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The Umbilical Cord: Some Old and New Twists [SA-29]

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**THE UMBILICAL CORD:
SOME OLD AND NEW TWISTS**

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UMBILICAL CORD: SOME OLD AND NEW TWISTS

OBJECTIVES:

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1. Describe how the concept of trophotropism helps explain a variety of placental and cord abnormalities.
2. Recognize the potential consequences of non-coiling of umbilical cord vessels.
3. Discuss the clinical importance of single artery umbilical cord and of various focal lesions of the cord.

Questions

1. The occurrence of Velamentous cord insertion can be explained by trophotropism.
TRUE
2. The direction of umbilical cord coiling correlates with the subsequently determined handedness of the fetus.
FALSE

UMBILICAL CORD: Some Old and New Twists

I. Normal umbilical cord and its vessels

- A. Three vessels
 - Two arteries carry desaturated blood from fetus to placenta.
 - Single vein carries oxygenated blood from placenta to fetus.
- B. The umbilical vessels course through Wharton's jelly in a coiled or helical pattern.
 - Coiling of vessels and cord length are related to fetal movement.
 - Left or counterclockwise helix is seven times as common as right or clockwise helix. Unknown etiology: not related to handedness or "bathtub vortex" theory.

II. Non-coiling of umbilical cord vessels

- A. Occurs in 5% of pregnancies
- B. Substantial risk of poor pregnancy outcomes (Strong et al 1993, 1994)
 - 10 consecutive non-coiled cords at birth:
 - 4 stillbirths
 - 4 severe heart rate decels --> operative delivery in 3
 - 1 Oligohydramnios and placental abruption
 - Of 2 twin sets with non-coiled cord of one twin each, the twin with non-coiled cord was 33% and 45% smaller than the other twin. The 45% smaller twin was a stillbirth.
 - 25 (3.7%) of 687 consecutive pregnancies has prenatally detected non-coiled cords by sonography:
 - Risk of fetal anomaly or death was 16% for non-coiled cord pregnancies vs 3.5% in a high risk subset of perinatal deliveries as a control group.

III. Single artery umbilical cord

- A. 30 consecutive cases (Nyberg 1991)
 - 15 with anomalies:
 - 12 major, 3 minor
 - 6 with aneuploidy - all with major anomalies
 - All cases with normal fetal anatomy by sonography were normal at birth. Sonography is a satisfactory screen to exclude clinical significance to a single artery cord.

- B. 37 of 118 cases (31%) abnormal (Chow 1998)
- Refutes popular misconception that renal anomalies are most common with SUA
 - Heart – 19, GI tract – 14, CNS – 9, GU tract – 6, Respiratory – 4, Musculoskeletal – 3, **Trisomies – 5**
 - Ultrasound detected 31/37 abnormalities (with 2 false positives)
 - o Misses: VSD – 2, TEF, Clubfoot, Ambiguous Genitalia, and one case of **Trisomy 18** with no other sonographic abnormalities at that time.
 - Despite miss of the Trisomy 18, the consensus is that an isolated SUA is still not an indication for amniocentesis. With an isolated SUA, the a priori risk of aneuploidy should not be reduced as with a completely normal detailed sonogram, but should be left at the a priori risk level.
- C. Where to look-
- Cord cross-section
 - Cord longitudinal section
 - Fetal abdomen - axial at/below umbilicus
- D. Two arteries to one artery in same cord.
- Normal variant: two arteries at fetal end can fuse near placenta. No clinical/anomaly significance.
- E. Multiple pregnancy. Single artery cords more common - little clinical significance, but still look for fetal anomalies. Marginal and velamentous cord origins are also more common in multiple pregnancy.
- F. SUA and IUGR
- Some, but not all, published reports indicate an increased incidence of fetal growth restriction when an SUA is present, even in the absence of anatomic or chromosomal abnormalities
 - A growth scan at 30 – 32 weeks is probably prudent

IV. Vasa Previa and Cord Presentation (Funic Presentation)

- A. Significant cause of morbidity/mortality.
- Bleeding from torn fetal vessels
 - Cord compression by presenting part during contraction
 - Cord prolapse--> emergency cesarian section
- B. Association of cord presentation with abnormal fetal lie - e.g. transverse
- C. Cause of Vasa Previa and of Obligate Cord Presentation: TROPHOTROPISM, which explains many placental and cord anomalies
- Marginal and velamentous cord origin from low lying placenta
 - Succenturiate lobe of placenta
 - Concept of trophotropism
 - * The trophoblastic villi of the placenta preferentially proliferate and grow toward regions of better uterine blood supply - generally toward the body and fundus. The villi may atrophy in areas of less adequate blood supply - especially frequent in the lower uterus / juxta-cervical area.
 - * The cord origin and each existing area of the placenta remains fixed relative to the underlying uterus.
 - * The placenta "migrates" only by growing new villi in one region and losing villi elsewhere by atrophy.
 - * The cord origin stays where it originated, at the center of the disc of the placenta in its initial implantation.
 - * With placental trophotropism, the cord origin may become marginal or velamentous.
 - * If the placental implantation and cord origin were initially low in the uterus, obligate cord presentation occurs.
 - * If a velamentous cord crosses the cervical os, there is vasa previa.
 - * If a placenta previa atrophies in the region of the cervical os, with villi proliferating in two directions, a placenta with a succenturiate lobe will result - with the lobes connected by fetal vessels which may cross the os: also a form of vasa previa, although not by the umbilical cord vessels.

V. Nuchal Cord

1. Cord by neck not sufficient
2. Two adjacent cross-sections of cord in longitudinal views of neck: high probability of nuchal cord.
3. Generally not of clinical significance - a common finding.
4. Frequently is a transient finding which may reduce itself spontaneously.
 - Although the presence of a nuchal cord on sequential sonograms in a given pregnancy is random, there is an increased frequency of nuchal cords with advancing gestation. (Clapp – 2003)
 - 12% at 24 –26 weeks and 37% at term
 - At term, more heart rate findings BUT no difference in C-section, Apgars, acidosis. None to NICU
5. Indentation of neck tissues by loops - possible significance.
6. Flattening of cross-section of umbilical vein - worrisome but rare.
7. Management of nuchal cord: Expectant
 - Fetal movement counting
 - Twice weekly biophysical profile/NST
 - Monitor fetal growth
 - Doppler - potentially greater concern if reduced/absent/reversed diastolic flow - but still:
 - Intervene only for signs of fetal distress, not for the anatomic finding itself.
 - Vaginal delivery permissible if no evidence of fetal compromise.

VI. Cord Knot

1. Characteristic configuration - rarely diagnosed.
2. Cord clumps - "not a knot"
3. False knots - focal varix or curlicue
4. Management: Expectant (as above)

VII. Focal cord masses

1. Focal thickening of Wharton's jelly
 - usually near umbilicus
 - common with omphalocele
 - may show areas of cystic (? pseudocyst) formation
2. True cord cyst
 - omphalo-mesenteric duct origin
 - allantoic remnant origin
3. Hemangioma, teratoma
4. Umbilical artery aneurysm
5. Umbilical vein varix
 - Variceal dilatation of intra-abdominal segment of umbilical vein
6. Management: Expectant (as above)
7. Special Considerations
 - Vascular tumor - risk of high output failure - as with a placental chorioangioma
 - Aneurysm or other unusual lesion - any increased risk of aneuploidy?

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