RESEARCH ARTICLE

The Case for Umbilical Cord Screening Via Ultrasound at 18–20 Weeks

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Abstract

Umbilical cord pathology accounts for 20–25% of stillbirths worldwide. Recent publications suggest that stillbirths could be prevented by routine 18 – 20-week ultrasound evaluations that include the full anatomy of the umbilical cord from the placenta to the fetal umbilicus. This manuscript reviews our current understanding of this field and includes suggestions for the future.

Keywords: Umbilical Cord, Ultrasound, Stillbirth, Umbilical Cord Pathologies,

Nuchal Cord, True Knot, Torsion, Fetal Acidosis, Hypercoiling, Umbilical Cord Entanglement

Background

Umbilical cord pathologies are underlying factors leading to 20–25% of stillbirths worldwide [1, 2]. Recent case reports demonstrate that these pathologies, collectively known as umbilical cord accidents (UCAs), can be imaged and pregnancies managed to avoid stillbirths. Training in obstetrics should include a frequent review of these pathologies (for example, cases of monoamniotic twins) together with updated strategies that might be used for their management.

Umbilical cord (UC) imaging has advanced in the last decade and now includes fetal magnetic resonance imaging (MRI) as a tool that can be used to evaluate potential abnormalities. These novel imaging methods are more accurate and result in improved detection of specific UC pathologies and anomalies [3, 4]. However, many studies focused on UCA and stillbirth remain inaccurate as they fail to include all 20 or more types of UC pathology [5]. For example, the incidence of UC torsion (sometimes referred to as UC coiling) is frequently underreported. Large studies often collect inconsistent observations and do not include many critical details such as the insertion and intrauterine location of the UC as well as its morphology and dimension. These details are critically important for the accurate diagnosis and prognosis of potential UCAs. A complete review of the UC requires visualization of its placental insertion as well as its location within the uterus, for example, whether it is in the posterior position over the sacral hump.

Some physicians hold the view that UCAs are not a major cause of stillbirths. This has been disproven both in animal model studies involving UC compression and by the high frequency of complications observed in cases of monoamniotic twins in which UC entanglement and prolapse frequently result in stillbirth. UC pathology is a clear and present risk factor associated with this outcome [6-8].

Discussion

Appropriate management of UCAs requires an awareness and understanding of the more than 20 known UC pathologies. Unfortunately, UCAs have been categorized as separate entities, which has created the impression that they are rare events. UCAs are in fact not unusual and have been reported as complications in one of every 1000 pregnancies. Factors contributing to UCAs include abnormal placental cord insertion, structural anomalies such as a single umbilical artery, thin UC, or amniotic band constriction syndrome, tumors or cysts, vascular events such as thrombosis and rupture, and mechanical events such as torsion (twisting), knots, and/or entanglements. Any pregnancy can be complicated by one or more of these factors [9-12].

Full evaluation of the potential for a UCA will require imaging of the UC from the placenta to the fetal umbilicus. For example, imaging modalities can be used to detect constriction due to malformation of the umbilical insertion. Atresia of the small intestine can lead to ulceration of an umbilical artery near the umbilicus [13-15]. These cases all require follow-up with sequential imaging studies performed after the initial diagnosis. Pregnant women must be informed of these findings and need to be educated and encouraged to report changes in fetal movements no matter how insignificant they seem [16, 17].

The possibility of a UCA must be considered in every pregnancy, analogous to our current routine assessments that identify

potential congenital anomalies or hypertension. It is important to recognize that UCAs occur and recur five times more frequently than these familiar conditions. However, because potential UCAs can be visualized by standard imaging modalities, these techniques can be used to prevent stillbirth. While one recent report suggested this may not be the case, UC torsion (hypercoiling) was included as a contributing factor [18]. In the 1600s, William Hunter was the first to describe the UC as containing helices as opposed to coils. While an average UC is 55 cm in length and contains 6–8 helices, the number of twists and helices remaining after birth are rarely mentioned in the delivery report. This leads to inherent inaccuracies in retrospective studies involving UC hypercoiling.

Some UCs are hyperhelical but not subject to torsion. While the umbilical arteries are typically paired with the umbilical vein, less commonly, the vein is found around an artery pair and thus vulnerable to torsion. These issues need to be discussed and corrections made to the current UC nomenclature.

Controversy continues regarding the risk of cord entanglement and stillbirth.
However, studies carried out in experimental animal models and case reports clearly point to UC compression as a cause of fetal death [19]. A recent case report involving monoamniotic twins conflicts with the 2020 American College of Obstetricians and Gynecologists (ACOG) Obstetric Care Consensus statement on UC events that noted that "…other causes of stillbirth should be excluded…" [20, p75]. If cord entanglement is not a significant risk, why do clinical protocols still recommend early delivery? There remains much confusion regarding the management of potential UCAs.

UCAs can result from a nuchal cord (NC). The mechanisms underlying this observation remain unclear and somewhat controversial largely due to our lack of understanding of how and when these babies die. NC-associated stillbirths typically occur before the onset of active labor, often between 35–37 weeks gestation. Unfortunately, most of the studies that address this issue are underpowered. NC stillbirths have been reported at a frequency of one in 3000 and typically occur while the mother is asleep. Tension on the loop, not the number of loops, is among the key issues associated with NC-associated stillbirth. Other issues contributing to this outcome include placental location and placental insertion of the UC as well as UC length and morphology. Tension on the NC can be imaged with fetal ultrasound (US) or MRI.

Women who conceived via assisted reproductive technologies (ARTs) should be monitored closely for potential UCAs. Several published reports have discussed methods that might be used for prenatal diagnosis and successful management of NCs. Many of the reports selected here describe decreased fetal movements as an initial clinical sign [21-26]. US technicians should be taught how to recognize and evaluate NC tension [27].

True knots can develop from Type B NCs that begin as a hitch. These structures can be identified by imaging technologies, including US. More frequent testing for this potential complication can be performed by US, as is typically performed in cases of monoamniotic twins. There are many examples in which true knots were diagnosed prenatally. Pregnant women must be informed of the importance of this diagnostic modality [28] and, if diagnosed, the need to report any and all changes in fetal

behavior. This is especially critical for women who have conceived with ART. Repeat examinations are also important given the possibility of UC entanglement and the risk of tension on the true knot.

As described earlier, complex UCAs require careful follow-up. It is also important to recognize that NCs can recur as a complication of multiple pregnancies. For example, the following is a unique report from France described a case of a woman who experienced six sequential NC-associated stillbirths [29].

402-General Gynecology and Obstetrics Society in France

May 17th reunion 1960

President : M.J. CHOSSON

Six fetal deaths during delivery because of repeated cervical circular (nuchal cord).

Seventh pregnancy. Proof of work. Caesarean. Child living with (circulars).

M.M MAWUPE VOVOR et A.M SUDRE

Protractor: M.J CHOSSON

Maternity hospital of Lome, Togo

The observation concerns Mrs F.T, 35 years old who consults at the 7th month of a 7th pregnancy. In her antecedents, there are 6 completed pregnancies each related to a stillborn fetus due to a (tight circular). The 7th pregnancy becomes for her a subject of anxiety; she longs to see this child live and confides to one of us.

On examination: 7 months pregnancy quite normal. Uterine height is 25 cm. Hearts sounds excellent. Touch, mobile cephalic presentation. Basin is normal. No blood abnormalities. General condition is excellent.

The patient feels reassured but is regularly monitored until June 30, 1959. At this date no uterine contraction appears, which further increases her anxiety. The uterine height is 34 cm, the top is high IGO located. Heart sounds are normal.

Fifteen days later, she consults at night for the first pains. Indeed, the contractions appeared are repeated, with good quality.

On examination, the cervix is erased, dilatation is between two and five francs, presentation is a vertex oriented in the left oblique diameter, movable vertex. Heart noises are good. In front of this favorable table it is decided to start a test of work.

It will last from 2am to 9am. The patient receives oxygen and is carefully monitored to avoid possible fetal distress.

At 4h: at 5 good francs artificial rupture of the water pocket. Clear liquid, the heart sounds are good, but the presentation does not engage.

Marseille, May 17 1960

At the beginning of the morning, the woman gets tired and especially worries. The dilatation is stationary. The head still does not come down, the hearts' sounds which were very good, started to accelerate. The patient begs us to deliver her and to give her a living child. Given the antecedents, the negative test of the work and especially the fetal suffering, we decide to carry out a caesarean section. Local anesthesia with novocaine, later supplemented with ether. Subtosan infusion. Intervention: Dr. Vovor.

Middle umbilical Laparotomy. Segmental caesarean section overflowing on the uterine body. Extraction of a 3.5 kg child carrying (two tight circulars). The child is cyanotic, does not scream, but after a short resuscitation will be fine. Intraparietal methergin. Uterine suture in 3 planes. Wall in two planes. Skin with horsehair. Normal delivery, the cord has no length anomalies. The immediate suites unfold without incident. The patient leaves the 12th day.

This observation seemed interesting to us in several ways:

- This woman had 6 normal pregnancies, 6 childbirth in which the child succumbed, and each time there were at least (two circulars) around the fetal neck. It would have been exciting to know the details of these deliveries, but it was not possible.

- The seventh birth seems very evocative; slow work, dilation poorly done, presentation that does not engage while the pelvis is normal, failure to break the PDE, and the appearance of fetal suffering signs, all these symptoms with antecedents would present the possibility of new furicidal abnormalities.

- Should it be done in this case a complete dilation, forceps application with cervis incision. We still preferred the safety of a hysterectomy in order to have a child in the best conditions possible.

For the future the problem remains whole, it will be essential to follow a future childbirth in the armed expectancy and obey the imperatives born of the fetal suffering and psychological data of our patient.
(Traduced from French by Laura Adam) 10/15/2009

Long UCs (i.e., >75 cm) are a known risk factor for stillbirth and cord entanglement. Long UCs can be identified by US and also can recur [30, 31].

UC torsion is another common UCA that is also poorly understood. Interestingly, this complication is very common among foals and is an accepted cause of perinatal death. In humans and other mammals, UC torsion has been associated with UC cord constriction. US can be used to image this pathology. A diagnosis will be revealed in sequential images that measure the vein-to-vein helix. A measurement of <2 cm suggests UC torsion and the need for frequent follow-up testing. Some UC morphologies may be more prone to torsion and constriction. The most common form of UC is a gradual helical artery paired with a vein. A non-helical UC may be more prone to occlusion with twisting. It is also critical to recognize that UCAs due to torsion can recur in the same pregnant woman.

UC constriction represents a different type of pathology that can also lead to torsion [32]. We previously monitored the case of a woman who experienced five pregnancies with recurrent UC constriction/torsions. We monitored the sixth pregnancy with home-based fetal monitoring and, due to the recurrence of this complication, successfully delivered an otherwise healthy female infant at 28 weeks who is now 18 years old.

Abnormal UC length (i.e., one that is either too long or too short) is another risk factor for stillbirth. UC length can be determined by US and should be part of the routine evaluation for anomalies at 18–20 weeks of gestation. Cases of a single umbilical artery (either straight and helical) should be monitored carefully, particularly when found in combination with UC length abnormalities.

UC vascular accidents can also be monitored and managed successfully with imaging technologies [33-38]. Numerous reports of vascular UCAs suggest that patients reporting changes in fetal behavior should undergo a complete evaluation of the UC from the placenta to the fetus. Of note, if a full review of the UC is performed routinely at 18–20 weeks of gestation, physicians will have a baseline scan that can be compared to any subsequent evaluation that might be clinically indicated.

Any anomalies suggested by US imaging can be evaluated by fetal MRI unless the situation suggests the need for immediate delivery.

UC attachment sites should also be evaluated by US or MRI imaging. Conditions of concern include marginal insertion (which is a frequent outcome of *in vitro* fertilization procedures), velamentous insertion, and/or UC constriction. Pregnant women need to be made aware of these findings and instructed to report any change in fetal behavior, fluid loss, and/or hemorrhage and report immediately to the birthing center if any of these symptoms are noted. Pregnant women must always be informed of these findings by the obstetrician and/or nurse-midwife. The possibility of stillbirth far outweighs any concerns regarding maternal anxiety [39, 40].

Animal model studies have revealed that repetitive UC compression disturbs the fetal acid-base status and can ultimately result in cardiovascular collapse [39, 40]. These studies clearly indicate that UCA is the cause of stillbirth. If one takes all 20 of the associated pathologies into consideration, the worldwide incidence of UCA stillbirth could easily exceed 25%. UCA detected at a stillbirth is frequently the result of a sequence of events and can be identified as the cause of fetal or perinatal death. These findings can be confirmed by autopsy and a full review of the placental pathology. Disturbances in the UC blood flow that result in severe acidosis are identified more frequently than gestational hypertension. Routine prenatal care protocols need to be changed to reflect this fact. Lack of attention to this concern represents a great disservice to pregnant women who experience UCA-associated fetal loss.

Conclusion

In conclusion, our findings provide a clear and specific answer to the question “Should pregnant women undergo placenta to fetus UC screening as part of the routine 18–20-week US scan?” The answer to this question is most certainly “yes” based on published literature from the last decade (too numerous to cite) the most significant papers cited in this paper.

Routine umbilical cord imaging will most certainly serve to reduce the rates of UCA-associated stillbirth. UCA can be the cause of stillbirth and findings of umbilical cord pathology should prompt a complete placental/umbilical cord review and autopsy [41-47].

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