

**Assessment of Gravid Cervix
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
1. Goldenberg RL. The management of preterm labor. <i>Obstet Gynecol.</i> 2002;100(5 Pt 1):1020-1037.	Review/Other-Dx	N/A	To review management of preterm labor.	The most important components of management are aimed at preventing neonatal complications through the use of corticosteroids and antibiotics to prevent group B streptococcal neonatal sepsis, and avoiding traumatic deliveries.	4
2. Hack M, Fanaroff AA. Outcomes of children of extremely low birthweight and gestational age in the 1990's. <i>Early Hum Dev.</i> 1999;53(3):193-218.	Review/Other-Dx	N/A	To review survival of children of extremely low birthweight and gestational age in the 1990's.	According to the authors, a review of the world literature and their experience reveal that at 23 weeks gestation survival ranges from 2% to 35%. At 24 weeks gestation the range is 17% to 58%, and at 25 weeks gestation the range is 35% to 85%. Authors conclude that with current methods of care, the limits of viability have been reached.	4
3. Berghella V, Roman A, Daskalakis C, Ness A, Baxter JK. Gestational age at cervical length measurement and incidence of preterm birth. <i>Obstet Gynecol.</i> 2007;110(2 Pt 1):311-317.	Review/Other-Dx	705 women	To estimate the risk of spontaneous PTB based on TVU CL and gestational age at which CL was measured.	705 women received 2,601 TVU measurements for CL. The incidences of spontaneous PTB before 35, 32, and 28 weeks were 17.7%, 10.6%, and 6.7%, respectively. The risk of spontaneous PTB before 35 weeks decreased by approximately 6% for each additional millimeter of CL (OR 0.94, 95% CI, 0.92–0.95, $P=.001$) and by approximately 5% for each additional week of pregnancy at which the CL was measured (OR 0.95, 95% CI 0.92–0.98, $P=.004$). Similar results were obtained for spontaneous PTB before 32 and 28 weeks.	4

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4. Hibbard JU, Tart M, Moawad AH. Cervical length at 16-22 weeks' gestation and risk for preterm delivery. <i>Obstet Gynecol.</i> 2000;96(6):972-978.	Observational-Dx	760 gravidas	To determine whether CL, as measured by TVU in asymptomatic gravidas at 16–22 weeks, is associated with risk of spontaneous preterm delivery.	CLs were normally distributed (mean 38.5 +/- 8.0 mm at 19.9 +/- 1.5 weeks) independent of gestational age at measurement, and the tenth, fifth, and two and a half percentiles were 30, 27, and 22 mm, respectively. 85 women delivered before 37 weeks, 51 before 35 weeks, and 27 before 32 weeks. RRs (95% CI) for spontaneous preterm delivery before 37 weeks were 3.8 (2.6, 5.6), 5.4 (3.3, 9.0), and 6.3 (3.0, 13.0) for the tenth, fifth, and two and a half percentiles, respectively; RRs for before 35 weeks were 4.5 (2.9, 6.9), 7.5 (4.5, 12.5), and 7.8 (3.6, 16.7); and for before 32 weeks were 5.2 (3.3, 8.3), 9.7 (5.8, 16.1), and 8.4 (3.6, 19.9), respectively. Multiple logistic regression analysis confirmed that CL was a significant predictor of PTB before 35 weeks, and that paras had a 43% greater risk compared with nulliparas. Sensitivity ranged from 13%–44%, specificity 90%–99%, PPV 15%–47%, and NPV 80%–98%.	3
5. Taipale P, Hiilesmaa V. Sonographic measurement of uterine cervix at 18-22 weeks' gestation and the risk of preterm delivery. <i>Obstet Gynecol.</i> 1998;92(6):902-907.	Observational-Dx	3,694 consecutive pregnant women with live singleton fetuses	To examine the uterine cervix with US to discover whether such a procedure would be helpful in determining which women will deliver prematurely.	Spontaneous delivery occurred before 37 completed weeks in 88 women (2.4%) and before 35 weeks in 31 (0.8%). The RR of delivery before 35 weeks was 8 (95% CI, 3, 19) when the CL was ≤29 mm. When dilatation of the internal cervical os of ≥5 mm was present, the RR of delivery before 35 weeks was 28 (95% CI, 12, 67). Either short cervix (≤29 mm) or dilatation of internal cervical os (≥5 mm) was present in 3.6% of the population; this combination had a sensitivity of 29% in predicting delivery at earlier than 35 weeks. After adjusting for cervical dilatation and length by using multiple logistic regression, nulliparity also remained a risk factor for delivery before 35 weeks (OR 3.6, 95% CI, 1.7, 7.5).	2

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6. 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. <i>N Engl J Med.</i> 1996;334(9):567-572.	Observational-Dx	2,915 women	Prospective, multicenter study: To measure CL (using TVU), and to document incidence of spontaneous delivery before 35 weeks. To calculate RR for preterm delivery based on CL.	RR of preterm delivery increases as CL decreases. At 24 weeks gestation age (RR was: (also done at 28 weeks): Cervix length at or below 40 mm (75th percentile); RR=1.98. Cervix length at or below 35 mm (50th percentile); RR=2.35. CL at or below 30 mm (25th percentile); RR=3.79. CL at or below 26 mm (10th percentile); RR=6.19. CL at or below 22 mm (5th percentile); RR=9.49. CL at or below 13mm (1st percentile) RR=13.99.	3
7. Hassan SS, Romero R, Berry SM, et al. Patients with an ultrasonographic cervical length < or =15 mm have nearly a 50% risk of early spontaneous preterm delivery. <i>Am J Obstet Gynecol.</i> 2000;182(6):1458-1467.	Observational-Dx	6,877 patients	To determine the value in the prediction of spontaneous preterm delivery of US measured CL measured between 14 and 24 weeks' gestation.	Mean CL was 37.5 mm. ORs for early preterm delivery (≤ 32 weeks' gestation) for patients with CLs ≤ 10 , ≤ 15 , ≤ 20 , ≤ 25 , and ≤ 30 mm were, respectively, 29.3 (95% CI, 11.3–75.8), 24.3 (95% CI, 12.9–45.9), 18.3 (95% CI, 10.8–31.0), 13.4 (95% CI, 8.8–20.6), and 3.2 (95% CI, 2.4–4.4). For early preterm delivery a CL of ≤ 15 mm had a PPV of 47.6%, a NPV of 96.7%, a sensitivity of 8.2%, and a specificity of 99.7%.	3
8. Guzman ER, Walters C, Ananth CV, et al. A comparison of sonographic cervical parameters in predicting spontaneous preterm birth in high-risk singleton gestations. <i>Ultrasound Obstet Gynecol.</i> 2001;18(3):204-210.	Observational-Dx	469 high-risk gestations	To assess the role of cervical US and to compare various sonographic cervical parameters in their ability to predict spontaneous PTB in high-risk singleton gestations.	Receiver operating characteristic curve analyses showed that a CL of ≤ 2.5 cm between 15 and 24 weeks' gestation was equal to the other US cervical parameters in its ability to predict spontaneous PTB. The sensitivities for delivery at <28 , <30 , <32 and <34 weeks' gestation were 94%, 91%, 83% and 76%, respectively, while the NPVs were 99%, 99%, 98% and 96%, respectively. The placement of a cerclage did not influence the PPVs and NPVs. In comparison to women with other risk factors, CL was best in the prediction of PTB in women with a prior mid-trimester loss; an optimal cut-off of ≤ 1.5 cm had sensitivities for delivery at <28 , <30 , <32 and <34 weeks' gestation of 100%, 100% 92% and 81%, respectively. The rate of preterm delivery at <34 weeks' gestation increased dramatically when the CL was ≤ 1.5 cm. CL was the only independent variable that entered the logistic regression model for the prediction of preterm delivery at <34 weeks' gestation.	3

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9. To MS, Skentou C, Liao AW, Cacho A, Nicolaides KH. Cervical length and funneling at 23 weeks of gestation in the prediction of spontaneous early preterm delivery. <i>Ultrasound Obstet Gynecol.</i> 2001;18(3):200-203.	Observational-Dx	6,334 pregnancies	To establish the relationship of CL at 23 weeks of gestation to the risk of spontaneous delivery before 33 weeks and to determine the possible additional risk if funneling is present. Women with a short cervix (≤ 15 mm) are given the option of participating in an ongoing multicenter randomized trial of cervical cerclage.	The median CL was 36 mm and in 1.6% of cases the length was ≤ 15 mm. There was a significant inverse association between CL and percentage rate of spontaneous delivery before 33 weeks. Funneling of the internal os was present in about 4% of pregnancies and the prevalence decreased with increasing CL from 98% when the length was ≤ 15 mm to about 25% for lengths of 16–30 mm and <1% at lengths of >30 mm. The rate of preterm delivery was 6.9% in those with funneling compared to 0.7% in those without funneling ($\chi^2 = 86.7$; $P < 0.0001$). However, logistic regression analysis demonstrated that funneling did not provide a significant additional contribution to CL in the prediction of spontaneous delivery before 33 weeks (OR for short cervix = 24.9, $Z = 4.43$, $P < 0.0001$; OR for funneling = 1.8, $Z = 0.84$, $P = 0.40$). In the prediction of preterm delivery, funneling does not provide any significant contribution in addition to CL.	3

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10. Crane JM, Hutchens D. Transvaginal sonographic measurement of cervical length to predict preterm birth in asymptomatic women at increased risk: a systematic review. <i>Ultrasound Obstet Gynecol.</i> 2008;31(5):579-587.	Review/Other-Dx	14 articles; 2,258 women	To estimate the ability of CL measured by TVU in asymptomatic high-risk women to predict spontaneous PTB.	CL measured by TVU predicted spontaneous PTB. The shorter the CL cut-off the higher the positive LR. The most common CL cut-off was <25 mm. Using this cut-off to predict spontaneous PTB at <35 weeks, TVU at <20 weeks gestation revealed LR+ = 4.31 (95% CI, 3.08–6.01); at 20–24 weeks, LR+ = 2.78 (95% CI, 2.22–3.49); and at >24 weeks, LR+ = 4.01 (95% CI, 2.53–6.34). In women with a history of spontaneous PTB (6 studies involving 663 women) CL at <20 weeks revealed LR+ = 11.30 (95% CI, 3.59–35.57) and at 20–24 weeks LR+ = 2.86 (95% CI, 2.12–3.87), but there were limited data on the use of CL of more than 24 weeks in this group (1 study involving 42 women). In women who had had excisional cervical procedures, 2 studies presented data on CL (1 at <24 weeks and 1 at >24 weeks), finding CL at <24 weeks to be predictive of spontaneous PTB at <35 weeks (LR+ = 2.91, 95% CI, 1.69–5.01). One study (of 64 women) evaluated CL in women with uterine anomalies, finding it predictive of spontaneous PTB at <35 weeks (LR+ = 8.14, 95% CI, 3.12–21.25).	4

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11. Berghella V, Baxter JK, Hendrix NW. Cervical assessment by ultrasound for preventing preterm delivery. <i>Cochrane Database Syst Rev.</i> 2013;1:CD007235.	Review/Other-Dx	5 trials (n = 507)	To assess the effectiveness of antenatal management based on TVU of CL screening for preventing PTB.	Knowledge of TVU CL results was associated with a nonsignificant decrease in PTB at <37 weeks (22.3% vs 34.7%, respectively; average risk ratio 0.59, 95% CI, 0.26 to 1.32; 2 trials, 242 women) and at <34 weeks (6.9% vs 12.6%; RR 0.55, 95% CI, 0.25 to 1.20; 3 trials, 256 women). Delivery occurred at a later gestational age in the knowledge vs no knowledge groups (mean difference 0.64 weeks, 95% CI, 0.03 to 1.25; 3 trials, 290 women). For all other outcomes for which there were available data (PTB at <34 or 28 weeks; birthweight <2500 grams; perinatal death; maternal hospitalization; tocolysis; and steroids for fetal lung maturity), there was no evidence of a difference between groups. The trial of singleton gestations with preterm premature rupture of membranes (n = 92) evaluated as its primary outcome safety of TVU CL in this population, and not its effect on management. There was no evidence of a difference in incidence of maternal and neonatal infections between the TVU CL and no TVU CL groups. In the trial of twin gestations with or without preterm labor (n = 125), there was no evidence of a difference in PTB at <36, 34, or 30 weeks, gestational age at delivery, and other perinatal and maternal outcomes between the TVU CL and the no TVU CL groups. Life-table analysis revealed significantly less PTB at <35 weeks in the TVU CL group compared with the no TVU CL group ($P=0.02$).	4
12. Fonseca EB, Celik E, Parra M, Singh M, Nicolaides KH. Progesterone and the risk of preterm birth among women with a short cervix. <i>N Engl J Med.</i> 2007;357(5):462-469.	Experimental-Dx	250 women	Multicenter, randomized trial was designed to evaluate the effect of vaginal progesterone on the incidence of spontaneous early preterm delivery in asymptomatic women found at routine mid-trimester screening to have a short cervix.	Spontaneous delivery before 34 weeks of gestation was less frequent in the progesterone group than in the placebo group (19.2% vs 34.4%; RR, 0.56; 95% CI, 0.36 to 0.86). Progesterone was associated with a nonsignificant reduction in neonatal morbidity (8.1% vs 13.8%; RR, 0.59; 95% CI, 0.26 to 1.25; $P=0.17$). There were no serious adverse events associated with the use of progesterone.	1

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13. Hassan SS, Romero R, Vidyadhari D, et al. Vaginal progesterone reduces the rate of preterm birth in women with a sonographic short cervix: a multicenter, randomized, double-blind, placebo-controlled trial. <i>Ultrasound Obstet Gynecol.</i> 2011;38(1):18-31.	Experimental-Dx	458 women	Multicenter, randomized, double-blind, placebo-controlled trial to determine the efficacy and safety of using micronized vaginal progesterone gel to reduce the risk of PTB and associated neonatal complications in women with a sonographic short cervix.	Women allocated to receive vaginal progesterone had a lower rate of PTB before 33 weeks than did those allocated to placebo (8.9% (n=21) vs 16.1% (n=36); RR, 0.55; 95% CI, 0.33–0.92; <i>P</i> =0.02). The effect remained significant after adjustment for covariables (adjusted RR, 0.52; 95% CI, 0.31–0.91; <i>P</i> =0.02). Vaginal progesterone was also associated with a significant reduction in the rate of PTB before 28 weeks (5.1% vs 10.3%; RR, 0.50; 95% CI, 0.25–0.97; <i>P</i> =0.04) and 35 weeks (14.5% vs 23.3%; RR, 0.62; 95% CI, 0.42–0.92; <i>P</i> =0.02), respiratory distress syndrome (3.0% vs 7.6%; RR, 0.39; 95% CI, 0.17–0.92; <i>P</i> =0.03), any neonatal morbidity or mortality event (7.7% vs 13.5%; RR, 0.57; 95% CI, 0.33–0.99; <i>P</i> =0.04) and birth weight <1500 g (6.4% (15/234) vs 13.6% (30/220); RR, 0.47; 95% CI, 0.26–0.85; <i>P</i> =0.01). There were no differences in the incidence of treatment-related adverse events between the groups.	1
14. Cahill AG, Odibo AO, Caughey AB, et al. Universal cervical length screening and treatment with vaginal progesterone to prevent preterm birth: a decision and economic analysis. <i>Am J Obstet Gynecol.</i> 2010;202(6):548 e541-548.	Review/Other-Dx	Hypothetical cohort of 4 million pregnant patients	To estimate which strategy is the most cost-effective for the prevention of PTB and associated morbidity.	Universal sonographic screening for CL and treatment with vaginal progesterone was the most cost-effective strategy and was the dominant choice over the 3 alternatives: CL screening for women at increased risk for PTB and treatment with vaginal progesterone; risk-based treatment with 17 alpha-hydroxyprogesterone caproate without screening; no screening or treatment. Universal screening represented savings of \$1,339 (\$8,325 vs \$9,664), when compared with treatment with 17 alpha-hydroxyprogesterone caproate, and led to a reduction of 95,920 PTBs annually in the United States.	4

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15. Romero R, Nicolaides K, Conde-Agudelo A, et al. Vaginal progesterone in women with an asymptomatic sonographic short cervix in the midtrimester decreases preterm delivery and neonatal morbidity: a systematic review and metaanalysis of individual patient data. <i>Am J Obstet Gynecol.</i> 2012;206(2):124 e121-119.	Review/Other-Dx	5 trials ; 775 women and 827 infants	To determine whether the use of vaginal progesterone in asymptomatic women with a sonographic short cervix (≤ 25 mm) in the midtrimester reduces the risk of PTB and improves neonatal morbidity and mortality.	Treatment with vaginal progesterone was associated with a significant reduction in the rate of PTB <33 weeks (RR, 0.58; 95% CI, 0.42–0.80), <35 weeks (RR, 0.69; 95% CI, 0.55–0.88), and <28 weeks (RR, 0.50; 95% CI, 0.30–0.81); respiratory distress syndrome (RR, 0.48; 95% CI, 0.30–0.76); composite neonatal morbidity and mortality (RR, 0.57; 95% CI, 0.40–0.81); birthweight <1500 g (RR, 0.55; 95% CI, 0.38–0.80); admission to neonatal intensive care unit (RR, 0.75; 95% CI, 0.59–0.94); and requirement for mechanical ventilation (RR, 0.66; 95% CI, 0.44–0.98). There were no significant differences between the vaginal progesterone and placebo groups in the rate of adverse maternal events or congenital anomalies.	4
16. Werner EF, Han CS, Pettker CM, et al. Universal cervical-length screening to prevent preterm birth: a cost-effectiveness analysis. <i>Ultrasound Obstet Gynecol.</i> 2011;38(1):32-37.	Review/Other-Dx	Cohort of 100,000 women	Decision analysis model to determine whether routine measurement of second-trimester transvaginal CL by US in low-risk singleton pregnancies is a cost-effective strategy.	The model predicts that routine cervical-length screening is a dominant strategy when compared to routine care. For every 100,000 women screened, \$12,119,947 can be potentially saved (in 2010 US dollars) and 423.9 quality-adjusted life-years could be gained. Additionally, the authors estimate that 22 cases of neonatal death or long-term neurologic deficits could be prevented per 100,000 women screened. Screening remained cost-effective but was no longer the dominant strategy when cervical-length US measurement costs exceeded \$187 or when vaginal progesterone reduced delivery risk at <34 weeks by less than 20%.	4
17. Practice bulletin no. 130: prediction and prevention of preterm birth. <i>Obstet Gynecol.</i> 2012;120(4):964-973.	Review/Other-Dx	N/A	Practice guideline on prediction and prevention of PTB.	N/A	4

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18. Berghella V, Odibo AO, To MS, Rust OA, Althuisius SM. Cerclage for short cervix on ultrasonography: meta-analysis of trials using individual patient-level data. <i>Obstet Gynecol.</i> 2005;106(1):181-189.	Review/Other-Dx	4 trials	To estimate by meta-analysis of randomized trials whether cerclage prevents PTB in women with a short CL.	In the total population, PTB at <35 weeks of gestation occurred in 29.2% (89/305) of the cerclage group, compared with 34.8% (105/302) of the no-cerclage groups (RR 0.84, 95% CI, 0.67–1.06). There was no significant heterogeneity in the overall analysis ($P=.29$). There was a significant reduction in PTB at <35 weeks in the cerclage group compared with the no-cerclage groups in singleton gestations (RR 0.74, 95% CI, 0.57–0.96), singleton gestations with prior PTB (RR 0.61, 95% CI, 0.40–0.92), and singleton gestations with prior second-trimester loss (RR 0.57, 95% CI, 0.33–0.99). There was a significant increase in PTB at <35 weeks in twin gestations (RR 2.15, 95% CI, 1.15–4.01).	4
19. Goya M, Pratorcorona L, Merced C, et al. Cervical pessary in pregnant women with a short cervix (PECEP): an open-label randomised controlled trial. <i>Lancet.</i> 2012;379(9828):1800-1806.	Experimental-Tx	385 pregnant women	Randomized, controlled trial to investigate whether the insertion of a cervical pessary in women with a short cervix identified by use of routine transvaginal scanning at 20–23 weeks of gestation reduces the rate of early preterm delivery.	385 pregnant women with a short cervix were assigned to the pessary (n=192) and expectant management groups (n=193), and 190 were analyzed in each group. Spontaneous delivery before 34 weeks of gestation was significantly less frequent in the pessary group than in the expectant management group (12 [6%] vs 51 [27%], OR 0.18, 95% CI, 0.08–0.37; $P<0.0001$). No serious adverse effects associated with the use of a cervical pessary were reported.	1

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20. Carlan SJ, Richmond LB, O'Brien WF. Randomized trial of endovaginal ultrasound in preterm premature rupture of membranes. <i>Obstet Gynecol.</i> 1997;89(3):458-461.	Experimental-Dx	47 patients assigned to no-probe and 45 patients assigned to probe group	Randomized study to assess the effect of weekly endovaginal US on the incidence of maternal infection and the time from rupture to delivery in women with preterm premature rupture of membranes.	The latency period, defined as days from rupture to delivery, was 9.8 and 11.7 days for the no-probe and probe groups, respectively (95% CI, -5.9, 2.1). There were no significant differences in the incidence of chorioamnionitis (28% and 20%), endometritis (6% and 9%), or neonatal infection (17% and 20%). The mean latency period in women who went into spontaneous labor and whose initial CL was 3.0 cm or less was 9.4 days, compared with 11.0 days if the cervix exceeded 3.0 cm, a nonsignificant difference. There were 3 neonatal deaths, all in the probe group and none directly related to infection. Endovaginal US in patients whose pregnancies are complicated by preterm premature rupture of membranes does not appear to increase the incidence of maternal infection.	1
21. 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? <i>Ultrasound Obstet Gynecol.</i> 2006;27(4):373-376.	Observational-Dx	76 patients enrolled and 66 available for outcome analysis	Prospective study of patients at 23–34 weeks to determine if dynamic cervical change (spontaneous real-time cervical shortening) is predictive of preterm delivery at <37 weeks' gestation in patients with symptoms of preterm labor.	Dynamic cervical change occurs frequently in association with shortened CL. In patients with longer initial CLs, dynamic change may increase the risk for preterm delivery. When dynamic change is noted in a patient with preterm labor symptoms, use of the minimum CL observed may be better compared with initial CL for determining preterm delivery risk.	3
22. The Fetal Medicine Foundation. Online Education: Cervical assessment. 2014; Available at: http://www.fetalmedicine.com/fmf/online-education/05-cervical-assessment/ . Accessed March 17, 2014.	Review/Other-Dx	N/A	An online course on cervical assessment. The course explains the technique of measuring CL and the clinical applications of this measurement.	N/A	4
23. Mella MT, Berghella V. Prediction of preterm birth: cervical sonography. <i>Semin Perinatol.</i> 2009;33(5):317-324.	Review/Other-Dx	N/A	To review the evidence for cervical US as a screening test for the prediction of PTB.	CL measurement by TVU in the second trimester is 1 of the most effective screening methods for the prediction of PTB. The shortest best CL is the most effective measurement for clinical use.	4

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24. de Tejada BM, Faltin DL, Kinkel K, Guittier MJ, Boulvain M, Irion O. Magnetic resonance imaging of the cervix in women at high risk for preterm delivery. <i>J Matern Fetal Neonatal Med.</i> 2011;24(11):1392-1397.	Observational-Dx	100 women	To assess whether changes in signal intensity of cervical stroma layers on MRI are associated with spontaneous preterm delivery.	36 women had a spontaneous preterm delivery. The proportion of spontaneous preterm delivery for high, intermediate, and low stromal differentiation was 7/24 (29%), 21/64 (33%; RR 1.1; 95% CI: 0.6–2.3), and 8/12 (67%; RR 2.3; 95% CI: 1.1–4.8), respectively. The risk of delivering within 7 days increased when stromal differentiation decreased, although the difference was not statistically significant.	2

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25. Rovas L, Sladkevicius P, Strobel E, Valentin L. Reference data representative of normal findings at two-dimensional and three-dimensional gray-scale ultrasound examination of the cervix from 17 to 41 weeks' gestation. <i>Ultrasound Obstet Gynecol.</i> 2006;27(4):392-402.	Observational-Dx	419 nulliparous women and 360 parous women	To create reference values representative of normal findings on 2D and 3D TVU examination of the cervix from 17 to 41 weeks' gestation and to determine the agreement between cervical measurements taken by 2D and 3D TVU.	There was excellent agreement between measurements taken by 2D and 3D US (interclass correlation coefficient values, 0.80–0.98) but measurements of cervical length taken using 3D US were greater than measurements taken by 2D US (mean difference, -0.04 +/- 0.36 cm). Cervical length did not change substantially between 17 and 32 gestational weeks but decreased progressively thereafter. Cervical length was similar in nulliparous and parous women at 17–32 weeks, but from 33 weeks the cervix tended to be longer in parous women. In nulliparae, cervical length decreased from a median of 3.8 (range, 0.7–6.1) cm at 17–32 weeks to 2.3 (range, 0.4–6.0) cm at 33–40 weeks and to 0.7 (range, 0.2–1.5) cm at 41 weeks. In parous women, the corresponding figures were 3.9 (range, 1.0–6.1) cm, 3.0 (range, 0.4–5.7) cm and 0.8 (range, 0.4–3.4) cm (results obtained by 3D US). Cervical anteroposterior diameter and width did not differ between nulliparous and parous women. Median anteroposterior diameter increased from 3.0 (range, 2.0–4.6) cm at 17–30 weeks to 3.5 (range, 1.8–5.5) cm at 31–40 weeks and to 4.0 (range, 2.8–5.9) cm at 41 weeks. Cervical width was 3.7 (range, 2.3–6.0) cm at 17–30 weeks and 4.5 (range, 2.3–6.1) cm at 31–41 weeks. The percentage of women with funneling increased from 4% (3/84) at 17–18 weeks to 63% (12/19) at 41 weeks and the percentage of women with an open cervical canal increased from 19% (15/84) to 72% (13/19). Funneling and opening of the cervical canal were equally common in nulliparous and parous women.	3

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26. Feltovich H, Hall TJ, Berghella V. Beyond cervical length: emerging technologies for assessing the pregnant cervix. <i>Am J Obstet Gynecol.</i> 2012;207(5):345-354.	Review/Other-Dx	N/A	Review emerging technologies for assessing the pregnant cervix.	Promising techniques to evaluate tissue hydration, collagen structure, and/or tissue elasticity are emerging. These will add to the body of knowledge about the cervix and facilitate the coordination of molecular studies and ultimately lead to novel approaches to PTB prediction and, finally, prevention.	4
27. Schnettler W, March M, Hacker MR, Modest AM, Rodriguez D. Impaired ultrasonographic cervical assessment after voiding: a randomized controlled trial. <i>Obstet Gynecol.</i> 2013;121(4):798-804.	Experimental-Dx	221 women	To estimate whether the timing of bladder emptying affects focal myometrial contraction development and image adequacy.	221 women provided 335 randomized encounters for analysis. Women in the deferred scan group were 30% less likely to experience a focal myometrial contraction (28.1% compared with 40.5%, RR 0.70, 95% CI 0.52–0.93) and 41% less likely to have inadequate images (18.6% compared with 31.5%, RR 0.59, 95% CI, 0.40–0.86). The 2 groups were equally likely to be diagnosed with placenta previa ($P=.13$). However, participants in the deferred scan group were 76% less likely to have images demonstrating a placenta previa and focal myometrial contraction (3.0% compared with 12.5%, RR 0.24, 95% CI, 0.09–0.62) than participants in the immediate scan group. 8 women would need to defer imaging for 15 minutes from bladder voiding to prevent 1 focal myometrial contraction of the lower uterine segment or inadequate imaging.	1
28. 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. <i>Obstet Gynecol.</i> 1994;83(2):248-252.	Review/Other-Dx	150 pregnant patients without pregnancy loss, 31 asymptomatic pregnant patients	To determine if transfundal pressure applied while scanning the cervix may assist in detecting asymptomatic incompetent cervix. Technique consisted of applying transfundal pressure for approximately 15 seconds in the direction of the uterine axis. The control patients were scanned a single time between 16 and 24 weeks gestational age. The at-risk patients were studied 73 times between 8 and 25 weeks gestational age.	Transfundal pressure elicited no change in internal os in 150 control patients. Transfundal pressure elicited opening of the internal os or descent of the fetal membranes in 14/31 (45%) patients who were at risk.	4

Assessment of Gravid Cervix
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
29. Wong G, Levine D, Ludmir J. Maternal postural challenge as a functional test for cervical incompetence. <i>J Ultrasound Med.</i> 1997;16(3):169-175.	Observational-Dx	24 pregnant patients without pregnancy loss, 41 patients at high-risk due to incompetent cervix	To evaluate whether a postural challenge (consisting of an upright maternal position) can be used to detect early changes in patients with incompetent cervix. Technique consisted of examining the cervix by TVU with the patient supine for at least 15 minutes, and then re-examining the cervix after she had been standing for at least 15 minutes. The control patients were scanned a single time; the at-risk patients were studied 74 times. In all cases gestation age ranged from 17–33 weeks.	In 24 control patients, maternal postural challenge test elicited no change in CL. Each of these patients delivered at term. Of 41 at risk patients, maternal postural challenge test demonstrated a greater than 33% decrease in CL in 16 patients (14 of whom delivered prematurely). Only 1/25 at risk patients who had a decrease of less than 33% delivered prematurely. The sensitivity of a postural change in patients at risk for preterm delivery was 93.3%, and the specificity was 92.3%.	3
30. Guzman ER, Pisatowski DM, Vintzileos AM, Benito CW, Hanley ML, Ananth CV. A comparison of ultrasonographically detected cervical changes in response to transfundal pressure, coughing, and standing in predicting cervical incompetence. <i>Am J Obstet Gynecol.</i> 1997;177(3):660-665.	Observational-Dx	89 patients	To compare various noninvasive stress techniques for their ability to elicit US cervical changes and to determine their efficacy in detecting US cervical incompetence.	The efficacy of transfundal pressure in detecting the cervix that had subsequent progressive changes on US was as follows: sensitivity 83.3%, specificity 97.2%, and PPV and NPV 88.2% and 95.8%, respectively. The efficacy of coughing was sensitivity 16.7%, specificity 100%, and PPV and NPV 100% and 85.5%, respectively. The efficacy of standing was sensitivity 33.3%, specificity 97.2%, and PPV and NPV 75% and 85.2%, respectively. Similar results were obtained when the analysis was confined to 37 patients who had a prior history of a mid-trimester miscarriage. Transfundal pressure was the most effective technique in eliciting cervical changes during the active assessment of the cervix during pregnancy and the most sensitive in detecting the cervix that had progressive second-trimester cervical shortening during pregnancy, compared with coughing or standing position.	3

**Assessment of Gravid Cervix
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
31. Cicero S, Skentou C, Souka A, To MS, Nicolaides KH. Cervical length at 22-24 weeks of gestation: comparison of transvaginal and transperineal-translabial ultrasonography. <i>Ultrasound Obstet Gynecol.</i> 2001;17(4):335-340.	Observational-Dx	500 women	To investigate the feasibility of measuring CL by transperineal or translabial sonography and compare the measurements obtained by this approach with those obtained transvaginally.	CL was successfully measured transvaginally in all cases. In the first phase of the study CL was measured by translabial-transperineal US in 84% of the 200 patients but there was poor agreement with measurements obtained transvaginally and the 95% tolerance interval for paired observations was -11.0 mm to 16.1 mm. After audit of results it became apparent that the translabially-transperineally derived images were inadequate in more than half of the cases but in those with adequate paired measurements there was a very good agreement between the 2 and the 95% tolerance interval for paired observations was -5.8 mm to 5.2 mm. In the second phase of the study special attention was paid towards recording measurements of CL only in cases where both the internal and external os were adequately visualized. Successful measurements by translabial-transperineal US were obtained in 78% of cases and the 95% tolerance interval for paired observations was -5.8 mm to 6.1 mm. The degree of patient acceptability of the 2 methods was similar.	3
32. Hertzberg BS, Livingston E, DeLong DM, McNally PJ, Fazekas CK, Kliewer MA. Ultrasonographic evaluation of the cervix: transperineal versus endovaginal imaging. <i>J Ultrasound Med.</i> 2001;20(10):1071-1078; quiz 1080.	Observational-Dx	64 pregnant women	To compare transperineal and endovaginal US of the gravid cervix to evaluate image quality and assess for a systematic difference in CLs measured by the 2 techniques.	There was a strong reviewer preference for endovaginal US images over transperineal images for both assessing the cervix ($P < .001$) and evaluating for placenta previa ($P < .001$). Despite this, transperineal and endovaginal US images were frequently rated as similar in diagnostic quality by both reviewers for depicting the cervix (35.9% of patients) and evaluating for placenta previa (57.8% of patients). The mean length of the cervix was slightly shorter at transperineal US (28.4 mm) than at endovaginal US (30.1 mm). When CLs were subdivided by gestational age, however, a significant length discrepancy was found only in the 14- to 20-week gestational age range. In this age range, mean CL at transperineal US (28.6 mm) averaged 5.5 mm less than at endovaginal US (34.1 mm).	2

**Assessment of Gravid Cervix
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
33. Hong JS, Park KH, Noh JH, Suh YH. Cervical length and the risk of microbial invasion of the amniotic cavity in women with preterm premature rupture of membranes. <i>J Korean Med Sci.</i> 2007;22(4):713-717.	Observational-Dx	50 singleton pregnancies	Prospective observational study to determine whether US measured CL is of value in the identification of MIAC in women with preterm premature rupture of membranes and to compare its performance with maternal blood C-reactive protein, white blood cell count, and amniotic fluid white blood cell count.	The prevalence of a positive amniotic fluid culture was 26% (13/50). Patients with positive amniotic fluid cultures had a significantly shorter median CL and higher median C-reactive protein, white blood cell count, and amniotic fluid white blood cell count than did those with negative cultures. Multiple logistic regression indicated that only CL had a significant relationship with the log odds of a positive amniotic fluid culture. TVU measurement of CL is valuable in the identification of MIAC in women with preterm premature rupture of membranes. CL performs better than amniotic fluid white blood cell count, maternal blood C-reactive protein, and white blood cell count in the identification of a positive amniotic fluid culture.	3
34. Gomez R, Romero R, Nien JK, et al. A short cervix in women with preterm labor and intact membranes: a risk factor for microbial invasion of the amniotic cavity. <i>Am J Obstet Gynecol.</i> 2005;192(3):678-689.	Observational-Dx	401 patients	To determine whether there was a relationship between sonographic CL and the presence of culture-proven MIAC in women with preterm labor and intact membranes. Patients were selected from a prospective cohort study.	The prevalence of MIAC was 7% (28/401). Spontaneous preterm delivery (≤ 35 weeks) occurred in 21.4% (82/384) of patients. ROC curve analysis showed a significant relationship between the frequency of MIAC and the length of the uterine cervix (area under the curve: 0.77; $P < .005$). Patients with a CL < 15 mm had a higher rate of a positive amniotic fluid culture than patients with a CL ≥ 15 mm (26.3% [15/57] vs 3.8% [13/344], respectively; $P < .05$). Moreover, patients with a short cervix (defined as < 15 mm) were more likely to deliver spontaneously before 35 weeks, 32 weeks, within 7 days, and within 48 hours of admission ($P < .05$ for all comparisons). 40% of patients (161/401) had a CL ≥ 30 mm. These patients had a very low risk of MIAC (1.9% [3/161]), spontaneous delivery ≤ 35 weeks (4.5% [7/154]), ≤ 32 weeks (2.6% [2/76]), within 7 days (1.9% [3/154]), and within 48 hours (0% [0/154]) of admission. Endovaginal US examination of the uterine cervix in women with preterm labor identifies patients at increased risk for intrauterine infection.	3

**Assessment of Gravid Cervix
EVIDENCE TABLE**

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
35. Hassan S, Romero R, Hendler I, et al. A sonographic short cervix as the only clinical manifestation of intra-amniotic infection. <i>J Perinat Med.</i> 2006;34(1):13-19.	Review/Other-Dx	152 patients with a short cervix at 14–24 weeks	Retrospective cohort study to determine the rate of MIAC and intra-amniotic inflammation in patients with a CL <25 mm in the mid-trimester.	57/152 patients had amniotic fluid analysis. The prevalence of MIAC was 9% (5/57). Among these patients, the rate of preterm delivery (<32 weeks) was 40% (2/5). Sub-clinical MIAC was detected in 9% of patients with a sonographically short cervix (<25 mm). Maternal parenteral treatment with antibiotics can eradicate MIAC caused by <i>Ureaplasma urealyticum</i> . This was associated with delivery at term in the 3 patients whose successful treatment was documented by microbiologic studies.	4
36. Friedman AM, Srinivas SK, Parry S, Elovitz MA, Wang E, Schwartz N. Can transabdominal ultrasound be used as a screening test for short cervical length? <i>Am J Obstet Gynecol.</i> 2013;208(3):190 e191-197.	Observational-Dx	1,217 women	To determine whether transabdominal US be used as a screening test for short CL.	Prevoid transabdominal CL \leq 36 mm detects 96% of transvaginal CLs \leq 25 mm with 39% specificity. A prevoid transabdominal CL \leq 35 mm detects 100% of transvaginal CLs \leq 20 mm with 41% specificity. Transabdominal images of the cervix could not be obtained in 6.2% of women prevoid and 17.9% of women postvoid.	2
37. American College of Radiology. ACR-SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation. Available at: http://www.acr.org/~media/ACR/Documents/PGTS/guidelines/Pregnant_Patients.pdf . Accessed September 5, 2014.	Review/Other-Dx	N/A	Guidance document to promote the safe and effective use of diagnostic and therapeutic radiology by describing specific training, skills and techniques.	N/A	4
38. American College of Radiology. ACR-ACOG-AIUM-SRU Practice Parameter for the Performance of Obstetrical Ultrasound. Available at: http://www.acr.org/~media/ACR/Documents/PGTS/guidelines/US_Obstetrical.pdf . Accessed September 5, 2014.	Review/Other-Dx	N/A	Guidance document to promote the safe and effective use of diagnostic and therapeutic radiology by describing specific training, skills and techniques.	N/A	4
39. Kanal E, Barkovich AJ, Bell C, et al. ACR guidance document on MR safe practices: 2013. <i>J Magn Reson Imaging.</i> 2013;37(3):501-530.	Review/Other-Dx	N/A	Guidance document on MR safety practices to help guide MR practitioners regarding MR safety issues and provide a basis for them to develop and implement their own MR policies and practices.	N/A	4

Assessment of Gravid Cervix
EVIDENCE TABLE

Reference	Study Type	Patients/ Events	Study Objective (Purpose of Study)	Study Results	Study Quality
40. American College of Radiology. <i>Manual on Contrast Media</i> . Available at: http://www.acr.org/Quality-Safety/Resources/Contrast-Manual . Accessed September 5, 2014.	Review/Other-Dx	N/A	Guidance document on contrast media to assist radiologists in recognizing and managing risks associated with the use of contrast media.	N/A	4

Evidence Table Key

Study Quality Category Definitions

- *Category 1* The study is well-designed and accounts for common biases.
- *Category 2* The study is moderately well-designed and accounts for most common biases.
- *Category 3* There are important study design limitations.
- *Category 4* The study is not useful as primary evidence. The article may not be a clinical study or the study design is invalid, or conclusions are based on expert consensus. For example:
 - a) the study does not meet the criteria for or is not a hypothesis-based clinical study (e.g., a book chapter or case report or case series description);
 - b) the study may synthesize and draw conclusions about several studies such as a literature review article or book chapter but is not primary evidence;
 - c) the study is an expert opinion or consensus document.

Dx = Diagnostic

Tx = Treatment

Abbreviations Key

CI = Confidence interval

CL = Cervical length

LR = Likelihood ratio

MIAC = Microbial invasion of the amniotic cavity

MRI = Magnetic resonance imaging

NPV = Negative predictive value

OR = Odds ratio

PPV = Positive predictive value

PTB = Preterm birth

ROC = Receiver-operator characteristic

RR = Risk ratio

TVU = Transvaginal ultrasound

US = Ultrasound