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“Tight” nuchal cord is an uncommon but important aetiology of “idiopathic” polyhydramnios: a review study

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ABSTRACT

The primary source of elimination of amniotic fluid is through foetal swallowing. Therefore, any condition that interferes with foetal swallowing, *e.g.*, nuchal cord, can cause polyhydramnios.

This research is done over about 1 year duration in three obstetric hospitals. The participants in the research were 1,000 pregnant women with polyhydramnios in the third trimester of pregnancy. A search for the cause of polyhydramnios is done including ultrasound of foetus with a screen for nuchal cord by colour Doppler ultrasound study of the foetal neck, which when present, these foetuses are followed until delivery to confirm the tightness of the cord and also to exclude other potential causes of polyhydramnios.

The survey for 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.

INTRODUCTION

Amniotic fluid is the product of complex and dynamic foetal 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 foetal swallowing, which has been observed as early as 16 weeks. On average, a foetus swallows from 200-450 ml per day at term, remov-

ing 50% of the amniotic fluid produced through foetal urination [1].

This fluid is absorbed through the foetal 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 foetal swallowing, *e.g.*, foetal malformations of the central nervous system (CNS) such as anencephaly, can cause polyhydramnios; the postulated mechanisms is due to

centrally-mediated reduction in foetal swallowing [1, 2]. Likewise, nuchal cord also interferes with mechanical swallowing causing decrease in amniotic fluid elimination and ultimately polyhydramnios.

METHODS

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 1,000 pregnant women with polyhydramnios in the third trimester of pregnancy. The diagnosis 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 foetus with a screen for nuchal cord by colour Doppler ultrasound study of foetal neck [2, 3].

Foetuses 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.*, duskiness of face, facial petechial, or conjunctiva haemorrhage), and also to exclude other potential causes of polyhydramnios, *e.g.*, congenital malformations of foetus.

RESULTS

The results of survey for the causes of polyhydramnios are listed (in percentages) in **Table 1**. 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 (**Figures 1,2**).

Loose nuchal cords which are found accidentally during the screen were actually did not cause polyhydramnios, but polyhydramnios have

Table 1. Estimated proportions of various aetiologies of polyhydramnios.

Maternal conditions		
Isoimmunization		n = 56 (5.6%)
Diabetes mellitus		n = 123 (12.3%)
Placental conditions		
Chorioangioma		n = 1 (0.1%)
Circumvallate placenta		n = 2 (0.2%)
Foetal conditions		
Multiple gestations	Twin-to-twin transfusion syndrome	n = 95 (9.5%)
Gastrointestinal	Esophageal atresia, duodenal or jejunal atresia, annular pancreas, midgut volvulus, diaphragmatic hernia, omphalocele, gastroschisis	n = 87 (8.7%)
CNS lesions	Anencephaly, hydrocephalus, encephalocele, spina bifida, microcephaly, hydranencephaly	n = 107 (10.7%)
Skeletal malformations	Arthrogryposis multiplex, osteogenesis imperfecta, thanatophoric dysplasia	n = 21 (2.1%)
Foetal tumours	Cystic adenomatoid malformation of the lung, sacrococcygeal teratoma, cervical teratoma	n = 11 (1.1%)
Cardiac disease	Severe congenital heart disease, foetal arrhythmias	n = 20 (2.0%)
Genetic disorders	Down syndrome, trisomy 13 and 18, multiple congenital anomalies, myotonia dystrophica	n = 89 (8.9%)
Foetal renal and endocrine disorders	Vasopressin insufficiency, congenital nephrotic syndrome	n = 8 (0.8%)
Hematologic disorders	Homozygous α -thalassemia, foeto-maternal haemorrhage	n = 25 (2.5%)
Intrauterine infections	Rubella, syphilis, toxoplasmosis, parvovirus	n = 46 (4.6%)
Miscellaneous	Nonimmune hydrops fetalis, foetal retroperitoneal fibrosis	n = 22 (2.2%)
Idiopathic		n = 287 (28.7%)

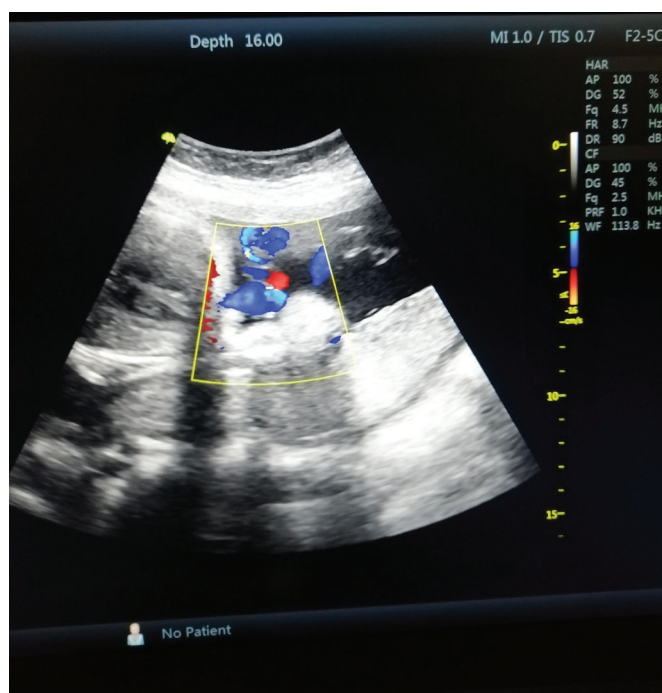


Figure 1. A mother with polyhydramnios shows nuchal cord in her foetus by colour Doppler ultrasound.



Figure 2. The same baby with polyhydramnios shows tight nuchal cord after delivery.

been attributed to other causes, *i.e.*, other than nuchal cord.

The authors intentionally avoid to use the P-value in the study because, as we mentioned in the title, tight nuchal cord is an uncommon (and probably rare) cause of polyhydramnios. Therefore, calculating the P-value it would have been statistically not significant. However, it should be considered in every case with idiopathic polyhydramnios.

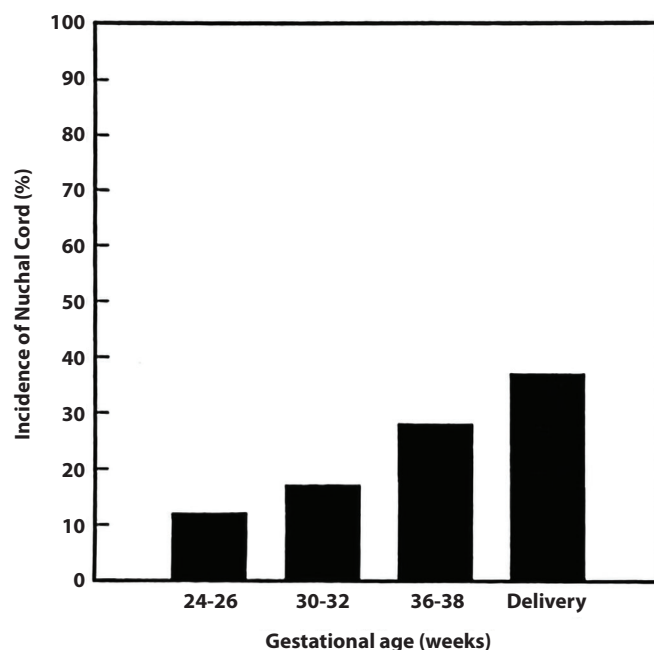


Figure 3. A diagram shows the incidence of nuchal cord is increases with advancing gestation age (with permission - from reference 5).

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 foetal neck 360 degrees during movement of the foetus through a loop of cord. Nuchal cords occur in about 10-29% of foetuses. The incidence of nuchal cords is increases with advancing gestation age [3] (**Figure 3**).

Nuchal cords are also proportionally increased with increase of cord length [4]. However, it can occur in shorter cords, in which the cord tends to be more tightly wrapped around the foetus neck. The tightness of nuchal cords is also proportionally correlated with numbers of loops: the more numbers of loops, the more tightness of cord [5]. Most nuchal cords (especially loose) are not associated with perinatal morbidity and mortality [3, 4], 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, such as foetal distress (manifested as hypotonic and variable deceleration of foetal heart rate), premature delivery, caesarean 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 haemorrhage, skin abrasion around the neck, and rarely stillbirth [3, 8].

Other studies have demonstrated opposite results with tight nuchal cord that led to oligohydramnios rather than polyhydramnios; this may be due to excessive compression on the umbilical vessels leading to hypovolemia, acidosis, and anaemia, which decrease renal perfusion and ultimately decrease urination [2, 5, 6].

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 foetus, 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.

CONCLUSIONS

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 caesarean section) if the polyhydramnios occurred near term and the foetus shows signs of foetal distress.

During the delivery of a foetus with nuchal cord, whether by normal vaginal or by caesarean 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, foetal surgery may make a hope in the management of preterm foetuses by unwrapping the nuchal cord by fetoscope while the foetus in the uterus.

COMPLIANCE WITH ETHICAL STANDARDS

Authors contribution

I.Y.O.: Conceptualization. I.K.Z.: Methodology. L.A.R.: Validation. M.H.S. Supervision, writing - original draft, writing - review & editing.

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Study registration

N/A.

Disclosure of interests

The authors declare that they have no conflict of interests.

Ethical approval

A formal IRB approval was obtained by the Nineveh Health Directorate Ethical Committee, before the beginning of the study.

Informed consent

Each enrolled patient gave informed consent to allow data collection and analysis for research purposes before to start the study.

Data sharing

Data are available under reasonable request to the corresponding author.

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