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Velamentous cord insertion in dichorionic and monochorionic twin pregnancies – Does it make a difference?

T. Costa-Castro [a, *], D.P. Zhao [b], M. Lipa [c], M.C. Haak [d], D. Oepkes [d], M. Severo [e], N. Montenegro [a], A. Matias [a], E. Lopriore [b]

[a] Department of Obstetrics and Gynecology, São João Hospital Center, Medical Faculty University of Porto, Porto, Portugal
[b] Division of Neonatology, Department of Pediatrics, Leiden University Medical Center, Leiden, The Netherlands
[c] 1st Department of Obstetrics and Gynecology of Medical University of Warsaw, Warsaw, Poland
[d] Division of Fetal Medicine, Department of Obstetrics, Leiden University Medical Center, Leiden, The Netherlands
[e] Epidemiology Unit, Medical Faculty University of Porto, Porto, Portugal

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ABSTRACT

Objective: To estimate the prevalence of velamentous cord insertion (VCI) in dichorionic (DC) and monochorionic (MC) twins with and without twin-twin transfusion syndrome (TTTS), and to study the associated outcomes.

Methods: We recorded the type of umbilical cord insertion in all consecutive DC and MC placentas examined in two European tertiary medical centers. The association between VCI and perinatal outcomes was estimated and compared.

Results: A total of 1498 twin placentas were included in this study (DC placentas n = 550, MC placentas without TTTS n = 513 and MC placentas with TTTS n = 435). The prevalence of VCI in DC, MC without TTTS and MC with TTTS groups was 7.6%, 34.7% and 36.1%, respectively ($P < 0.001$). In MC twins (non-TTTS and TTTS groups), VCI was associated with severe birth weight discordance (odds ratio [OR] 4.76 95% CI 2.43, 10.47 and OR 4.52 95% CI 1.30, 28.59, respectively). In MC twins without TTTS, VCI was associated with small for gestational age (OR 1.66, 95% CI 1.12, 2.50). VCI was significantly associated with increased risk of intrauterine fetal demise in MC twins, and this effect was greater in the non-TTTS group (OR 2.71 95% CI 1.38, 5.47). These associations did not occur in DC group. Gestational age at birth was lower in the presence of VCI in the DC and MC twins without TTTS.

Conclusion: Our findings confirm that the prevalence of VCI is higher in MC twins than in DC twin pregnancies. VCI is an important indicator of adverse perinatal outcome, particularly in MC twins.

1. Introduction

Over the past years, with the development of assisted reproductive techniques, multiple pregnancy rates have increased throughout the world. The risk of complications and adverse outcome is higher in these pregnancies compared to singletons. Twin pregnancies are at higher risk of spontaneous abortion, fetal malformations and low birthweight (due to intrauterine growth restriction and preterm birth). There are also a number of unique complications in twins contributing to this higher morbidity and mortality, particularly related to the type of chorionicity. Monochorionic (MC) twins are at risk of developing severe complications such as twin-twin transfusion syndrome (TTTS) and twin anemia polycythemia sequence (TAPS) due to unbalanced inter-twin blood transfusion via placental vascular anastomoses.

The type of umbilical cord insertion in singletons and twin pregnancies is also a potential risk factor for adverse outcome. Velamentous cord insertion (VCI) in singletons is associated with an increased risk of adverse perinatal outcomes including prematurity and intrauterine growth restriction (IUGR) [1–5]. This type of abnormal cord insertion is more common in twin pregnancies than in singletons. The incidence of VCI has been reported to range from 0.1% to 1.8% among all pregnancies [4,5] and the risk is up to 10-fold higher in multiple pregnancies [6]. MC twin pregnancies in particular have significantly higher rates of VCI [7]. VCI in MC twin placentas has been proposed as a contributory factor in the

* Corresponding author.
E-mail address: teresacostacastro@gmail.com (T. Costa-Castro).

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development of selective intrauterine growth restriction (sIUGR) [8].

Antenatal surveillance in twins aims to identify those pregnancies at an increased risk of complications. Therefore, the identification and combination of ultrasound predictors of adverse outcome (such as VCI) may be useful in risk stratification and management of twin pregnancies.

The objective of this study was to estimate the incidence of VCI in dichorionic (DC) and MC twins and to study the association between VCI and clinical outcomes in both groups.

2. Material and methods

All consecutive placentas of DC and MC twin pregnancies examined at the São João Hospital Center (Portugal) and the Leiden University Medical Center (The Netherlands) between January 2005 and September 2015 were included in this study. Chorionicity was confirmed after delivery by gross examination of the dividing membrane and/or histopathological examination of the placenta and the dividing membrane. Placentas were divided in three groups (DC twins, MC twins without TTTS and MC twins with TTTS). In MC twins group, TTTS was diagnosed using standard antenatal ultrasound criteria [9]. Quintero stage [10] was established at the time of the diagnosis of TTTS. Both University Hospitals are tertiary medical centers for perinatal medicine. The Leiden University Medical Center is the national referral center for fetal therapy in the Netherlands, including laser treatment for TTTS. Most TTTS cases referred to Leiden are therefore treated with laser. The São João Hospital Center is the northern region referral center for complicated twin pregnancies. Most TTTS cases in this center are referred to Harris Birthright Research Centre for Fetal Medicine for laser treatment. Part of the placentas (n = 630) included in this study were already presented in previous reports [7,11].

During prenatal ultrasound, great care was taken to define which fetus would be born first. At delivery, umbilical cords were labeled to identify the first and second-born twin. The type of abnormal umbilical cord insertion, velamentous (cord insertion into the fetal membranes rather than onto the placental disc) or marginal insertion (cord insertion within 1 cm of placental margin), was recorded.

We studied the association of VCI with several outcomes, including gestational age (GA) at birth, small for gestational age (SGA), severe birthweight discordance (BWD) (>25%), intrauterine fetal demise (IUFD) and neonatal mortality, in three groups (DC twins, MC twins without TTTS and MC twins with TTTS). BWD was calculated with the following formula [(BW larger fetus − BW smaller fetus)/BW larger fetus] × 100%. SGA was defined as a birth weight less than 10th percentile. Neonatal mortality is defined as an infant death before 28 days of age. We excluded MC twin pregnancies treated with selective feticide, twin reversed arterial perfusion, monoamniotic twins and higher multiple pregnancies. Placentas with IUFD were excluded when placental maceration prohibited accurate evaluation of type of umbilical cord insertion and placental sharing.

2.1. Statistical analysis

The prevalence of VCI was calculated using the number of VCI per twin pair (zero, one or both twins having a VCI). The fetal level data (SGA, IUFD, neonatal mortality and VCI) was aggregated by pair of twins, meaning that we have counted the number of twins that have a certain condition (0, 1 or 2). The Chi-square test was used to assess the association between the fetal level data aggregated and pair level data with VCI.

Crude and adjusted odds ratios (OR) and respective 95% confidences intervals (CI) were estimated by Bernoulli generalized linear models with logit link function for the pair level dichotomous outcome variables, respectively. Regression coefficients and 95% CI were estimated by linear regression for the pair level continuous variable (GA at birth).

The interaction between these groups (DC twins, MC twins without TTTS and MC with TTTS) and VCI with different outcomes was studied. The number of fetuses with several outcomes (SGA, IUFD, neonatal mortality) or exposure (VCI) was aggregated (0 versus 1 or 2 twins). A P-value < 0.05 was considered to indicate statistical significance. Statistical analyses were performed using the software R 3.0.1 and SPSS for Windows version 17.0 (SPSS, Inc., Chicago, Illinois, USA).

3. Results

A total of 1551 twin placentas were examined at our two centers (DC placentas, n = 552 and MC placentas, n = 999). In the MC twins group there were 463 pregnancies complicated with TTTS and 536 pregnancies without TTTS. The MC pregnancies with TTTS were managed with fetoscopic laser coagulation (n = 393), amniodrainage (n = 35) or without intrauterine intervention (n = 35).

Mean gestation age at birth in the DC, MC without TTTS and MC with TTTS groups was 35 weeks (range: 23–41 weeks), 33 weeks (range: 16–40 weeks) and 31 weeks (range: 16–38 weeks), respectively.

Baseline characteristics of the studied population are presented in Table 1.

The data required for this study could not be recorded completely for 53 (3.4%) placentas (DC group: n = 2; MC non-TTTS-group: n = 23; MC TTTS group: n = 28). These cases were excluded from further analysis.

The prevalence of VCI per twin pair (one fetus with VCI) in DC, MC without TTTS and MC with TTTS groups was 7.7% (44/568), 34.7% (178/513) and 36.1% (157/435), respectively. The prevalence of VCI in both fetuses, per twin pair, in DC, MC without TTTS and MC with TTTS groups was 0.9% (5/568), 2.3% (12/513) and 3.9% (17/435), respectively ($P < 0.001$).

Further details on type of umbilical cord insertion in both groups are presented in Table 2. One example of DC placenta and one of MC placenta with VCI are shown in Figs. 1 and 2 (pictures were taken after colored dye injection).

In DC twins, VCI in one/both fetuses was significantly associated with a lower GA at birth. There was no association between the presence of VCI and SGA, severe BWD, IUFD or neonatal mortality in this group.

In MC twins (non-TTTS and TTTS group), VCI in at least one fetus was associated with severe BWD. In 75.1% of the cases VCI was present in the smaller twin. In the non-TTTS group there was an association between VCI and SGA.

Our results showed significant interaction between the three groups (DC, MC without TTTS and MC with TTTS groups) and VCI when we considered severe BWD, IUFD and GA at birth. The effect of VCI in BWD is greater among MC twins than among DC twins. The prevalence of IUFD in MC twins without TTTS increased in the presence of VCI. The same did not happen in the other two groups and this difference was statistically significant. The effect of VCI on GA at birth is different between the three groups. GA at birth significantly lowers in the presence of VCI in DC twins and MC twins without TTTS.

We did not find any interaction between these three groups and VCI when considering SGA and neonatal mortality. We found no association between the presence of VCI and neonatal mortality.

Results of risk analysis are presented in Table 3.