



HAL
open science

Assessment of the impact of an expectant management in case of abnormally progressing first-stage labor

Yasmine Boukerfa-Bennacer, Marianne Perrot, Antoine Giraud, Adeline Dussot, Béatrice Trombert-Paviot, Céline Chauleur, Tiphaine Raia-Barjat

► To cite this version:

Yasmine Boukerfa-Bennacer, Marianne Perrot, Antoine Giraud, Adeline Dussot, Béatrice Trombert-Paviot, et al.. Assessment of the impact of an expectant management in case of abnormally progressing first-stage labor. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, 2021, 258, pp.362-365. 10.1016/j.ejogrb.2021.01.041 . hal-04826737

HAL Id: hal-04826737

<https://hal.science/hal-04826737v1>

Submitted on 19 Dec 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial 4.0 International License

Assessment of the impact of an expectant management in case of abnormally progressing first-stage labor

Yasmine Boukerfa-Bennacer MD¹, Marianne Perrot MD¹, Antoine Giraud MD, PhD^{2,3},
Adeline Dussot MD¹, Béatrice Trombert-Paviot MD, PhD⁴, Céline Chauleur MD, PhD^{1,3},
Tiphaine Raia-Barjat MD, PhD^{1,3}

¹ *Department of Obstetrics, Centre Hospitalier Universitaire de Saint-Étienne, Saint-Étienne, France*

² *Neonatal Intensive Care Unit, Centre Hospitalier Universitaire de Saint-Étienne, Saint-Étienne, France*

³ *INSERM U1059 Sainbiose, Université Jean Monnet, Saint-Étienne, France*

⁴ *Department of Public Health and Medical Informatics, Centre Hospitalier Universitaire de Saint-Étienne, Saint-Étienne, France*

Correspondence:

Tiphaine RAI A-BARJAT

Department of Gynecology and Obstetrics

Centre Hospitalier Universitaire de Saint-Étienne

42055 Saint-Étienne cedex 2 France

Phone: +33 - 4 - 77 82 86 09

Fax: +33 - 4 - 77 82 89 54

Email: tiphaine.barjat@chu-st-etienne.fr

Short title: Expectant management in first-stage labor arrest

Keywords: labor arrest; first-stage labor; cesarean section; expectant management

ABSTRACT

Objective: To compare the cesarean section rate before and after the introduction of an expectant management protocol in patients with abnormally progressing first-stage labor.

Methods: A prospective monocentric cohort study performed between January 2012 and July 2016.

Results: 267 patients were included, 97 in the control group and 170 in the study group. The number of cesarean sections decreased from 86% to 45% ($p < 0.001$). The number of instrumental extractions increased from 8.3% to 29.4% ($p < 0.001$). The number of postpartum hemorrhages increased from 5.2% to 18% ($p < 0.01$). No differences in the rates of perineal lesions, neonatal pHa below 7.10, and shoulder dystocia were observed.

Conclusion: The expectant management in patients with labor arrest in the first stage was associated with a decrease in the number of cesarean sections, at the cost of an increase in instrumental extractions and postpartum hemorrhages.

INTRODUCTION

The global cesarean section rate doubled between 2000 and 2015 to 21.1% of births (1,2). This rapid increase has not been associated with a decrease in maternal and fetal morbimortality (1,3). The World Health Organization (WHO) recommends a cesarean section rate between 10 and 15% (2,4). In France, the cesarean section rate is around 21% (5). The use of cesarean section is a risk factor for scarred uterus, uterine rupture, hemostasis hysterectomy, placenta *accreta*, and the recourse to a cesarean section for a subsequent pregnancy (1,3,4).

The labor arrest and the nonreassuring fetal tracing are the main indications for cesarean section. The definition of the different stages of spontaneous labor was clarified in 2010. The first stage of labor is divided into a latent phase up to 5 cm and an active phase from 6 cm until complete dilatation (6). American recommendations advocate expectant management in case of labor arrest with a new definition of abnormal first-stage labor (6,7). Following the latest recommendations of the CNGOF (National College of French Gynecologists and Obstetricians) and ACOG (American College of obstetricians and gynecologists) on the management of labor arrest, a new protocol has been implemented in order to accept expectant management in patients with first-stage labor arrest (8,9).

The main objective of this study was to compare the cesarean section rate before and after the introduction of an expectant management protocol in patients with first-stage labor arrest. The secondary objectives were to compare the rate of instrumental extraction, maternal morbidity, and neonatal morbidity.

MATERIAL AND METHODS

Type of study and inclusion criteria

This is a monocentric prospective cohort study performed in the Gynecology and Obstetrics department of the Saint-Étienne University Hospital between January 2012 and July 2016. The control group with first-stage labor arrest before the introduction of the expectant management protocol was included from January 2012 to May 2013; the study group was included from January 2015 to July 2016. The expectant management protocol was implemented in 2014, and the study group period began after the teams had fully adopted the protocol. The inclusion criteria were: ≤ 1 cm of labor progress over two hours (i.e., three identical dilatations one hour apart), ≥ 4 cm of dilatation, single pregnancy, cephalic presentation, term ≥ 37 weeks, and ruptured membranes. Patient information was given in the consultation waiting room. The study received a favorable opinion from the Committee for Research Ethics in Obstetrics and Gynecology (No. CEROG 2020-OBST-0405).

Conduct of the study

Data collection was performed prospectively on a standardized observation notebook from medical records. Before introducing the expectant management protocol in 2015, a cesarean section was performed in case of ≤ 1 cm of labor progress over two hours. During 2014, an expectant management policy was gradually implemented in the department. A new regional protocol (Elena Perinatal Network; www.chu-st-etienne.fr/elena) was applied in the delivery room. In this new protocol, in the case of spontaneous labor, the latent phase was prolonged from 20 hours for nulliparous women and 14 hours for multiparous women. Women with prolonged latent phase and absence of abnormality of the fetal heart rate were allowed to wait 6 hours at the same dilatation after implementing corrective measures: gradually increasing oxytocin to obtain 3 or 4 uterine contractions every 10 minutes, amniotomy, and

finally the application of epidural analgesia if this had not been done. For women with labor arrest in the active phase (from 6 cm), an expectation of 4 hours was allowed in the case of an adequate uterine activity or 6 hours in the case of an inadequate uterine activity. All patients benefited from the previous corrective measures, i.e., bladder emptying, correction of mechanical factors using different positions (right and left lateral decubitus, Crouzat-Walcher positions, or Rosa, "four-legged", seated), manual rotation of posterior presentations between 8 and 10 cm, control of a rigid cervix with antispasmodics, Magnesium, an injection of 10 mL of Lidocaine into the epidural catheter to relax the cervix called "cervical dose". Only the first episode of labor arrest from 120 minutes was considered. The following labor arrest episodes were not considered in the duration of labor arrest but in the total duration of labor. The maternal-fetal ratio (MFR) was defined as maternal height (cm) divided by symphyseal-fundal uterine height (cm). Shoulder dystocia was defined as a requirement of additional obstetric maneuvers when gentle downward traction has failed to affect the shoulders' delivery.

Statistical analysis

Statistical analyses were performed using SAS software, version 9.2. Continuous variables were expressed as mean (standard deviation). Categorical variables were expressed as absolute numbers (percentage). The primary endpoint was the rate of cesarean section following the use of the expectant management protocol. The association between the rate of cesarean section and the use of expectant management was then examined using multivariable logistic regression analysis to adjust for potential confounding factors of relevant maternal characteristics. Qualitative variables were analyzed by the Fisher exact test when the numbers were less than five or by the Chi 2 test when the validity conditions were met. Quantitative variables were analyzed by Student's t-test or Mann Whitney's test when data were,

respectively, normally or not normally distributed. The level of significance was set at $p < 0.05$.

RESULTS

Two hundred sixty-seven patients with first-stage labor arrest were included, 97 in the control group and 170 in the study group.

Demographic and obstetrical characteristics of the patients in the two groups were similar, except for the age (Table 1). The spontaneous labor rate was higher in the study group ($p=0.02$).

Table 1: Demographic and obstetrical characteristics:

	Control group n= 97	Study group n= 170	p value
Age (years), (Mean \pm SD)	27.1 (\pm 4.8)	28.7 (\pm 5.5)	0.02
Height (cm), (Mean \pm SD)	162.0 (\pm 6.8)	162.4 5(\pm 6.6)	0.6
BMI (kg/m²), (Mean \pm SD)	24.3 (\pm 4.6)	25.6 (\pm 5.8)	0.08
uterine height (cm), (Mean \pm SD)	33.1 (\pm 2.3)	33.5 (\pm 2.4)	0.2
MFR, (Mean \pm SD)	4.9 (\pm 0.4)	4.8 (\pm 0.4)	0.29
Parity, n (%)			
Primiparous	73 (75%)	112 (66%)	0.11
Multiparous	24 (25%)	58 (34%)	
Ethnicity, n (%)			
Caucasian	2 (65%)	103 (61%)	0.13
Others	35 (35%)	67 (39%)	
Gestational age at delivery in weeks (Mean \pm SD)	40 \pm 1	40 \pm 1	0.14
History of cesarean section, n (%)	16 (16.5%)	34 (20%)	0.48
Pathology of pregnancy, n (%)	18 (18.6%)	46 (27%)	0.12
Type of labor, n (%)	63 (65%)	85 (50%)	

Spontaneous	34 (35%)	85 (50%)	0.02
Induced			
Dilation at diagnosis (cm), n (%)	22 (22.7%)	51 (30%)	
4	31 (32%)	43 (25%)	
5	16 (16.5%)	25 (15%)	0.32
6	4 (4.1%)	16 (9%)	
7	7 (7.2%)	14 (8%)	
8	7 (17.5%)	21 (12%)	
9			
Fetal head engagement, n (%)	3 (3%)	2 (1%)	0.36
Engaged	94 (97%)	168 (99%)	
Not engaged			
Presentation determined clinically, n (%)			0.18
Anterior	4 (27%)	3 (38%)	
Posterior	44 (49%)	72 (44%)	
Other	21 (24%)	30 (18%)	

Abbreviations: BMI, body mass index; MFR, maternal fetal ratio; SD, standard deviation

The number of C-sections decreased significantly from 86% to 45% ($p < 0.0001$). The risk of cesarean section was 8-fold higher in patients from the control group (OR= 8.2; CI 95% (4.2-15.8)). After adjusting for labor induction, the cesarean risk was 10-fold higher in the control group (OR=9.8; CI 95% (4.9-19.4)).

The rate of instrumental extraction decreased from 8.3% in the control group to 29.4% in the study group ($p < 0.001$) (Table 2). There was no difference in perineal lesions. The number of postpartum hemorrhages (PPH) increased in the study group, from 5.2% to 18% ($p = 0.004$). Five were severe, with losses superior to one liter, all in the study group. Two patients were treated with sulprostone; one patient required sulprostone and a Bakri balloon.

Table 2: Delivery mode and maternal outcomes

	Control group n=97	Study group n=170	p value
Number of cesarean sections, <i>n</i> (%)	84 (86.6%)	77 (45%)	<.0001
Cesarean section indication, <i>n</i> (%)			
Stagnation	2 (64%)	4 (26%)	0.43
Abnormal fetal heart rate	21 (22%)	27 (16%)	0.16
Extraction failure	1 (1%)	3 (2%)	0.35
Number of natural deliveries, <i>n</i> (%)	13 (13.4%)	93 (55%)	<.0001
Number of instrumental extractions, <i>n</i> (%)	8 (8%)	50 (29%)	<.0001
Perineal lacerations, <i>n</i> (%) :			
- 1st and 2nd degree:	11 (85%)	77 (83%)	0.96
- Episiotomy:	1 (7%)	4 (4%)	0.49
- 3rd and 4th degree:	2 (15%)	6 (6%)	0.28
Postpartum hemorrhage >500 mL, <i>n</i> (%)	5 (5.2%)	30 (18%)	0.0036

There were no differences in birth weight and head circumference between the two groups (Table 3). The mean arterial pH (pHa) was lower in the study group (p=0.004). Apgar scores were comparable in both groups. The shoulder dystocia rate trended to increase from 1 to 6.5% in control *versus* study group (p=0.06) (Table 3).

Table 3: Neonatal characteristics and outcomes

	Control group n=97	Study group n=170	p value
Birth weight (g), (Mean ± SD)	491 (± 430)	426 (±484)	0.28
Head circumference (cm), (Mean ± SD)	34.6 (± 1.6)	34.5 (±1.5)	0.6
Arterial pH (Mean ± SD)	7.27 (± 0.06)	7.20 (±0.1)	0.004
- Arterial pH < 7.10 (n, %)	2 (2%)	5 (3%)	1
Venous pH (Mean ± SD)	7.27 (± 0.052)	7.30 (±0.1)	0.37
Arterial lactates (Mean ± SD)	3.9 (± 2.2)	4.9 (±2.3)	0.002
Venous lactates (Mean ± SD)	3.5 (± 1.8)	4.3 (±2)	0.003
Apgar score <7 at 5 minutes (n, %)	3 (3.1)	4 (2.4)	0.7
Shoulder dystocia, n (%)	1 (1%)	11 (6.5%)	0.06
Mc Roberts	1 (1%)	5 (3%)	
Jacquemier	0	6 (3.5%)	

SD: standard deviation

The use of oxytocin before the labor arrest diagnosis was greater in the control group (p=0.02). Regarding maternal positions during labor, the use of different positions was more frequent in the study group, with more maternal mobilizations (p<.0001 for all positions). The length of labor arrest was higher in the study group, increasing from 218 ± 59 minutes to 240

± 93 minutes ($p=0.04$). Total labor length increased from 387 ± 153 minutes to 531 ± 197 minutes ($p<0.0001$).

DISCUSSION

In our study, an expectant management in first-stage labor arrest significantly reduces the number of cesarean sections.

A limit is the higher proportion of induced labor in the study group. Labor induction is a risk factor of labor arrest and cesarean section, which can only strengthen the result showing a decrease in the number of cesarean sections. Another limit is the respect of the protocol. Mean labor arrest length was longer than expected for the control group with an indication of a cesarean section after 2 hours of labor arrest. Mean labor arrest length in the study group was shorter than the 4 to 6 hours accepted before the indication of cesarean section.

Concerning demographic characteristics, our two groups were comparable, except for the age and the type of labor induction. Waldenstrom *et al.* compared the risk of labor arrest and maternal age in 998 675 patients and found that an age upper than 35 years was a risk factor for labor arrest (10). Many studies have shown that correction of posterior to anterior presentation varieties resulted in a favorable outcome with a natural delivery. Lan-ping Liu *et al.* showed that lateral decubitus with a hyper-flexed leg in the stirrup was associated with occipito-anterior rotation of the fetal head and increased natural delivery rate (11–14). In the case of spontaneous labor in a single pregnancy with a cephalic presentation, the use of oxytocin in discontinuous doses from the active phase of labor (> 5 cm) reduced the risk of cesarean section and hyperkinesia (15). An amniotomy should be performed, and then oxytocin should be used if labor arrest persists after 1 hour (9).

In our study, a substantial reduction in the cesarean section rate was observed following the expectant management protocol. A similar result was described by Wang *et al.* in a large retrospective study (16). The number of cesarean sections for labor arrest in the active phase decreased from 44% to 55% in the control group ($p < 0.001$). Non-reassuring fetal tracing led

more often to a cesarean section in the study group, 31% *versus* 13% ($p < 0.001$). The authors also found that the rate of instrumental extraction (forceps) was significantly higher in the study group; there were no differences in the number of postpartum hemorrhages and severe perineal lesions. The authors found no significant difference regarding neonatal outcome (17).

Nelson *et al.* studied the cesarean section rate in primiparous women for labor arrest before implementing the ACOG recommendations. His study included 13269 primiparous women who had a cesarean section: 65% of cesarean sections were performed for labor arrest, 8% for labor arrest between 0 and 3 cm, and 92% after 4 cm. Moreover, 66% of women with labor arrest after 4 cm reached a dilatation greater than 6 cm, and 95% of cesarean sections were performed after 6 cm dilatation or had an expectation of at least 6 hours with corrective measures. He concluded that the new American recommendations would not change the cesarean section rate in primiparous patients (18).

Marpeau *et al.* studied the mechanisms of labor arrest. In 83% of cases, the postpartum pelvimetry was normal in women with labor arrest in the first stage (19). Kjaergaard *et al.* studied labor arrest incidence, maternal and fetal outcomes in nulliparous patients without comorbidity. He found a rate of labor arrest of 37%, of which 61% corresponded to labor arrest in the second stage of labor. Compared to women delivered without labor arrest, patients with labor arrest had more cesarean sections and vacuum extraction, more postpartum hemorrhage, more non-clear amniotic fluid, and their children were more often given low one-minute neonatal Apgar scores (20).

Concerning maternal outcomes, in our study, we found more postpartum hemorrhages and longer labor length. Sheldon *et al.* found that the main risk factors for postpartum hemorrhage were multiparity, gestational age beyond 41 years, induction of labor, and cesarean section (21).

Concerning the perineal lesions, there was no difference before and after the expectant management protocol. Williams *et al.* showed that a longer second phase of labor, the use of instrumental extraction, and the presence of meconium fluid were risk factors of perineal laceration (22). Cheng *et al.* showed that a prolongation of the second stage of labor longer than 4 hours was associated with a higher rate of instrumental extraction, cesarean section, and 3rd- and 4th-degree perineal laceration (23). Le Ray *et al.* also studied the impact of a prolongation of the second stage of labor. Expulsive efforts lasting less than one hour were associated with a higher rate of spontaneous vaginal births. The risk of neonatal asphyxia increased proportionately with each additional hour of pushing. The risk of postpartum hemorrhage and maternal fever increased significantly beyond 2 hours of expulsive efforts (24).

Concerning neonatal characteristics, the means arterial pH, arterial lactates, and venous lactates were lower in the group after protocol, but there was no difference in the number of acidoses. Several authors demonstrated that the risk of severe neurological complications increased significantly with a pHa below 7.10 in a cohort of 51519 term births (25, 26).

In our study, there was a trend towards an increased rate of shoulder dystocia after the introduction of the expectant management protocol. The association of labor arrest and shoulder dystocia was not described previously (27).

CONCLUSION

An expectant management in case of stagnation of dilatation in the first phase of labor was associated with a reduction of cesarean sections, and an increase of instrumental extractions and post-partum hemorrhages. Neonatal outcomes were not impacted. These results do not necessarily need to modify our protocol but should lead us to exercise cautiously not to compromise maternal and neonatal well-being.

REFERENCES

1. Mahadik K. Rising Cesarean Rates: Are Primary Sections Overused? *J Obstet Gynaecol India*. 2019;69:483-9.
2. Boerma T, Ronsmans C, Melesse DY, Barros AJD, Barros FC, Juan L, et al. Global epidemiology of use of and disparities in caesarean sections. *Lancet Lond Engl*. 2018;392:1341-8.
3. Gregory KD, Jackson S, Korst L, Fridman M. Cesarean versus vaginal delivery: whose risks? Whose benefits? *Am J Perinatol*. 2012;29:7-18.
4. Betran AP, Torloni MR, Zhang JJ, Gülmezoglu AM, WHO Working Group on Caesarean Section. WHO Statement on Caesarean Section Rates. *BJOG Int J Obstet Gynaecol*. 2016;123:667-70.
5. Blondel B, Coulm B, Bonnet C, Goffinet F, Le Ray C, National Coordination Group of the National Perinatal Surveys. Trends in perinatal health in metropolitan France from 1995 to 2016: Results from the French National Perinatal Surveys. *J Gynecol Obstet Hum Reprod*. 2017;46:701-13.
6. Zhang J, Landy HJ, Ware Branch D, Burkman R, Haberman S, Gregory KD, et al. Contemporary patterns of spontaneous labor with normal neonatal outcomes. *Obstet Gynecol*. 2010;116:1281-7.
7. Pitkin RM, Friedman EA. Primigravid labor: a graphicostatistical analysis. *Obstet Gynecol* 1955;6:567-89. *Obstet Gynecol*. 2003;101:216.
8. American College of Obstetricians and Gynecologists (College), Society for Maternal-Fetal Medicine, Caughey AB, Cahill AG, Guise J-M, Rouse DJ. Safe prevention of the primary cesarean delivery. *Am J Obstet Gynecol*. 2014;210:179-93.
9. Dupont C, Carayol M, Le Ray C, Barasinski C, Beranger R, Burguet A, et al. [Oxytocin administration during spontaneous labour: Guidelines for clinical practice. Guidelines short text]. *Gynecol Obstet Fertil Senol*. 2017;45:56-61.
10. Waldenström U, Ekéus C. Risk of labor dystocia increases with maternal age irrespective of parity: a population-based register study. *Acta Obstet Gynecol Scand*. 2017;96:1063-9.
11. Guittier M-J, Othenin-Girard V. [Correcting occiput posterior position during labor: the role of maternal positions]. *Gynecol Obstet Fertil*. 2012;40:255-60.
12. Liu L-P, Chen J-H, Yang Z-J, Zhu J. Corrective effects of maternal extreme flexure and hip abduction combined with contralateral side-lying on persistent foetal occipito-posterior position. *Int J Nurs Pract*. 2018;24:e12663.
13. Reichman O, Gdansky E, Latinsky B, Labi S, Samueloff A. Digital rotation from occipito-posterior to occipito-anterior decreases the need for cesarean section. *Eur J Obstet Gynecol Reprod Biol*. 2008;136:25-8.
14. Desbriere R, Blanc J, Le Dû R, Renner J-P, Carcopino X, Loundou A, et al. Is maternal posturing during labor efficient in preventing persistent occiput posterior position? A randomized controlled trial. *Am J Obstet Gynecol*. 2013;208:60.e1-8.

15. Saccone G, Ciardulli A, Baxter JK, Quiñones JN, Diven LC, Pinar B, et al. Discontinuing Oxytocin Infusion in the Active Phase of Labor: A Systematic Review and Meta-analysis. *Obstet Gynecol.* 2017;130:1090-6.
16. Wang D, Ye S, Tao L, Wang Y. The impact of a new standard labor protocol on maternal and neonatal outcomes. *Arch Gynecol Obstet.* 2017;296:1085-90.
17. Burgess APH, Katz JE, Moretti M, Lakhi N. Risk Factors for Intrapartum Fever in Term Gestations and Associated Maternal and Neonatal Sequelae. *Gynecol Obstet Invest.* 2017;82:508-16.
18. Nelson DB, Alexander JM, McIntire DD, Leveno KJ. « New or not-so-new » labor management practices and cesarean delivery for arrest of progress. *Am J Obstet Gynecol.* 2020;222:71.e1-71.e6.
19. Marpeau L, Sergent F, Manson F, Verspyck E, Eurin D. [Mechanisms of the stagnation of dilatation in the active phase of labor]. *Gynécologie Obstétrique Fertil.* 2002;30:282-5.
20. Kjaergaard H, Olsen J, Ottesen B, Dykes A-K. Incidence and outcomes of dystocia in the active phase of labor in term nulliparous women with spontaneous labor onset. *Acta Obstet Gynecol Scand.* 2009;88:402-7.
21. Sheldon WR, Blum J, Vogel JP, Souza JP, Gülmezoglu AM, Winikoff B, et al. Postpartum haemorrhage management, risks, and maternal outcomes: findings from the World Health Organization Multicountry Survey on Maternal and Newborn Health. *BJOG Int J Obstet Gynaecol.* m2014;121 Suppl 1:5-13.
22. Williams MK, Chames MC. Risk factors for the breakdown of perineal laceration repair after vaginal delivery. *Am J Obstet Gynecol.* 2006;195:755-9.
23. Cheng YW, Hopkins LM, Caughey AB. How long is too long: Does a prolonged second stage of labor in nulliparous women affect maternal and neonatal outcomes? *Am J Obstet Gynecol.* 2004;191:933-8.
24. Le Ray C, Audibert F, Goffinet F, Fraser W. When to stop pushing: effects of duration of second-stage expulsion efforts on maternal and neonatal outcomes in nulliparous women with epidural analgesia. *Am J Obstet Gynecol.* 2009;201:361.e1-7.
25. Yeh P, Emary K, Impey L. The relationship between umbilical cord arterial pH and serious adverse neonatal outcome: analysis of 51,519 consecutive validated samples. *BJOG Int J Obstet Gynaecol.* 2012;119:824-31.
26. Graham EM, Ruis KA, Hartman AL, Northington FJ, Fox HE. A systematic review of the role of intrapartum hypoxia-ischemia in the causation of neonatal encephalopathy. *Am J Obstet Gynecol.* 2008;199:587-95.
27. McFarland M, Hod M, Piper JM, Xenakis EM, Langer O. Are labor abnormalities more common in shoulder dystocia? *Am J Obstet Gynecol.* 1995;173:1211-4.