Nuchal cord entanglement and outcome of labour induction

Tullio Ghi[1]
Laura D'Emidio[2]
Raffaella Morandi[1]
Paolo Casadio[1]
Gianluigi Pilu[1]
Giuseppe Pelusi[1]

[1] Department of Obstetrics and Gynecology
Alma Mater Studiorum, University of Bologna
University Hospital of Bologna, Bologna, Italy
[2] "Artemisia" Fetal-Maternal Medical Center
Viale Liegi 45, Rome, Italy

Reprint requests to: Tullio Ghi, MD
I Clinica Ostetrica-Ginecologica
University of Bologna
Policlinico S. Orsola-Malpighi
Via Massarenti 13 - 40100 Bologna, Italy
Tel./Fax: 39 051 636 4411
E-mail (1): tullioghi@yahoo.com
E-mail (2): tullio.ghi@aosp.bo.it

Summary

Aim of the study. **To assess whether nuchal cord entanglement would affect the outcome of elective labour induction.**
Method. **In a group of pregnant women, the outcome of elective labour induction was evaluated in relation to a list of possibly related variables, including the presence of nuchal cord at delivery.**
Results. **Overall 184 women submitted to induction of labour were prospectively examined. Vaginal delivery was observed in 141 women (76.6%), with 105 of them (or 57%) having been delivered within 24 h from induction. At delivery, nuchal cord was detected in 59 out of 184 neonates (32%). Among the pre-induction and post-induction variables, only parity ≥ 1 (OR 3.44; 95% CI: 1.67-7.06) and a Bishop score ≥ 5 (OR 3.59; 95% CI: 1.93-6.70) appeared statistically associated with the success of induction. The chance of vaginal delivery within 24 hours from labour induction (31/59 or 53% vs 74/125 or 59%; OR: 0.92; 95% CI: 0.75-1.12) were comparable among the neonates with and without nuchal cord at birth.**
Conclusions. **In women undergoing cervical ripening, multiparity and a favourable cervical score seem the only factors that predict a successful induction. An entangled cord around the fetal neck does not seem to increase the risk of induction failure.**

KEY WORDS: nuchal cord, induction of labour, fetal distress.

Introduction

Among the methods of labour induction, cervical ripening with prostaglandins is commonly performed with vaginal delivery mostly occurring within 24 hours from starting time (1).
Among the variables that may predict the success rate of labour induction, parity and Bishop score of the cervix are traditionally reported (2-6). More recently, the effect of nuchal cord on labour induction has been investigated (7). The prevalence of nuchal cord at delivery is extremely high with a single loop reported in around the 30% of neonates (8). In theory, an entangled cord around the neck may prevent progression of the fetal head towards the outlet and may be associated to a non reassuring fetal heart rate pattern thus contributing to the induction failure. Some studies have reported a higher prevalence of nuchal cord in pregnancies following induction of labour (9, 10) possibly due to the increased uterine activity caused by prostaglandins administration. The aim of this study is to assess whether nuchal cord entanglement would affect the outcome of elective labour induction.

Material and Methods

From January to October 2006, all pregnant women requiring cervical ripening for induction of labour were recruited for the purpose of this study. Entry criteria were singleton pregnancy, gestational age (GA) between 36 and 41 completed weeks, cephalic presentation, estimated fetal weight below the 95th centile for gestational age, no history of previous hysterothomy. Cervical ripening was attempted by vaginal PGE2 application (Dinoprostone gel) whose dose (1 or 2 mg) varied according to parity and Bishop score, as previously described. Clinical evaluation was carried out by an experienced obstetrician with each patient being assigned a Bishop score. According to our Institution protocol, prostaglandines administration was carried out every 6 hours under CTG control (a 45 minutes trace for each application) until active labour started for a maximum of 4 applications within 24 hours. Induction was defined successful whether vaginal delivery was achieved within 24 hours from starting time. Following those, amniothomy and/or stepwise intravenous oxytocin infusion were considered if labour onset was not achieved. Caesarean section was considered with no clinical evidence of labour at the highest dose of intravenous oxytocin permitted (40 mL/min). Continuous monitoring of fetal heart rate was established throughout the labour. Prior to labour induction the following variables were considered for each woman: ethnicity, age, gestational age, parity, body mass index (BMI), amniotic fluid index, indi-

cation to labour induction and Bishop score. After delivery the following variables were derived for each case: neonatal weight, the presence of cord entanglement and the number of loops around the fetal neck at delivery. Outcomes assessed included: i) induction to delivery time; ii) the mode of delivery and the indication to cesarean section when the fetus was delivered abdominally. We were aiming to evaluate the correlation between pre- and post induction variables and the outcomes.
Association between categorical variables was tested using the Chi-Square or Fisher's test as appropriate. Comparison of continuous variables was performed with the t-Student test. Binary logistic regression was used assess the relationship between nuchal cord and gestational age, amniotic fluid, parity, BMI and neonatal weight. Multivariate logistic regression, including variables such as gestational age, parity, Bishop score, maternal BMI, nuchal cord, amount of amniotic fluid and neonatal weight, were employed to detect independent predictors for success of labour induction.

Results

During the study period, 184 women requiring induction of labor were enrolled and prospectively examined. Vaginal delivery was observed in 141 women (76.6%), with 105 of them (or 57%) having been delivered within 24 h of induction. Mean induction to delivery time was 20.8 ± 17.3 hours. Among the 43 (23%) abdominal deliveries, the indication was abnormal cardiotocogram in 20 (10.8%) and non progressing labour in the remaining 23 cases (12.5%). No case of perinatal complication was registered in the study group with a mean birthweight of 3427 ± 485 gr. Demographic and clinical details of the study group are presented on Table I. Among the pre-induction and post-induction variables, only parity ≥ 1 (OR: 3.44; 95% CI: 1.67-7.06) and a Bishop score ≥ 5 (OR: 3.59; 95% CI: 1.93-6.70) appeared statistically associated with the success of induction (Tab. II).
At delivery, nuchal cord was detected in 59 out of 184 neonates (32%), including a single loop in 55 (29.8%), a double one in 4 (2.1%) and a triple one in a single case (0.5%). A significant association with the presence of nuchal cord at birth was noted with none of the population variables, including gestational age ≥ 41 weeks (OR: 0.83; 95% CI: 0.45-1.54) (Tab. III).
The outcome of labour induction according to the presence of nuchal cord at delivery is summarised on Table IV. The chance of vaginal delivery within 24 hours from labour induction (31/59 or 53% vs 74/125 or 59%; OR: 0.92; 95% CI: 0.75-1.12) and the induction to delivery time (20.6 ± 17.05 hours vs 21.2 ± 17.5 hours, p 0.86) was comparable among the neonates with and without nuchal cord at birth. Furthermore, either the overall risk of caesarean section (14/59 or 24% vs 29/125 or 23%, OR: 1.02; 95% CI: 0.62-1.67) or the risk of caesarean due to abnormal cardiotocogram (8/59 or 14% vs 12/125 or 10%, OR: 1.48; 95% CI: 0.58-3.75) did not vary among the two groups.
Multiple logistic regression analysis was performed to analyse the contribution of the different variables to the outcome of the induction. Multiparity (adjusted OR: 3.38; 95% CI: 1.59-7.22, p 0.002) and Bishop score ≥ 5 (adjusted OR: 3.55; 95% CI: 1.86-6.77, p < 0.001) were found to be independent predictors of a successful labour induction (Tab. V).

Table I - Demographic and clinical details of the study population.

N patients	184
Indication to induction	
Post term (≥ 41+1 weeks)	90 (49%)
Reduced amniotic fluid	42 (23%)
Maternal complications	16 (9%)
Prolonged rupture of membranes (≥ 24 hours)	9 (5%)
Fetal malformation	4 (2%)
Fetal weight < 5 centile	2 (1%)
Other	21 (11%)
Ethnicity	
Caucasian	121 (66%)
Afrocaribbean	21 (11%)
Asian	42 (23%)
Age	33 (± 5)
BMI	27.9 (± 3.9)
GA (weeks)	40 (range 35-42)
Parity ≥ 1	52 (28%)
Bishop ≥ 5	83 (45%)

Table II - Relationship between pre-induction and post-induction variables and the outcome of labour induction (univariate logistic regression).

	Vaginal delivery ≥ 24 h (n=105 or 58%)	OR (95% CI)	p
Parity ≥ 1 (n = 52)	40 (77%)	3.44 (1.67-7.06)	0.001
Bishop score ≥ 5 (n = 83)	61 (74%)	3.59 (1.93-6.70)	< 0.001
GA ≥ 41 weeks (n = 90)	53 (59%)	1.16 (0.65-2.07)	0.657
BMI < 25 (n = 36)	19 (53%)	0.81 (0.39-1.66)	0.578
AFI > 5 cm (n = 142)	79 (56%)	0.77 (0.38-1.55)	0.485
Neonatal weight ≥ 3500 g (n = 83)	48 (58%)	1.06 (0.59-1.90)	0.882

Table III - Relationship between nuchal cord at delivery and population variables (univariate logistic regression).

	Nuchal cord at delivery (n=59 or 32%)	OR (95% CI)
GA ≥ 41 weeks (n = 90)	27 (30%)	0.83 (0.45-1.54)
Parity ≥ 1 (n = 52)	18 (35%)	1.18 (0.6-2.31)
BMI ≥ 25 (n = 148)	49 (33%)	1.29 (0.58-2.84)
AFI ≥ 5 (n = 42)	9 (21%)	0.50 (0.23-1.19)
Neonatal weight ≥ 3500 g (n = 83)	25 (30%)	0.85 (0.46-1.58)

Table IV - Relationship between nuchal cord at delivery and outcomes of labour induction.

	Nuchal cord at delivery (n=59)	OR (95% CI)
Vaginal delivery < 24 h (n = 105)	31 (53%)	0.92 (0.75-1.12)
Caesarean section (n = 42)	14 (24%)	1.02 (0.62-1.67)
Caesarean section for fetal distress (n = 20)	8 (14%)	1.48 (0.58-3.75)

Table V - Results of multivariate logistic regression for the evaluation of the factors influencing the outcome of labour induction.

	Vaginal delivery < 24h		
	OR	95% CI	p
Parity ≥ 1	3.38	1.59-7.22	0.002
Bishop score ≥ 5	3.55	1.86-6.77	< 0.001

Discussion

Several factors have been assessed as potential contributors to the success of labour induction. Lower BMI, advanced gestational age, lower neonatal birth weight, have been reported to be associated with higher vaginal delivery rate after induction of labor (11). In this study, multiparity and a favourable cervical score prior to prostaglandines administration appeared the only factors that predicted a successful induction. With a Bishop score greater than 5 the chance of achieving a vaginal delivery within 24 hours was three-fold higher in a nullipara and almost ten-fold in a multipara. As Bishop Score has a low interobserver reproducibility, more recently a sonographic rather than clinical evaluation of the cervix has been proposed to predict the outcome of labour induction. Measurement of cervical length obtained by transvaginal ultrasound prior to prostaglandines administration seems to be more accurate than Bishop score in predicting the time to delivery interval (12, 13). A correlation between nuchal cord and induction of labour has been recently noted, being still uncertain if nuchal cord incidence is increased by labour induction or if pregnancies with nuchal cord more frequently undergo labour induction. In a population-based case-control study, induction of labour has been shown to be significantly associated with a higher prevalence of nuchal cord at delivery (9). This association may be related to increased uterine activity, which may be caused by agents used for induction of labour and may affect the umbilical cord position. Ogueh et al. (10) in 2006 confirmed a higher prevalence of umbilical cord around the neonatal neck in pregnancies having undergone induction of labour and reported an association between nuchal cord and increased second stage of labour. According to our data, the presence of cord entanglement around the fetal neck does not seem to be among the factors affecting the outcome of labour induction. In our series, in fact, the frequency of nuchal cord was not increased when vaginal delivery took place more than 24 hours from labour induction or in cases of caesarean section. The presence of nuchal cord did not seem to be more likely also when caesarean section was performed due to suspected fetal distress. Traditionally, a cord entanglement around the fetal neck during the labor is regarded as a cause of fetal distress. However, whether or not nuchal cords are associated with significantly increased adverse perinatal outcome is debated (14, 15). Some Authors (9, 16-18) reported that the nuchal cord is associated with an increased risk of fetal distress, meconium-stained amniotic fluid and lower Apgar score whereas others (19) did not find an increased frequency of nonreassuring fetal heart rate patterns, operative vaginal delivery and low Apgar score in cases with nuchal cord. In a very large study including more than twenty thousand pregnancies with nuchal cord documented at birth, Sheiner et al. (20) reported a higher rate of labour induction and not reassuring fetal heart pattern, but no significant association with perinatal mortality or caesarean section.

Our results somehow supports the view that in cases of labour induction having the umbilical cord around the neck does not pose the neonate at increased risk of abnormal cardiotocogram and in general of adverse peri-

natal outcome. As a consequence, looking for the presence of nuchal cord prior to labour induction does not seem of clinical interest. Sonographic detection of nuchal cord prior to induction of labor and its clinical significance had been recently investigated by Peregrine et al (7). In fact, thanks to color Doppler ultrasound the presence of cord encirclement around the fetus during labour is amenable of ultrasound depiction. However, an entangled cord around the fetal neck is worthy to be sonographically detected if this may affect the outcome of labour induction. Based on our results, such a finding is not associated to a higher risk of induction failure or cesarean section due to suspected fetal distress, and should therefore not to be sonographically investigated prior to prostagladines administration as this does not alter obstetric management of patients. On the other hand, the chance of abnormal cardiotocography and decelerations during labour is reported to be higher when the fetus has more than one cord encirclements (21), with the outcome of labour induction being possibly affected in these cases. However the number of fetuses delivered with multiple cord encirclements after labour induction was too small in these series to allow a separate analysis.

Moreover, our data seem to indicate that fetal cord entanglement does not contribute to prevent spontaneous onset of labour. Fetal head descent is supposed to play a crucial role in promoting labour onset through its active pressure against the unripened cervix. In theory, cervical stretching may be hampered by nuchal cord entanglement, with fetal head maintained outside the pelvic inlet. This may lead to speculate that spontaneous onset of labour is more unlikely when fetal head is encircled by umbilical cord. However, the presence of nuchal cord did not seem to be related to gestational age at induction as the number of post-term pregnancies was comparable between the cases with and without nuchal cord at delivery.

In conclusion, in women undergoing cervical ripening the presence of entangled cord around the fetal neck does not seem to increase the risk of induction failure, fetal distress and adverse perinatal outcome. Such a finding, when occasionally suspected at ultrasound prior or during induction of labour, should not alter obstetric management of those patients subjected to elective induction of labour.

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