

The Umbilical Cord

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The umbilical cord carries blood from the placenta to the baby. We can see the umbilical cord during sonography, and variations in shape and other features are common. Some of the variations in the cord can have important implications for care of the pregnancy. We examine the cord during every sonogram; if a variation or abnormality is identified, we will explain the finding to you and, if appropriate, make recommendations regarding pregnancy care.

That the cord carries *baby's blood* to the placenta. There is no connection between Mom's circulation and baby's. Maternal blood flows through the uterus to the placenta. Maternal vessels come close enough to fetal vessels to permit the transfer of oxygen and nutrients to the baby. The umbilical arteries branch within the placenta, to form tiny *capillaries*, which are the sites of transfer of oxygen and nutrients. The *capillaries* coalesce to form small veins, and the veins come together to form the umbilical vein.

The umbilical cord usually has two arteries and one vein. The arteries arise from the internal iliac arteries, and can be seen adjacent to the fetal bladder on ultrasound. The umbilical vein carries blood back to the baby via the *ductus venosus* within the baby's liver. In most umbilical cords, the blood vessels *spiral*,

like the fibers in a rope. The blood vessels in the cord are surrounded by thick sheath, and within the sheath is a substance called Wharton's jelly, which protects the umbilical cord from pressure.

Number of cord vessels. We are able to see the individual vessels of the umbilical cord in most pregnancies after 18 weeks gestation, and often as early as 12-13 weeks. About 99% of the time, the umbilical cord has two arteries. *Single umbilical artery* occurs in 0.5-1% of all pregnancies. This condition is associated with increased risks of birth defects and of pregnancy complications. We have published articles regarding the recognition and management of pregnancies with a single umbilical artery, and have developed a separate information sheet about single umbilical artery.

Cord entry into the abdomen. The entry of the umbilical cord into the abdomen forms the "belly button". This can be seen on most ultrasound scans between 15 and 30 weeks gestation. *Omphalocele* is a condition in which the entry of the umbilical cord into the baby's abdomen is abnormal. This occurs in <1:500 pregnancies. It is a significant birth defect, carries associations with chromosomal and other abnormalities, and requires surgery after birth to repair.

Persistent right umbilical vein. Very early in embryonic development, there are two umbilical veins as well as two arteries. Usually, the right umbilical vein disappears, and the left vein persists. In 0.2 to 0.5% of pregnancies, it is the left umbilical vein that disappears, leaving a persistent right umbilical vein. There may be an association between persistent right umbilical vein and increased rates of fetal abnormalities. When we see a persistent right umbilical vein, we recommend:

- A comprehensive, targeted sonogram to check the baby for structural abnormalities.
- A *fetal echocardiogram* to specifically assess the baby for cardiac abnormalities.

Umbilical vein varix is a condition in which the umbilical vein is dilated (wider than normal) as it runs through the abdomen. There is controversy in the literature as to the best way to manage pregnancies when an umbilical vein varix is diagnosed. There may be associations between umbilical vein varices and certain fetal abnormalities, and therefore we recommend a comprehensive review of fetal anatomy when an umbilical cord varix is seen. There may be an association with an increase in the rate of stillbirth. If we identify an umbilical vein varix for your baby, we will develop an individualized management plan, which will typically include:

- Kick counts after 26 weeks gestation, as for all pregnancies.
- Twice a week fetal monitoring (Nonstress tests) and fluid volume checks from 32-34 weeks (sometimes earlier) until delivery.
- Periodic ultrasound scans for assessment of your baby's growth and health.

After delivery, flow within the umbilical vein stops, and therefore umbilical vein

varices do not cause problems for the baby after delivery.

Cord entry into the placenta. The cord enters the body of the placenta 90 to 95% of the time, at or near the edge (*marginal cord insertion*) in 5-9%, and the cord splits into individual vessels that run through the membranes (*membranous cord insertion*) before entering the placenta in about 1% of all pregnancies. Our center was one of the first to attempt routine imaging of the cord insertion into the placenta. With today's ultrasound technology, we are able to see the entry of the cord into the placenta in about 90% of sonograms at the 18-22 week time. As the pregnancy progresses, it becomes more difficult to see the entry of the cord into the placenta, especially if the placenta is on the back wall of the uterus and the baby is in front of it.

Marginal cord insertions may be associated with increased chances of premature birth and of growth problems for the fetus. Therefore, if we see a marginal cord insertion at the time of an ultrasound scan, we recommend:

- Education of Mother regarding signs and symptoms of preterm labor.
- Growth assessments by ultrasound at 30-32 weeks and again at about 36 weeks of pregnancy.

Membranous cord insertion is associated with increased rates of single umbilical artery, of fetal growth problems, of preterm birth, and also with heart rate abnormalities during labor which result in an increase in the rate of forceps or vacuum delivery, but not of cesarean section. Membranous cord insertions are common in multiple gestations. For example, in over half of triplet pregnancies, at least one of the babies has a membranous cord.

When we identify a membranous cord insertion, we recommend:

- Careful evaluation of the umbilical cord, to make certain that 2 arteries are present.
- Education of Mother regarding signs and symptoms of preterm labor.
- Growth assessments by ultrasound monthly during the pregnancy.
- Kick counts starting at 26 weeks, as for all pregnancies.
- Monitoring of the baby continuously during labor.
- Consideration of labor induction near term, especially if the cervix is favorable, so that the labor can be under the most controlled circumstances possible.
- Twice a week nonstress tests and fluid checks from 28-30 weeks until delivery.
- Monitoring of the baby continuously during labor.
- Consideration of labor induction as early as 36 weeks gestation, if the cervix is favorable and fetal lung maturity is demonstrated based on amniocentesis.

Vasa Previa. Sometimes, vessels within the membranes will be seen to run close to or over the cervix. This is a very uncommon condition – about 1:2300 pregnancies, but carries tremendous risk to the baby, since during labor the vessels can rupture, causing bleeding from the umbilical cord. We pioneered techniques for detection of vasa previa, and have published one of the largest series on the subject. If a vasa previa is detected during your sonogram, we will give detailed recommendations for pregnancy care for you.

Cord knots are present in between .3 and 2.1% of deliveries. Most knots are believed to form between 13 and 26 weeks gestation, when the fetus tends to be most mobile within the uterus. Umbilical cord knots are notoriously difficult to detect by sonography, and have been rarely diagnosed in utero. There is no unanimity of opinion regarding management of pregnancy once a cord knot has been diagnosed. If we suspect that a cord knot is present, we recommend:

- Growth assessments by ultrasound monthly during the pregnancy.
- Kick counts starting at 26 weeks, as for all pregnancies.

The hypercoiled cord. The umbilical cord is sometimes seen to be “too coiled”. One author has suggested that less than 2 cm between turns of the umbilical vein places the pregnancy at increased risk. We rely upon the cord appearance as much as the measured distance. Hypercoiled cords are rare; when we identify one on ultrasound, management recommendations are individualized.

Nuchal Cord (cord around the neck). Nuchal cords are frequently seen by ultrasound. They are present in about 6% of all pregnancies at 20 weeks gestation, and in almost 30% by full term! Interestingly, nuchal cords are more common in male than female babies, and are more common among Caucasians than other ethnic groups.

Ultrasound during labor is a very reliable method of checking for nuchal cords. Before the baby is fixed in position during labor, though, the baby just has to rotate for the cord to loop (or unloop) around the neck.

Two recent studies have examined the effects of nuchal cord on the course of labor. Jauniaux and colleagues compared pregnancy outcomes in 550 babies born with a nuchal cord and an equal number without. Pregnancy outcomes were similar with no nuchal cord or with a single nuchal cord. Babies with multiple loops of cord around the neck had increased rates of cesarean birth (12.5% vs. 5.3%) and newborn complications. In another study, Larson and colleagues looked at outcomes in

over 8000 term births. Single nuchal cords were present in 25.6%, double loops in 3.2%, triple loops in 0.5%, and quadruple nuchal cords in 0.07%. The pregnancy outcomes were similar with or without a single nuchal cord, but with multiple loops there were increased rates of forceps and vacuum deliveries (17% vs. 11%). In their study, there was little difference in the rate of cesarean section (11.7% vs. 10.3%). Double nuchal cords are associated with increased rates of heart rate abnormalities during labor and also meconium (passage of stool by the fetus into the amniotic fluid before birth), so these pregnancies need to be monitored continuously during labor.

It is debated whether double or triple nuchal cords might be associated with growth disturbances for the baby. Quadruple nuchal cords are associated with decreased fetal growth, but even with among the 6 babies in Larson's study with quadruple nuchal cords, only 1 required cesarean section, 2 had forceps or vacuum deliveries, and 3 had spontaneous vaginal births.

Is there an association between nuchal cords and stillbirth? In a study by Larson, Rayburn, and Hardin, the stillbirth rate was actually *lower* among babies with a nuchal cord; the great majority of these babies had a single nuchal cord.

Could nuchal cords be associated with long term neurodevelopmental problems for the baby? This is an unanswered question, and an area of active research.

Maternal Fetal Medicine is a constantly changing field. The information given here may not be current. Please check with one of the Maternal Fetal Medicine Specialists for up to date information. Questions and comments are welcome. Please address these to:

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What if the cord is around the neck?

Single nuchal cord is very common, and is frequently a transient finding on ultrasound. That is, if Mom has a repeat ultrasound scan, even within a few days, the cord is no longer around the neck. When we see a single nuchal cord on scan, we recommend scrupulous kick counts, as for all pregnancies.

When we see a double nuchal cord, we recommend:

- Sonography on a monthly basis, to recheck to see whether the cord is still looped about the neck (often, on recheck, it is not.)
- Kick counts starting at 26 weeks, but twice daily rather than the usual once per day recommendation.
- Twice a week nonstress tests and fluid checks from 26 - 32 weeks gestation, until delivery or resolution of the double nuchal cord.
- Monitoring of the baby continuously during labor.
- Consideration of labor induction near term, if the cervix is favorable.
- Awareness of likelihood of fetal heart rate abnormalities during labor, and the possible need for interventions.

When three or more loops are seen, management is individualized.

Glossary

Kick counts refer to counting of fetal activity on a daily basis. Normally, the baby moves at least 10 times in an hour during her/his usual active period. Kick counts are the most important means of monitoring baby's health in utero and are started at 26 weeks gestation. Kick count tracing sheets are available from San Diego Perinatal Center.

Nonstress tests are periods of fetal monitoring to determine whether the baby shows heart rate rises in association with activity. The combination of a *reactive* nonstress test – that is, one in which 2 heart rate rises, each of at least 15 beats per minute above baseline and lasting 15 seconds, is an excellent means of assessing fetal health. The combination of twice a week nonstress tests and amniotic fluid assessments is done in addition to kick counts in pregnancies in which there is a high risk situation for the baby in utero.

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