultrasound Obstet Gynecol* 2002; 19(5):475-477.
29. Hertzberg BS, Kliewer MA, Farrell TA, DeLong DM. Spontaneously changing gravid cervix: clinical implications and prognostic features. *Radiology* 1995; 196(3):721-724.
30. Parulekar SG, Kiwi R. Dynamic incompetent cervix uteri. Sonographic observations. *J Ultrasound Med* 1988; 7(9):481-485.
31. Riley L, Frigoletto FD, Jr., Benacerraf BR. The implications of sonographically identified cervical changes in patients not necessarily at risk for preterm birth. *J Ultrasound Med* 1992; 11(3):75-79.
32. Jenkins SM, Kurtzman JT, Osann K. Dynamic cervical change: is real-time sonographic cervical shortening predictive of preterm delivery in patients with symptoms of preterm labor? *Ultrasound Obstet Gynecol* 2006; 27(4):373-376.
33. Gibson JL, Macara LM, Owen P, Young D, Macauley J, Mackenzie F. Prediction of preterm delivery in twin pregnancy: a prospective, observational study of cervical length and fetal fibronectin testing. *Ultrasound Obstet Gynecol* 2004; 23(6):561-566.
34. Bly S, Van den Hof MC. Obstetric ultrasound biological effects and safety. *J Obstet Gynaecol Can* 2005; 27(6):572-580.

The ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.