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4D and Doppler sonography in the diagnosis and surveillance of a true cord knot

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4D and Doppler sonography in the diagnosis and surveillance of a true cord knot

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Keywords:	Umbilical cord knot, ultrasound, clinical management, Doppler velocimetry

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Abstract

Prenatal diagnosis of a true knot of the umbilical cord is very often an incidental observation at ultrasound with a difficult differential diagnosis between true and false knots. Furthermore, very little is known about the optimal management of these cases. We report the importance of color Doppler and four-dimensional ultrasound for the differential diagnosis in case of suspect of cord knot and the impact of Doppler flow velocimetry in the longitudinal management of such a case.

Word Count***Abstract******76******Article******773******References******5***

Introduction.

Clinical evidence at birth of true knots of the umbilical cord is not uncommon, with a reported incidence of about 1% of all deliveries ¹, and is associated with an estimated risk of antepartum fetal demise up to ten times higher than in the general population ². Most true knots present as an unexpected finding at delivery and are not associated to an increased risk of obstetrical intervention and poor neonatal outcomes ² as the larger part of these are loose knots. On the other hand, the loose knot may tighten during pregnancy for active fetal movements or during labor leading to fetal distress or asphyxia till intrauterine death.

Prenatal diagnosis of a true knot of the umbilical cord is very often an incidental observation at ultrasound and very little is known about the optimal management of these cases. We report a case of sonographic evidence of a true knot of the umbilical cord and the relevance of ultrasound in its longitudinal management.

Case report.

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A 44-year-old, gravida 4 para 2, was referred to our unit at 28 weeks of gestation for a routine ultrasound scan. During the examination, a double loop floating loosely in the amniotic fluid was seen on a longitudinal section of the umbilical cord (Figure 1A) which was confirmed on color flow imaging as being cord vessels (Figure 1C), thus the suspect of a cord knot was made. To differentiate between true and false knots, we looked for the “four-leaf clover” image and the “hanging nose” sign³, two reported sonographic characteristics of true knots, but they were not obtained on any section plane. We further assessed the putative knot using four-dimensional ultrasound (Xario, Toshiba, Japan) that confirmed the presence of a loose true knot (Figure 1D). Subsequently, umbilical artery Doppler was assessed before and after the knot (resistance index 0.62 and 0.77, respectively; Figure 2A-B). A specific counseling was made and was proposed another sonographic evaluation in a week to confirm the presence of the knot and to repeat the Doppler assessment (because of the slightly increase in resistances after the knot). At 29 weeks, the same imagine was recorded with no differences in resistance indexes between proximal and distal to the knot (0.66 vs 0.68). The patient was fully aware of the situation and accepted to carry on the pregnancy with a close

Ultrasound in true cord knots

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7 surveillance by monitoring daily fetal movements (maternal
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12 labor and was aware that an emergency caesarean section could
13 have been performed in case of instrumental (sonographic or
14 cardiotocographic) evidence of fetal distress. All sonographic
15 evaluations showed the same image (Figure 1B) and good Doppler
16 assessment (Figure 2C-D) until term (last evaluation at 37w 5d with
17 RI of 0.48 and 0.47 proximal and distal to the knot, respectively)
18 when she was admitted at 39 weeks of gestation for spontaneous
19 onset of labor. No alterations were recorded at cardiotocography
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Discussion.

Notwithstanding the relatively high incidence of true knots of the umbilical cord at birth and the increased risk of stillbirth^{2,4}, a prenatal diagnosis is infrequently reported³. Different sonographic characteristics have been proposed as typical images to identify true knots although none of them has been reported to be specific for the diagnosis⁵. Indeed, it is a difficult diagnosis but supplementary ultrasonographic evaluations including color Doppler imaging, Doppler flow velocimetry and four-dimensional ultrasound may improve the detection rate of true knots and differentiate these from false images (false knots). In our case the differential diagnosis was possible using the 4D imaging that clearly showed a true knot with further information that it was a loose one.

Once the prenatal diagnosis of a true knot is highly suspected, the management of the case has to be prudent, given the increased risk of intrauterine fetal demise^{1,2}, and an adequate counseling has to be offered to parents. A longitudinal assessment has to be planned to monitor the pregnancy, mainly based on umbilical artery Doppler velocimetry till term and cardiotocography in continuum during labor is recommended.

In conclusion, four-dimensional ultrasound helps for the differential diagnosis in case of suspect of cord knot and the Doppler

Ultrasound in true cord knots

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Figure legends**Figure 1a**

Bi-dimensional images of the cord knot at diagnosis (28 weeks). Doppler sonography displayed a vascular spatial configuration pattern consistent with a true knot of the umbilical cord in all of the planes.

Figure 1b

Bi-dimensional images of the cord knot later in pregnancy (32 weeks). The 2D spatial arrangement of the loops appears strongly suggestive of a knot in this section.

Figure 1c

Longitudinal section of the cord at 28 weeks of gestation on color Doppler. Doppler sonography displayed a vascular spatial configuration pattern consistent with a true knot of the umbilical cord in all of the planes.

Figure 1d

Longitudinal section of the cord at 28 weeks of gestation on four-dimensional ultrasonography. Three-dimensional is helpful in

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Figure 1b

Bi-dimensional images of the cord knot later in pregnancy (32 weeks). The 2D spatial arrangement of the loops appears strongly suggestive of a knot in this section.

Figure 1c

Longitudinal section of the cord at 28 weeks of gestation on color Doppler. Doppler sonography displayed a vascular spatial configuration pattern consistent with a true knot of the umbilical cord in all of the planes.

Figure 1d

Longitudinal section of the cord at 28 weeks of gestation on four-dimensional ultrasonography. Three-dimensional is helpful in

Ultrasound in true cord knots

determining the presence of a true knot of the umbilical cord mainly in the second trimester when it “floats” in a pocket of amniotic fluid.

Figure 2a

Doppler flow velocimetry of the umbilical artery proximal to the knot at 28 weeks of gestation.

Figure 2b

Doppler flow velocimetry of the umbilical artery distal to the knot at 28 weeks of gestation. The assessment of differences in resistance indexes suggests a tightening knot.

Figure 2c

Doppler flow velocimetry of the umbilical artery proximal to the knot at 32 weeks of gestation.

Figure 2d

Doppler flow velocimetry of the umbilical artery distal to the knot at 32 weeks of gestation.

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Fig 1a Bi-dimensional images of the cord knot at diagnosis (28 weeks). Doppler sonography displayed a vascular spatial configuration pattern consistent with a true knot of the umbilical cord in all of the planes.
269x192mm (96 x 96 DPI)

Review



Fig 1b Bi-dimensional images of the cord knot later in pregnancy (32 weeks). The 2D spatial arrangement of the loops appears strongly suggestive of a knot in this section.
239x170mm (96 x 96 DPI)

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Fig 1c Longitudinal section of the cord at 28 weeks of gestation on color Doppler. Doppler sonography displayed a vascular spatial configuration pattern consistent with a true knot of the umbilical cord in all of the planes.
259x191mm (96 x 96 DPI)

view



Fig 1d Longitudinal section of the cord at 28 weeks of gestation on four-dimensional ultrasonography. Three-dimensional is helpful in determining the presence of a true knot of the umbilical cord mainly in the second trimester when it "floats" in a pocket of amniotic fluid.
216x164mm (96 x 96 DPI)

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Fig 2a Doppler flow velocimetry of the umbilical artery proximal to the knot at 28 weeks of gestation.
311x206mm (96 x 96 DPI)

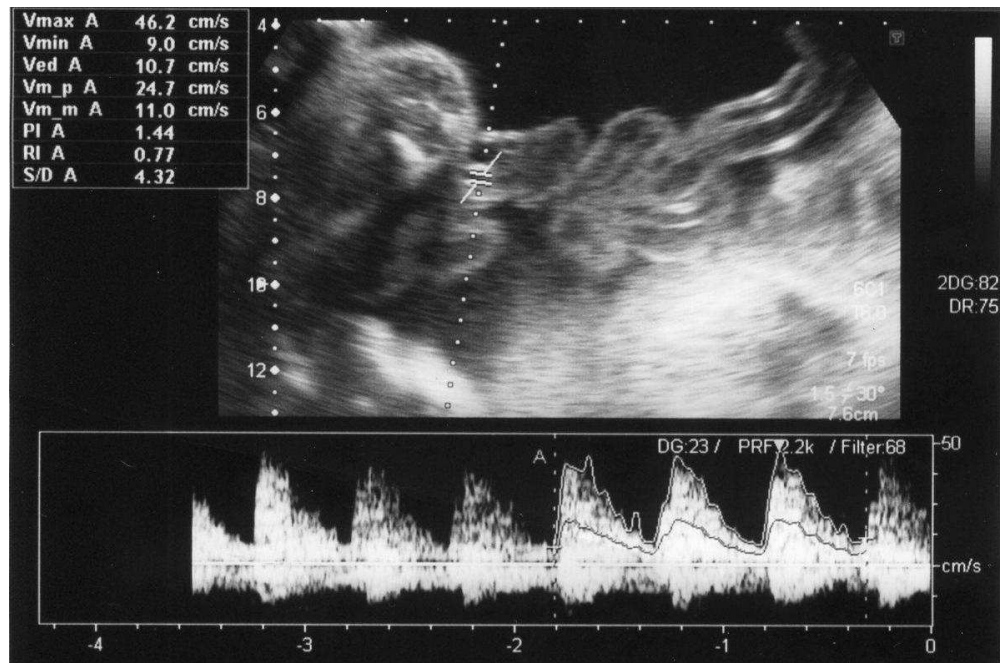


Fig 2b Doppler flow velocimetry of the umbilical artery distal to the knot at 28 weeks of gestation. The assessment of differences in resistance indexes suggests a tightening knot.
317x208mm (96 x 96 DPI)

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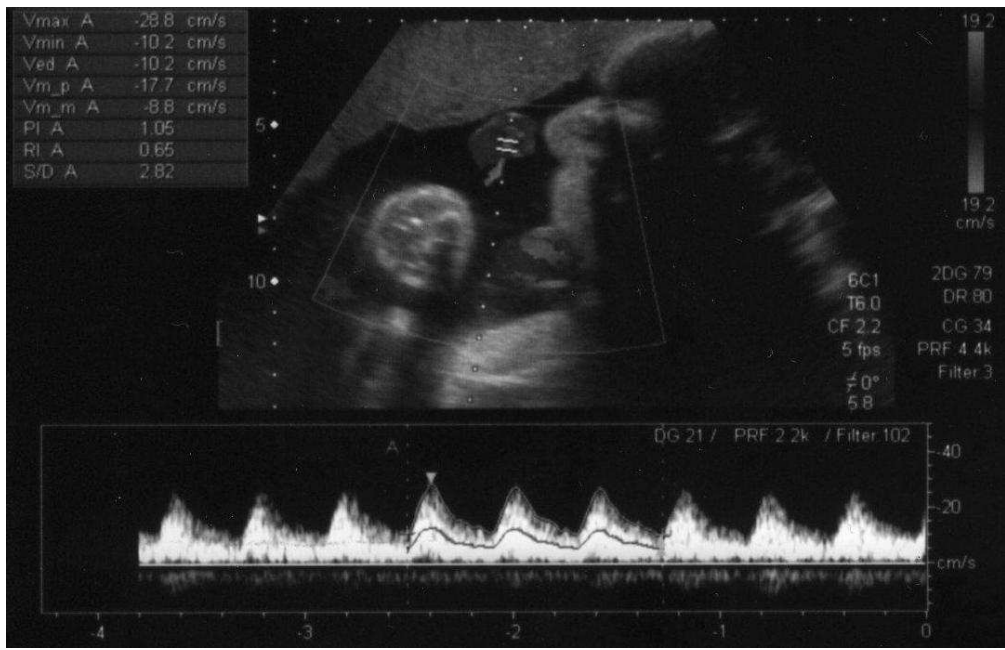
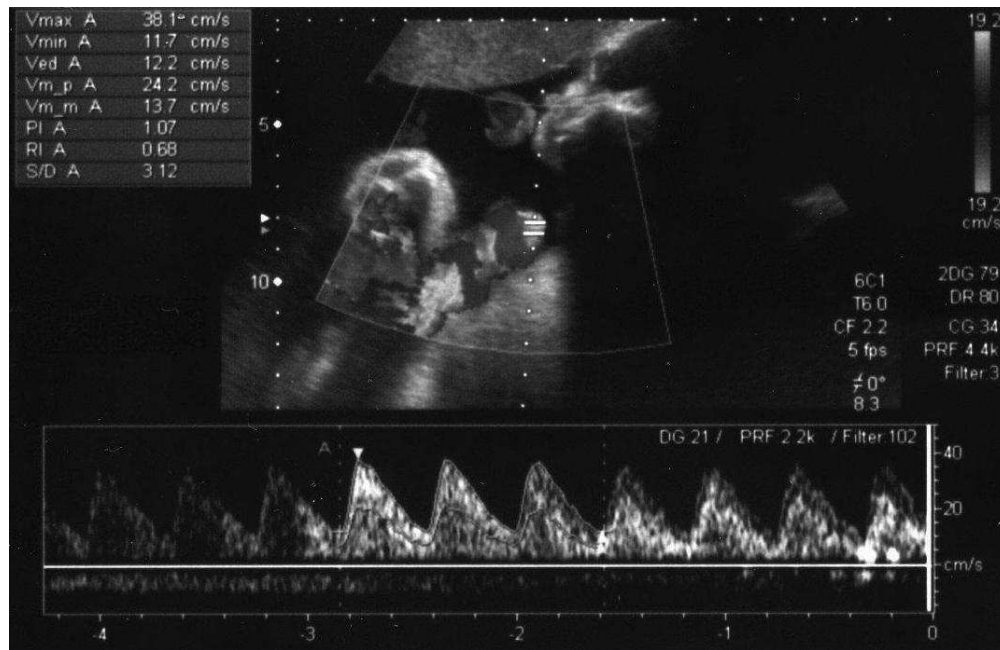


Fig 2c Doppler flow velocimetry of the umbilical artery proximal to the knot at 32 weeks of gestation.
284x182mm (96 x 96 DPI)

Review



30 Fig 2d Doppler flow velocimetry of the umbilical artery distal to the knot at 32 weeks of gestation.
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