“Tight” Nuchal Cord is an uncommon but important etiology of “Idiopathic” Polyhydramnios

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Systematic Review

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Abstract

The primary source of elimination of amniotic fluid is through fetal swallowing. This fluid is absorbed through the fetal gastrointestinal system and is either recycled through the kidneys or is transferred to the maternal compartment through the placenta. Therefore any condition that interfere with fetal swallowing e.g. nuchal cord can cause polyhydramnios. This research is done over about 1 year duration (between 2021–2022) in three obstetric hospitals in Mosul city. The participants in the research are 1000 pregnant women with polyhydramnios in the third trimester of pregnancy. A search for the cause of polyhydramnios is done including ultrasound of fetus with a screen for nuchal cord by color Doppler ultrasound study of neck of the fetus. Fetuses with nuchal cords are followed until delivery to confirm the tightness of the cord and also to exclude other potential causes of polyhydramnios. The survey of the causes of polyhydramnios reveals that 4.1% of the idiopathic cases of polyhydramnios was due to tight nuchal cord, i.e., 1.2% of the total cases; whereas loose nuchal cords which are found accidentally during the screen was actually did not cause polyhydramnios. Nuchal cord is an uncommon but significant cause of polyhydramnios that constitute at least 4% of all cases of idiopathic polyhydramnios. Therefore it should be searched for in any pregnant woman with polyhydramnios, especially in the third trimester of pregnancy.

Introduction

Amniotic fluid is the product of complex and dynamic fetal and placental physiologic processes. Disruption of the fine balance may result in overproduction or underproduction of fluid. The primary source of elimination of amniotic fluid is through fetal swallowing, which has been observed as early as 16 weeks. On average, a fetus swallows from 200–450 ml per day at term, removing 50% of the amniotic fluid produced through fetal urination [1].

This fluid is absorbed through the fetal gastrointestinal system and is either recycled through the kidneys or is transferred to the maternal compartment through the placenta. Therefore any condition that interfere with fetal swallowing e.g. fetal malformations of the central nervous system (CNS) e.g. anencephaly can cause polyhydramnios; the postulated mechanisms is due to centrally-mediated reduction in fetal swallowing [1, 2]. Likewise, nuchal cord also interfere with mechanical swallowing causing decrease in amniotic fluid elimination and ultimately polyhydramios.

Method

This research is done over about 1 year duration (between 2021–2022) in three obstetric hospitals in Mosul city (Al-Mosul, Al-Salam, and Al-Batool hospitals); as well as in the clinics of the obstetricians who are participants in this research.

The participants in the research are 1000 pregnant women with polyhydramnios in the third trimester of pregnancy. The diagnoses of polyhydramnios is done by physical examination and confirmed by
ultrasound (US) through either determination of Amniotic Fluid Index (AFI) or Deepest Vertical Pocket (DVP).

AFI is determined by measuring the vertical dimension of amniotic fluid pockets in 4 quadrants and reporting the sum of these values; an index > 24 cm suggests polyhydramnios. DVP method reports the deepest pocket of fluid identified; a value of > 8 cm is considered abnormal [2].

A search for the cause of polyhydramnios is done including ultrasound of fetus with a screen for nuchal cord by color Doppler ultrasound study of neck of the fetus [2, 3].

Fetuses with nuchal cords are followed until delivery to confirm the tightness of the cord around the neck (which is defined by any feature of strangulation e.g. duskeness of face, facial petechiae, or conjunctival hemorrhage), and also to exclude other potential causes of polyhydramnios e.g. congenital malformations of fetus.

Results

The results of survey for the causes of polyhydramnios are listed (in percentages) in Table 1.
<table>
<thead>
<tr>
<th>Maternal conditions</th>
<th>Isoimmunization</th>
<th>5.6%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetes mellitus</td>
<td>12.3%</td>
<td></td>
</tr>
<tr>
<td>Placental conditions</td>
<td>Chorioangioma</td>
<td>0.1%</td>
</tr>
<tr>
<td></td>
<td>Circumvallate placenta</td>
<td>0.2%</td>
</tr>
<tr>
<td>Fetal conditions</td>
<td>Twin-to-twin transfusion syndrome</td>
<td>9.5%</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>Esophageal atresia, duodenal or jejunal atresia, annular pancreas, midgut volvulus, diaphragmatic hernia, omphalocele, gastroschisis</td>
<td>8.7%</td>
</tr>
<tr>
<td>CNS lesions</td>
<td>Anencephaly, hydrocephalus, encephalocele, spina bifida, microcephaly, hydranencephaly</td>
<td>10.7%</td>
</tr>
<tr>
<td>Skeletal malformations</td>
<td>Arthrogryposis multiplex, osteogenesis imperfecta, thanatophoric dysplasia</td>
<td>2.1%</td>
</tr>
<tr>
<td>Fetal tumors</td>
<td>Cystic adenomatoid malformation of the lung, sacrococcygeal teratoma, cervical teratoma</td>
<td>1.1%</td>
</tr>
<tr>
<td>Cardiac disease</td>
<td>Severe congenital heart disease, fetal arrhythmias</td>
<td>2.0%</td>
</tr>
<tr>
<td>Genetic disorders</td>
<td>Down syndrome, trisomy 13 and 18, multiple congenital anomalies, myotonia dystrophica</td>
<td>8.9%</td>
</tr>
<tr>
<td>Fetal renal and endocrine disorders</td>
<td>Vasopressin insufficiency, congenital nephrotic syndrome</td>
<td>0.8%</td>
</tr>
<tr>
<td>Hematologic disorders</td>
<td>Homozygous α-thalassemia, fetomaternal hemorrhage</td>
<td>2.5%</td>
</tr>
<tr>
<td>Intrauterine infections</td>
<td>Rubella, syphilis, toxoplasmosis, parvovirus</td>
<td>4.6%</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>Nonimmune hydrops fetalis, fetal retroperitoneal fibrosis</td>
<td>2.2%</td>
</tr>
<tr>
<td><strong>Idiopathic</strong></td>
<td>28.7%</td>
<td></td>
</tr>
</tbody>
</table>

It was estimated that 4.1% of the idiopathic cases of polyhydramnios was due to tight nuchal cord, i.e., 1.2% of the total cases (shown in Figs. 2 and 3).

Loose nuchal cords which are found accidentally during the screen was actually did not cause polyhydramnios, but polyhydramnios have been attributed to another causes, i.e. other than nuchal cord.

**Discussion**

Polyhydramnios complicates 1–3% of pregnancies; although the true incidence of amniotic fluid disorders is confounded by the lack of a uniform approach to diagnosis. Idiopathic polyhydramnios is the
most common cause, affecting approximately 40% of patients with polyhydramnios. However, 25% of these cases will demonstrate an abnormality after delivery e.g. congenital malformations of the CNS or syndromes [2].

Nuchal cord occurs when the umbilical cord becomes wrapped around the fetal neck 360 degrees during movement of the fetus through a loop of cord. Nuchal cords occur in about 10–29% of fetuses. The incidence of nuchal cords is increases with advancing gestation age (shown in Fig. 1).

Nuchal cords are also proportionally increase with increase of cord length [6]. However, it can occur in shorter cords, in which the cord tends to be more tightly wrapped around the fetus neck. The tightness of nuchal cords is also proportionally correlated with numbers of loops; the more numbers of loops, the more tightness of cord [4].

Most nuchal cords (especially loose) are not associated with perinatal morbidity and mortality [3, 5], but a few studies have shown that nuchal cord can affect the outcome of delivery with possible long-term effects on the infants. However, nuchal cords which are tightly wrapped around the neck are more likely to cause problems e.g. fetal distress (manifested as hypotonia and variable deceleration of fetal heart rate), premature delivery, cesarean delivery, meconium stained liquor, birth asphyxia (with long-term neurodevelopmental consequences), as well as features of strangulation e.g. duskiness of face, facial petechiae, conjunctival hemorrhage, skin abrasion around the neck, and rarely stillbirth [3].

Other studies have demonstrated an opposite results with tight nuchal cord that led to oligohydramnios rather than polyhydramnios; this is may be due to excessive compression on the umbilical vessels leading to hypovolemia, acidosis, and anemia which decrease renal perfusion and ultimately decrease urination [2, 4, 5].

Therefore, it is speculated that tight nuchal cord can cause either polyhydramnios or oligohydramnios depending on the degree of pressure of the cord on the neck of fetus, if it is only interfere with swallowing, it will cause polyhydramnios, whereas if it is severe enough to cause compression on the umbilical vessels as well, it will cause oligohydramnios.

**Conclusion**

Nuchal cord is an uncommon but significant cause of polyhydramnios that constitute at least 4% of all cases of idiopathic polyhydramnios. Therefore it should be searched for in any pregnant woman with polyhydramnios, especially in the third trimester of pregnancy.

**Recommendation**

Unfortunately, there is no treatment for nuchal cord during pregnancy except for early delivery (usually by caesarian section) if the polyhydramnios occurred near term and the fetus shows signs of fetal distress. The delivery of a fetus with nuchal cord, whether by normal vaginal or by caesarian delivery, if the cord is
too tight to slip over baby's head, it might be clamped and cut before it is completely delivered to prevent it from tearing away from the placenta [7].

However, fetal surgery may make a hope in the management of preterm fetuses by unwrapping the nuchal cord by fetoscope while the fetus in the uterus.

**Declarations**

**Ethics:** The study protocol was reviewed and approved by the committee of Nineveh health directorate at 16th of March-2022.

**Ethical statement:**

The paper is not previously published in any language, including the abstract and whether the paper is currently under consideration elsewhere for publication.

**Conflict of Interest:**

The authors have no conflicts of interest to declare.

**Funding sources:**

The authors have no relevant financial or non-financial interests to disclose.

**Authors' contributions:**

Mohammed H. Al-Sabawi: contributed to study design and calculation of results.

Intisar Y. Al-Obaydi: contributed to data collection and the introduction.

Inaam K. Al-Zori: contributed to data collection and ultrasound examination.

Luma A. Al-Rejabo: contributed to data collection and discussion.

**References**

Figures

Figure 1

A diagram shows the incidence of nuchal cords is increases with advancing gestation age (with permission)

Figure 2

A mother with polyhydramnios shows nuchal cord in her fetus by color Doppler ultrasound
Figure 3

Same baby with polyhydramnios shows tight nuchal cord after delivery