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Original Research

Fulfillment of the criteria for diagnosis of cephalo-pelvic disproportion: ACOG guidelines

S. Srisukho[1], K. Srisupundit[1], T. Tongsong[1,*]

[1] *Department of Obstetrics and Gynecology, Faculty of Medicine, Chiang Mai University (Thailand)*

Summary

Purpose: To determine the proportion of cesarean delivery due to CPD without fulfillment of the criteria for diagnosis. *Materials and Methods*: The obstetric database, between January 2010 and December 2012, was assessed to identify the records of cesarean delivery due to CPD, and the complete medical records were comprehensively reviewed. The degree of adherence to the guidelines on diagnosis of CPD was determined using the criteria recommended by American Congress of Obstetricians and Gynecologists (ACOG) in 2003 compared with that based on the new ACOG 2014 guidelines. *Results*: During the study period, 475 women underwent cesarean delivery indicated by CPD. The percentages of cases diagnosed with CPD without fulfilling the criteria recommended by ACOG 2003 and ACOG 2014 were 19.37% (92 cases) and 92.42% (432), respectively. Regarding ACOG 2003, cases with non-adherence to the guidelines were mainly associated with diagnosis in the latent phase (55 cases; 11.58%), missed diagnosis for macrosomia in cases of prelabor cesarean section (25 cases; 5.26%), and unfulfilled criteria for diagnosis in the second stage (7 cases; 1.47%). *Conclusion*: Approximately 19% based on ACOG 2003 guidelines and 92% based on ACOG 2014 guidelines failed to meet the criteria for diagnosis of CPD, suggesting that strengthening diagnosis may reduce a large number of unnecessary cesarean sections.

Key words: Cesarean delivery; Cephalopelvic disproportion; Guidelines.

Introduction

The rising cesarean section rate (CSR) is one of the obstetric challenges faced in many countries [1-4]. For example, the CSR in the United States had a rapid increase from 22% in 1996 to 33% in 2011 [5]. In our hospital (Maharaj Nakorn Chiang Mai Hospital, Thailand), the CSR significantly increased from 11.3 % in 1992 to 23.6 % in 2011 [6]. Such CSRs are much higher than the appropriate CSR, 10-15% in low-risk obstetric population, as suggested by the World Health Organization (WHO) [7]. Though cesarean section can be life-saving for the mother and fetus in certain situations, the rapid increase in CSR without a decrease in the morbidity and mortality of mothers and neonates raises much concern about the overuse of cesarean section [8]. Therefore, it is essential for obstetricians to recognize safe and appropriate opportunities of preventing the overuse of cesarean section, especially primary cesarean delivery. Cesarean birth indicated by cephalopelvic disproportion (CPD) accounts for a significant increase in CSR. The prevalence of CPD in our hospital increased from 3.2% in 1992 to 7.9 % in 2011 [6]. According to WHO recommendations, the optimal CSR due to CPD should not be more than 5% [7]. Therefore, it is reasonable to hypothesize that such a higher rate was partly associated with the overdiagnosis of CPD; this is supported by many previous studies [9-12]. Therefore, a strategy to reduce the rate of overdiagnosis of CPD is certainly effective in reducing the overuse of cesarean section.

CPD means a disproportion of the fetal size relative to the maternal pelvis, resulting in failure to progress. In practice, diagnosis of CPD is usually based on protracted or arrested labor during the active phase, probably secondary to true disparity between fetal size and maternal pelvic size, and fetal malposition or malpresentation. The diagnosis of CPD has been mostly done using ACOG guidelines (ACOG 2003), based on the classic studies of Friedman [13]. Currently, new guidelines on the diagnosis of CPD has been proposed by a workshop convened by the United States National Institute of Child Health and Human Development (NICHD), Society of Maternal-Fetal Medicine (SMFM), and the American College of Obstetricians and Gynecologists (ACOG 2014) [14], mainly based on the studies of Zhang *et al*. [15-17]. However, the new guidelines have not been validated yet. The objective of this study is to determine the proportion of cesarean births diagnosed with CPD without fulfilling the criteria based on the long-practiced guidelines (ACOG 2003) and the new guidelines (ACOG 2014).

Materials and Methods

A retrospective analytical study was undertaken at a tertiary center (teaching hospital), Department of Obstetrics and Gynecology, Chiang Mai University, Thailand. The study was conducted with ethical approval by the institutional review board (approval number: OBG-2555-01374). The obstetric database, i.e., the computerized delivery records from January 1, 2010, to December 31, 2012, was assessed and reviewed for details of delivery. The

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Table 1. — *Labor characteristics of the cases diagnosed for CPD based on ACOG 2003 and ACOG 2014 guidelines.*

	ACOG 2003 guidelines	No. of cases	Percent	ACOG 2014 guidelines	No. of cases	Percent
Total CPD (n: 475)	Unfulfilled criteria	92	19.37	Unfulfilled criteria	439	92.42
	Fulfilled criteria	383	80.63	Fulfilled criteria	36	7.58
Labor characteristics	Prelabor / latent phase	80	16.84	Prelabor / Cx < 6 cm	186	39.16
	Protracted dilatation	14	2.95	Cx > 6 cm, UA < 4 hr	217	45.68
	Arrest of dilatation	327	68.84	Cx > 6 cm, UA > 4 hr	31	6.53
	Prolonged deceleration	13	2.74	Normal 2nd stage	37	7.79
	Abnormal 2nd stage	41	8.63	Abnormal 2nd stage	4	0.84
UA adequacy (n: 469)	Adequate	436	92.96	Adequate	108	23.03
	Inadequate	33	7.04	Inadequate	361	76.97
Suspected macrosomia (n: 30)	Less than < 4500 g	25	83.33	Less than 5000 g	30	100
	4500 g or more	5	16.67	5000 g or more	0	0

ACOG: American Congress of Obstetricians and Gynecologists, Cx: cervical dilatation, UA: uterine activity.

records of singleton pregnancies that underwent primary cesarean delivery due to CPD (cephalopelvic disproportion) were identified. The full medical records of the digitally selected cases were also assessed and comprehensively reviewed.

The baseline characteristics of the women and all the clinical parameters that are essential for diagnosis of CPD were extracted and recorded, for example, time sequence of clinical events; strength of uterine contraction; pattern of labor progression, including the details of rate, duration and pattern of cervical effacement, dilatation, and descent; clinical assessment of pelvimetry; degree of molding and caput; and estimated fetal weight, either by manual or ultrasound assessment.

In our practice, the diagnosis of CPD follows the guidelines recommended by the American Congress of Obstetricians and Gynecologists (ACOG) in 2003, which was referred to as the gold standard criteria for the diagnosis of CPD [18]. Briefly, the ACOG 2003 criteria consist of all the following three components: 1) active phase of at least 3-4 cm of cervical dilatation and 100% of cervical effacement, 2) good uterine contraction for at least 2 hours, primarily based on clinical evaluation in this study, and 3) abnormal labor curve, any one of the following: protracted dilatation ($<$1.2 cm/hr for nulliparas or $<$1.5 cm/hr for multiparas), secondary arrest of dilatation ($>$ 2 hr), arrest of descent ($>$ 1 hr, in pelvic division), prolonged deceleration phase ($>$ 3 hr for nulliparas or $>$ 1 hr for multiparas), or prolonged second stage ($>$ 2 hr for nulliparas or $>$ 1 hr for multiparas in case of no regional anesthesia).

This analysis also includes the proportion of women diagnosed with CPD who met the criteria of the new guidelines recommended by ACOG and SMFM (Society for Maternal and Fetal Medicine) [14], referred to as ACOG 2014. The recommendations are as follows:1) active phase defined by cervical dilatation of at least 6 cm together with no cervical change in spite of adequate uterine activity for at least 4 hours (or at least 6 h of oxytocin administration with inadequate uterine activity), OR 2) arrest of labor in the second stage of labor for at least 2 or 3 hours of pushing in multiparous or nulliparous women, OR 3) prelabor cesarean delivery to avoid potential birth trauma in cases of estimated fetal weights of at least 5000 g in women without diabetes and at least 4500 g in women with diabetes. Note that protracted dilatation or descent was not considered as abnormal labor indicated for cesarean delivery, and clinical parameters like molding/caput and adequacy of clinical pelvimetry were not included in the criteria.

Statistical analyses were performed using SPSS version 21.0 (IBM Corp. Released 2012; IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp). The main outcome measures were proportions of cesarean delivery that failed to meet the criteria according to ACOG 2003 and ACOG 2014. The descriptive data were presented as percentage, mean and SD for parametric data and as median and range for nonparametric data.

Results

Of the 6,048 births during the study period, 1458 or 24.1% underwent cesarean section. Among them, 475 or 7.85% were indicated by CPD. The mean $\pm$ SD of maternal age for those indicted by CPD was 28.9 $\pm$ 5.8 years (range: 16-45). Among them, 87 (18.3%) had advanced maternal age and 19 (4.0%) were adolescents. Nearly two-third (298 women, 64%) were nulliparous. The mean $\pm$ SD of pre-pregnancy body mass index was 23.2 $\pm$ 4.7 kg/m^2 (range: 15-43). The mean $\pm$ SD of gestational age at delivery was 39 $\pm$ 1.5 weeks (range: 27-42), and the mean $\pm$ SD of birth weight was 3323 $\pm$ 463 grams (range: 2010-4950).

The percentage of cases diagnosed with CPD without fulfillment of the criteria recommended by ACOG 2003 and ACOG 2014 were 19.37% and 92.42%, respectively, as presented in Table 1. Regarding ACOG 2003, cases with non-adherence to the guidelines were mainly associated with cesarean delivery before active phase (55 cases; 11.58%), suspected fetal macrosomia but finally proven to have average birth weight (25 cases; 5.26%), inadequate criteria of active phase (5 cases; 1.05%), and failure to meet second stage criteria (7 cases; 1.47%), among which 6 cases had failure of vacuum extraction procedure. Note

Table 2. — *Clinical parameters contributing to probability of vaginal delivery (n: 475*).*

		No. of cases	Percent
Molding	Non-significant	229	74.59
	Significant	78	25.41
	Total	**307**	**100**
Molding AND Inadequacy of pelvis	One or none	367	92.21
	Both	31	7.79
	Total	**398**	**100**
Molding AND Significant caput	One or two or none	385	96.73
AND Inadequacy of pelvis	All	13	3.27
	Total	**398**	**100**
Molding AND Significant caput	One or none	260	83.6
	Both	51	16.4
	Total	**311**	**100**
Adequacy of pelvimetry	Adequate	149	33.94
	Inadequate	141	32.12
	Equivocal	149	33.94
	Total	**439**	**100**

* Total number of cases: 475, but each parameter containing cases with missing data.

that only 12 cases (2.53%) failed to meet the minimal criteria of ACOG 2003 after entering the active phase. Approximately 70% of them were nulliparous. Maternal obesity accounted for 42.39% (39 of 92 cases). Additionally, 44 cases (47.82%) had medical complications, half of which were associated with diabetes mellitus. Certainly, all the 92 cases also failed to meet the more strict criteria recommended by ACOG 2014.

Surprisingly, only 36 cases (7.58%) met the criteria of the new guidelines recommended by ACOG 2014. Among them, 31 out of 475 (6.52%) were diagnosed with CPD in the active phase, and 5 cases (1.05%) were diagnosed in the second stage.

Table 2 presents the proportions of other factors contributing to the probability of successful delivery, including degree of molding and caput as well as adequacy of pelvic size based on clinical pelvimetry and estimation of fetal size. Approximately 25% of cases diagnosed with CPD had significant molding, and as high as 83% had either molding or caput formation at the time of CPD diagnosis. Furthermore, approximately one-third were documented to have pelvic inadequacy for fetal size by the attending physicians. Notably, 27 out of the 36 cases (75%) meeting the criteria of ACOG 2014 also had significant molding.

Discussion

Our standard guidelines on the diagnosis of CPD, which have been practiced for several years, are based on the recommendation of ACOG, originally developed by Friedman E [13]. Note that nearly 20% of parturient diagnosed with CPD did not meet the standard diagnostic criteria. Thus, a significant number of cesarean sections might have been avoided if an audit system had been strictly used. Nevertheless, our results suggest that the previous ACOG guidelines for the diagnosis of CPD can result in overdiagnosis, and the CSR is still relatively high even though the guidelines have been perfectly followed. In particular, diagnosis of CPD at 3-4 cm cervical dilatation can simply lead to false CPD. The new guidelines recommended by ACOG and SMFM, based on the studies of Zhang *et al*. [15-17], may be more attractive and are worth being tested. Unbelievably, more than 90% of our cases did not meet the criteria of the new guidelines, indicating that several unnecessary cesarean sections could be avoided. Nevertheless, it may be very hard for the dramatic changes in clinical practice introduced by the new guidelines to be accepted widely.

It is noteworthy that approximately 45% of cases that failed to meet the 6 cm dilation criteria of CPD were associated with duration of adequate contraction of less than 4 hours, and nearly 40% were diagnosed with CPD before the cervix was 6 cm dilated. We observed that most of them were also suspected of fetal macrosomia. Therefore, such suspicion might reduce the options of the obstetricians in diagnosis of CPD. Furthermore, nearly all cases diagnosed in the second stage could have waited, according to the new guidelines. In our practice, most patients with expected prolonged second stage were offered operative vaginal delivery if the condition was proper for the procedure, and it was rarely delayed until fulfillment of the criteria of prolonged second stage. If the procedure was not successful, CPD was diagnosed without meeting the criteria based on duration of delivery.

Based on this study, we have taken note of the following:

i. Nearly 20% of cases diagnosed with CPD did not fulfill the criteria of ACOG 2003, whereas more than 90% did not fulfill the criteria of ACOG 2014. Accordingly, based on the new guidelines, most cases of CPD in real practice were misdiagnosed. The very high disparity between the two guidelines suggests that it may be very hard

for the new guidelines to gain wide acceptance, and they should be thoroughly validated before implementation.

ii. With ACOG 2003 guidelines, CSR was relatively high (7.85%) but not too high as far as a total cesarean section rate of not more than 25% could be accepted. However, with an effective audit system to maintain adherence to the standard criteria, 1-2% of CSR due to CPD could be further avoided. Therefore, strengthening the existing standard criteria could probably make the CSR acceptable. We have to be clear on the targeted CSR due to CPD. Probably, what we initially needed was an effective audit system rather than new guidelines.

iii. With the new guidelines, a great number of cesarean sections could certainly be avoided. Nevertheless, an increased risk associated with prolonged duration of labor could be anticipated. Before implementation, the risks and benefits of the new guidelines must be evaluated by large prospective studies, and the necessity of having such new drastic changes must be weighed against the adverse outcomes associated with long duration of labor.

iv. The new guidelines are based exclusively on the pattern of Zhang labor curve without the incorporation of other clinical parameters contributing to the probability of safe vaginal delivery, such as degree of molding and caput as well as adequacy of pelvic size in relation to fetal size. As noted, most cases with CPD meeting the ACOG 2014 criteria already had molding. Since the new guidelines have not been tested and validated yet, it seems reasonable to accept cesarean delivery in cases meeting the criteria of ACOG 2003 with the aforementioned clinical parameters. The clinical evaluation of labor is a process of serially estimating the likelihood of a safe vaginal delivery and must include clinical parameters like molding, caput, adequacy of pelvis, and fetal attitude, since we can probably predict dystocia without waiting for the fulfillment of the criteria of ACOG 2014. In other words, the labor curve and clinical parameters can help us avoid prolonged labor and testing with patient's pain or exhaustion. Based on this study, should we wait until the fulfillment of ACOG 2014 criteria in all cases or should we use clinical parameters to guide the management? From our point of view, the active phase should not always begin at 6 cm dilation but rather at 2-6 cm dilation; it varies among individuals. For example, assume that the cervix is 2 cm dilated, 100% effaced for several hours and then rapidly dilates to 5 cm and arrested for 3 hours in spite of adequate contraction. If this mother has a relatively inadequate pelvimetry, the baby is relatively large and irreducible molding is then detected, with the new guidelines, this would be normal latent phase, and the labor should be allowed to continue. However, most obstetricians can appreciate that CPD is very likely and little would be gained by further labor, and the fetus might be exposed to unnecessary risk and the mother to unnecessary pain. We should address whether or not the mother has to be tested with pain to fulfill the criteria. We have to train residents and midwives to gain experience of all clinical parameters rather than only labor curve.

v. The ACOG 2014 guidelines suggest that cesarean section, to avoid birth trauma, be limited to estimated fetal weights of $\geq$ 5000 g in women without diabetes and $\geq$ 4500 g in women with diabetes. This recommendation is meaningless among our obstetric population since during the 3-year-period, we found not a single case of birth weight of $\geq$ 5000 g. Only 0.18% and 1.48% of our newborns had birth weights $\geq$ 4500 g and $\geq$ 4000 g, respectively. From our point of view, an estimated fetal weight of greater than 99^{th} or 97.5^{th} percentile at term, based on the growth curve derived from its own population, for non-diabetic and diabetic mothers may probably be better if used as the cut-off and could be more widely used. For example, the average size of our mothers (Thai women) as well as the average pelvic size are usually much smaller compared with Western women; an estimated fetal weight of more than 4000 g (97.5^{th} percentile of our population at term) in diabetic mothers is appropriate for prelabor cesarean section. However, the women should be counseled that estimates of fetal weight, particularly late in gestation, are usually imprecise.

The weaknesses of this analysis include the following: 1) retrospective nature leading to incomplete data in several cases and not perfectly reliable data in some cases, 2) no control group to compare the obstetric outcomes between the two guidelines in real practice, 3) subjective assessment of several parameters essential for diagnosis of CPD, such as strength of uterine contraction, adequacy of maternal pelvic size, etc., and 4) no evaluation of other obstetric outcomes, such as perinatal morbidity and mortality. The strengths of this analysis are as follows: 1) adequate sample size to represent real clinical practice and 2) the review being primarily based on the full medical records, not just delivery records, resulting in more reliable information.

In conclusion, adherence to the ACOG 2003 guidelines for the diagnosis of CPD was 80.63%, whereas more than 90% underwent cesarean delivery for CPD with unfulfilled criteria of ACOG 2014. However, most cases had some clinical parameters suggestive of CPD, such as molding, caput and inadequacy of pelvic size. Hopefully, our results would be useful and lead to strengthening of the diagnosis of CPD and the reduction of unnecessary cesarean delivery as well as seriously address the issues of implementation of the new guidelines before being thoroughly validated and their use without incorporation of clinical parameters.

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Competing Interest

The authors declare no conflict of interest.

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Corresponding Author:
THEERA TONGSONG, M.D.
Department of Obstetrics and Gynecology,
Faculty of Medicine, Chiang Mai University,
Chiang Mai 50200 (Thailand)
e-mail : theera.t@cmu.ac.th