Pregnancy Outcome and Predictive Factors for Adverse Pregnancy Outcomes of Cephalopelvic Disproportion Pregnancies in a Resource-Limited Setting with an Efficient Referral System

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Objective: *Small local hospitals with inexperienced personnel often have adverse incidence that could be prevented. A good referral system could reduce this unnecessary death rate. The present study was conducted to determine the pregnancy outcomes of cephalopelvic disproportion (CPD) cases that were referred for cesarean section at a tertiary center and presented the predictive factors for adverse pregnancy outcomes.*

Material and Method: *A retrospective study that descriptively presented the adverse pregnancy outcome in referred CPD pregnancies and analyzed for predictive factor of overall adverse pregnancy outcome.*

Results: *One hundred ninety five referred CPD pregnancies were included in this study. The mean duration ± SD from CPD diagnosis to childbirth was 232.32±103.75 minutes. Pregnancy additional complication was found in 42/195 (21.5%) cases, but there were no maternal or neonatal mortalities. The NICU admission and postpartum hemorrhage rates were 21.5% and 12.3%, respectively. Obesity BMI was associated with an increased risk of overall adverse maternal outcomes (OR 3.12). Previously complicated pregnancy and cervical dilatation at CPD diagnosis were significant predictors for overall neonatal adverse outcomes. The highest risk was for pregnant women who were cesarean delivered at 10 cm cervical dilatation (OR 2.84 vs. cervical dilatation ≤5 cm, p-value 0.002).*

Conclusion: *A referral system is one of the modalities to avoid maternal and neonatal mortality for CPD pregnant women in a resource-limited setting. We suggest that early referral before advanced progression of cervical dilatation, especially in obese pregnant women and in complicated pregnancies, may improve the pregnancy outcomes.*

Keywords: *Predictive factor, Cephalopelvic disproportion (CPD), Pregnancy outcome, Referral*

Cephalopelvic disproportion (CPD) is a common cause of dystocia. It occurs due to disproportion between the maternal birth passage and the size of fetal head. Fetal macrosomia, infertility treatment, previous cesarean delivery, maternal obesity, and polyhydramnios have been found to be risk factors of CPD[1]. Pelvimetry, using imaging studies such as X-ray and computed tomography are not routinely recommended for predicting or diagnosing CPD, as the clinical progression of labor is the certain means of CPD diagnosis. Cesarean delivery is the appropriate delivery route when CPD is diagnosed. However, postpartum hemorrhage, blood transfusion, low Apgar scores, and intrapartum death have been reported as maternal and neonatal complications[1].

Maternal mortality ratio (MMR) is defined as the number of maternal deaths that result from the reproductive process per 100,000 live births. Statistical reports from the Thailand Ministry of Public Health in 2010 showed that, the MMR ranged from 10.2 to 12.2 between 2006 and 2010. In Songkhla province, the MMR was reported by Songkhla province Maternal and Child Health Board (MCH) to range from 13.1 to 21.8 between 2006 and 2010, which are notably higher than the overall Thailand ratio and unacceptable. Low resource setting hospital means the unavailable equipment or medical personnel such as operative room enough for take care complicated delivery. The most common cause of maternal mortality was postpartum hemorrhage which and many modalities have been introduced to improve the maternal health care system. Direct transportation of intra-partum pregnant women

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who are diagnosed as CPD in surgery-limited hospitals to a tertiary center is one of the many policies aimed at reducing the MMR. This policy was initiated in May 2009.

Songklanagarind Hospital is the major tertiary hospital, including the obstetrics center, in the south of Thailand. Following the MCH policy, four community hospitals, Thepa, Sabayoi, Na Thawi, and Chana, which are located in the political violence area (red zone), were assigned to be under Songklanagarind Hospital's responsibility. Up until now, three and a half years after the policy initiation, the pregnancy outcomes have not been evaluated. The present study was conducted to evaluate maternal and neonatal outcomes of CPD referred cases. A secondary objective was to identify the predictive factors for adverse maternal and neonatal outcome among CPD referred cases.

Material and Method

This retrospective study was conducted at the Department of Obstetrics and Gynecology, Songklanagarind Hospital using the inpatient delivery database of the Department of Obstetrics and Gynecology. The inclusion criterion for the study group was all pregnant women who were referred from any of the four community hospitals under the responsibility of Songklanagarind Hospital due to CPD between May 1, 2009 and December 31, 2012. Pregnant women referred for any other indications were not included. Cases that were vaginally delivered were also excluded. CPD was diagnosed if all following criteria presented, (1) Cervical dilatation and effacement ≥4 cm and 80%, respectively, (2) good uterine contraction ≥2 hours, and (3) arrest/protraction of labor or prolonged second stage. The present study was approved by the Ethics Committee of the Faculty of Medicine, Prince of Songkla University to which Songklanagarind Hospital belongs.

The maternal records along with pregnancy and neonatal outcomes were reviewed. Maternal record data of interest included age, parity, body mass index, referring hospital, religion, education level, underlying diseases, history of previous pregnancies, CPD risk factors such as fetal macrosomia, maternal obesity, and polyhydramnios, pregnancy complications such as pre-eclampsia, gestational diabetes, and chorioamnionitis, or meconium stain. Maternal outcomes of interest were (1) postpartum hemorrhage, defined as hemorrhage after birth estimated at more than 1,000 mL, (2) uterine atony, (3) medication

required for uterine contraction other than oxytocin and methergine, as these medications are used in most cases in the hospital but if physician used other medication that showed the patient need uterotonic drugs for good uterine contraction or to stop bleeding, (4) uterine tear more than usual in cesarean section, (5) blood transfusion, (6) maternal ICU admission, (7) puerpural infection, defined as a temperature of 38.0°C or higher after delivery (excluding the first 24 hours), (8) local wound infection, defined as a cesarean section wound having evidence of infection, (9) maternal mortality, (10) prophylactic intravenous (IV) antibiotics, (11) postpartum IV or oral antibiotics, (12) maternal and neonatal hospitalization period, (13) neonatal intensive care unit (NICU) admission, (14) Apgar scores at 1 and 5 minutes.

The statistical analyses were performed with the STATA V10 software (StataCorp, College Station, TX). The descriptive data are presented as numeral, percentage or mean and standard deviation. Statistical significance was determined using the X^2 and t-test for differences in qualitative and continuous variables, respectively. Logistical regression analysis to identify predictive factors for adverse outcomes was used to estimate odds ratios and their 95% confidence intervals (CI). A p-value <0.05 was considered statistically significant.

Results

One hundred ninety five cases referred for emergency cesarean section due to CPD and finally cesarean sections were recruited in the study. Table 1 showed the basic maternal characteristics. There were no pregnancies complicated with polyhydramnios. All participants finally delivered by cesarean section. The ratio of male to female fetal sex at birth was 121 to 74. The mean time from CPD diagnosis at referred hospital to childbirth was 232.32±103.75 minutes. Most of the newborns (171/195, 87.7%) weighed 2,500 to 4,000 grams at birth. Forty-two (21.5%) of the cases had pregnancy complications, including chorioamnionitis, preeclampsia, and gestational diabetes. All participants were administered an antibiotic before the cesarean section. Table 2 presented the adverse pregnancy outcomes. No maternal mortality occurred during the study period.

Table 3 and 4 showed the univariate and multivariate analyses of the predictive factors for overall maternal adverse outcomes, respectively. Body mass index (BMI) and nulliparity were statistically significant variables that predicted the overall maternal

Table 1. Basic patient characteristics

Variable	Level	Total number (%)
Age, years	<20	32 (16.4)
	20-35	138 (70.8)
	>35	25 (12.8)
BMI, kg/m^2	<18.5	3 (1.6)
	18.8-25	39 (20.0)
	25-30	89 (45.6)
	>30	64 (32.8)
Parity	Nulliparous	125 (64.1)
	Parous	70 (35.9)
Occupation	Government employee	4 (2.1)
	Farmer	54 (27.7)
	Employee	52 (26.7)
	Housewife	49 (25.1)
	Other	36 (18.5)
Religion	Buddhist	54 (27.7)
	Muslim	141 (72.3)
Intrapartum syntocinon use	Yes	103 (52.8)
	No	54 (27.7)
	Missing data	38 (19.5)
Labour type	Spontaneous	155 (92.8)
	Induced	12 (7.2)
	Missing data	28 (14.4)
Underlying disease	Yes	13 (6.7)
	No	182 (93.3)

BMI = body mass index

Table 2. Adverse pregnancy outcomes in 195 referred CPD cases

Adverse pregnancy outcome	Incidence (%)
Fetal IUGR	2.1
Fetal birth weight more than 4,000 g	10.3
Maternal admission more than 7 days	5.6
Neonatal admission more than 7 days	8.2
Presence of meconium in amniotic fluid	33.8
More than normal uterotonic medication needed (syntocinon and methergin)	17.4
Stillbirth	0
Apgar <7 at 1 minute	12.3
Apgar <7 at 5 minutes	3.1
NICU admission	21.5
Uterine tear more than usual for cesarean section	9.7
Blood transfusion	2.6
PPH	12.3
Uterine atony	20.5
Puerperal morbidity	19.5
Indicated for intravenous or oral antibiotic	71.3
Local wound infection	3.6

CPD = cephalopelvic disproportion; IUGR = intrauterine growth restriction; NICU = neonatal intensive care unit; PPH = postpartum hemorrhage

adverse outcomes in univariate analysis, but only BMI remained statistically significant in multivariate analysis. A high BMI (BMI more than 30) was associated with increased risk of an adverse maternal outcome.

Table 5 and 6 presented the univariate and multivariate analyses of predictive factors for overall neonatal adverse outcome, respectively. Complicated pregnancy, syntocinon use, and cervical dilatation at CPD diagnosis were variables that were statistically significant predictors for overall neonatal adverse outcomes in univariate analysis. However, only complicated pregnancy and cervical dilatation 10 cm at CPD diagnosis remained as significant predictors after multivariate analysis. The highest overall neonatal adverse outcomes were found in CPD diagnosed women who were cesarean delivered at 10 cm cervical dilatation.

Discussion

Thailand is a developing country and the availability of cesarean section is limited in some rural areas, referred to as resource-poor settings. Thus, pregnant women who need emergency care for some obstetric conditions such as obstructed labor and postpartum hemorrhage (PPH) are at extra risk for maternal and neonatal morbidity and mortality. CPD is one of the major causes of obstructed labor, for which an emergency cesarean section is the main treatment. Although symphysiotomy has been reported to be an alternative modality for CPD treatment, it was also regarded as a "second class" operation that was suggested for use only in some specific circumstances[2,3]. Our institution is the only tertiary care center in the southern part of Thailand, which has the highest maternal morbidity and mortality of all regions of Thailand. We developed a referral policy for dealing with near-birth complications such as CPD with the aim of reducing maternal and neonatal morbidity and mortality related to the unavailability of proper and timely surgical intervention in these remote areas. To the best of our knowledge, this is the first study to evaluate pregnancy outcomes and predictive factors for adverse maternal and neonatal outcomes resulting

Table 3. Univariate analysis of predictive factors for overall maternal adverse outcomes

Variable	Level	Total number	Adverse of pregnancy outcome, number (%)	p-value
Age, years	<20	32	11 (34.4)	0.082
	20-35	138	63 (45.7)	
	>35	25	16 (64.0)	
BMI, kg/m²	<18.5	3	1 (33.3)	0.027
	18.8-25	39	13 (33.3)	
	25-30	89	37 (41.6)	
	>30	64	39 (60.9)	
Parity	Nulliparous	125	50 (4.0)	0.021
	Parous	70	40 (57.1)	
Occupation	Government employee	4	2 (50.0)	0.954
	Farmer	54	24 (44.4)	
	Employee	52	23 (44.2)	
	Housewife	49	25 (51.0)	
	Other	36	16 (44.4)	
Religion	Buddhist	54	23 (42.6)	0.537
	Muslim	141	67 (47.5)	
Underlying disease	Yes	13	9 (69.2)	0.084
	No	182	81 (44.5)	
Duration from diagnosis to childbirth, hours	1-3	59	26 (44.1)	0.632
	4	64	33 (51.6)	
	>5	61	27 (44.3)	
Cervical dilatation at CPD diagnosis, cm	≤5	52	21 (40.4)	0.579
	6-9	52	24 (46.2)	
	10	91	45 (49.5)	
Intrauterine syntocinon use	Yes	103	43 (41.7)	0.413
	No	54	27 (50.0)	
Fetal sex	Male	121	55 (45.5)	0.802
	Female	74	35 (47.3)	

Table 4. Multivariate analysis of predictive factors for overall maternal adverse outcomes

Variable	Level	OR	95% CI	p-value
BMI, kg/m²	<18.5	1	0.08, 12.07	0.026
	18.8-25	1	-	
	25-30	1.42	0.65, 3.13	
	>30	3.12	1.36, 71.8	

from CPD in a resource-poor setting in which the patients are transferred to a tertiary care facility for emergency cesarean section.

Interestingly, our study had larger number of adverse pregnancy outcomes compared to previous reports of CPD patients. The proportions of adverse maternal outcomes including PPH and genital organ injuries were higher. For adverse neonatal outcomes, although the presence of meconium in the amniotic

fluid was higher than in the previous report, our incidence of low Apgar scores was lower[1]. Moreover, there were no stillbirths in our cases. Definite comparisons of our various finding were not possible because of differences in the clinical settings between the two studies; however, the high NICU admission rate in our study was of concern. In the previous study in Bangkok, the capital city of Thailand, the rate of NICU admission in cesarean section was only 0.6%, which was much lower than our rate of 21.5%[4]. Thus, a policy for reduction of NICU admission rate should be implemented in the future.

The present study found that obese pregnant women were at increased risk for maternal adverse outcomes, while those with full cervical dilatation or a complicated pregnancy had increased risk of neonatal adverse outcome. Previous studies have reported risk factors for adverse perinatal outcomes in

Table 5. Univariate analysis of predictive factors for overall neonatal adverse outcomes

Variable	Level	Total number	Adverse pregnancy outcome, number (%)	*p*-value
Age, years	<20	32	15 (46.9)	0.600
	20-35	138	75 (54.3)	
	>35	25	15 (60.0)	
BMI, kg/m^2	<18.5	3	2 (66.7)	0.922
	18.8-25	39	22 (56.4)	
	25-30	89	46 (51.7)	
	>30	64	35 (54.7)	
Parity	Nulliparous	125	64 (51.2)	0.322
	Parous	70	41 (58.6)	
Occupation	Government employee	4	2 (50.0)	0.268
	Farmer	54	27 (50.0)	
	Employee	52	24 (46.2)	
	Housewife	49	33 (67.3)	
	Other	36	19 (52.8)	
Religion	Buddhist	54	29 (53.7)	0.980
	Muslim	141	76 (53.9)	
Underlying disease	Yes	13	9 (69.2)	0.249
	No	182	96 (52.7)	
Duration from diagnosis to childbirth, hours	1-3	59	37 (62.7)	0.247
	4	64	35 (54.7)	
	>5	61	27 (44.3)	
Cervical dilatation at CPD diagnosis, cm	≤5	52	23 (44.2)	0.002
	6-9	52	21 (40.4)	
	10	91	61 (67.0)	
Complicated pregnancy	Yes	42	30 (71.4)	0.010
	No	153	75 (49.0)	
Intrapartum syntocinon use	Yes	103	46 (44.7)	0.024
	No	54	34 (63.0)	
Fetal sex	Male	121	66 (54.5)	0.802
	Female	74	39 (52.7)	

Table 6. Multivariate analysis of predictive factors for overall neonatal adverse outcomes

Variable	Level	OR	95% CI	*p*-value
Cervical dilatation at CPD diagnosis, cm	≤5	1	-	0.002
	6-9	0.94	0.42, 2.09	
	10	2.84	1.38, 5.84	
Complicated pregnancy	No	1	-	0.006
	Yes	2.81	1.30, 6.07	

CPD patients including fetal macrosomia, infertility treatment, previous cesarean delivery, maternal obesity, polyhydramnios, and health facility system[1,5]. We did not analyze the fetal birthweight as a predictive factor because the actual fetal birthweight cannot be accurately determined before delivery and so cannot be an effective predictor for reducing adverse pregnancy outcomes. No instances of infertility treatment, previous cesarean section, or polyhydramnios were found among our case. An association between being overweight or obese and adverse maternal outcome has been previously reported in many studies[6-8]. Common adverse maternal outcomes in high BMI were PPH and infectious complication. We hypothesized that intra-operative technical difficulties increased the amount of blood loss.

The present study found that a complicated pregnancy and second stage cesarean section increased the risk for an adverse neonatal outcome. This finding was similar to that of a previous study in Nigeria[9], in which second stage cesarean section significantly increased the risks of maternal and neonatal morbidity

and mortality. Common adverse maternal and neonatal outcomes following a second stage cesarean section included high blood loss, high intra-operative trauma, birth asphyxia, NICU admission, and neonatal death. Moreover, the patient condition of the study from Nigeria was similar to that of the current study, in that referred patients were at higher risk than their institutional patients.

In conclusion, the present study indicates that a referral system is one modality that can reduce maternal and neonatal mortality for CPD women in a resource-limited setting. However, in our study we also found that adverse maternal and neonatal outcomes were still very high, and we suggest that early referral before advanced progression of cervical dilatation, especially in obese pregnant women and those with complicated pregnancy may improve the pregnancy outcomes. Our policy should be adjusted to reflect this data. Future studies should be done to monitor the effectiveness of the policy.

What is already known on this topic?

Cephalopelvic disproportion (CPD) is a common cause of dystocia and cesarean delivery is the appropriate delivery route. Postpartum hemorrhage, blood transfusion, low Apgar scores, and intrapartum death have been reported as maternal and neonatal complications in CPD[1].

What this study adds?

Referral system is one modality that can reduce maternal and neonatal mortality for CPD women in a resource-limited setting. Early referral before advanced progression of cervical dilatation, especially in overweight or obese pregnant women and those with complicated pregnancy may improve the pregnancy outcomes.

Acknowledgements

Potential conflicts of interest

None.

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ผลการคลอดและปัจจัยคาดเดาของการเกิดผลการตั้งครรภ์ไม่พึงประสงค์ของหญิงตั้งครรภ์ที่เกิดภาวะผิดสัดส่วนระหว่างอุ้งเชิงกรานหญิงตั้งครรภ์กับศีรษะทารกซึ่งส่งตัวมาผ่าท้องคลอดที่โรงพยาบาลสงขลานครินทร์

ปรัชญ์รตนา นุชประมูล, ธารางรัตน์ หาญประเสริฐพงษ์

วัตถุประสงค์: โรงพยาบาลชุมชนขนาดเล็กขาดสูตินรีแพทย์ผู้เชี่ยวชาญซึ่งเป็นความเสี่ยงของการเกิดหญิงตั้งครรภ์เสียชีวิตที่หลีกเลี่ยงได้ การศึกษานี้ทำเพื่อประเมินผลการคลอดของหญิงตั้งครรภ์ที่มีภาวะขนาดศีรษะทารกผิดสัดส่วนกับช่องทางคลอดที่ได้รับการส่งตัวจากโรงพยาบาลชุมชนขนาดเล็กสู่โรงพยาบาลตติยภูมิ และแสดงปัจจัยเสี่ยงของการเกิดผลการคลอดไม่พึงประสงค์

วัสดุและวิธีการ: ศึกษาแบบย้อนหลังทั้งพรรณนาและวิเคราะห์ โดยพรรณนาแสดงอัตราการเกิดผลการคลอดไม่พึงประสงค์ และวิเคราะห์แสดงปัจจัยเสี่ยงของการเกิดผลการคลอดไม่พึงประสงค์

ผลการศึกษา: หญิงตั้งครรภ์ที่มีภาวะขนาดศีรษะทารกผิดสัดส่วนกับช่องทางคลอดที่ได้รับการส่งตัวจากโรงพยาบาลชุมชนขนาดเล็กสู่โรงพยาบาลสงขลานครินทร์ 195 ราย เข้าร่วมการศึกษานี้ ระยะเวลาตั้งแต่วินิจฉัยจนทารกเกิดเฉลี่ย 232.32 นาที มีภาวะแทรกซ้อนของการคลอดร้อยละ 21.5 ไม่มีหญิงตั้งครรภ์ตายหรือทารกเกิดตาย ทารกแรกเกิดเข้ารับการรักษาในหออภิบาลทารกแรกคลอดวิกฤตร้อยละ 21.5 หญิงตั้งครรภ์เกิดภาวะตกเลือดหลังคลอดร้อยละ 12.3 ความอ้วนของหญิงตั้งครรภ์เป็นปัจจัยเสี่ยงของผลการคลอดไม่พึงประสงค์ของหญิงตั้งครรภ์ หญิงตั้งครรภ์ที่มีโรคประจำตัวมาก่อนและผ่าตัดคลอดในระยะคลอดที่สองเป็นปัจจัยเสี่ยงของผลการคลอดไม่พึงประสงค์ของทารกแรกเกิด

สรุป: ระบบการส่งต่อผู้ป่วยเป็นวิธีหนึ่งในการเลี่ยงภาวะแทรกซ้อนของการคลอดในโรงพยาบาลชุมชนขนาดเล็ก และควรส่งตัวหญิงตั้งครรภ์แต่เนิ่นก่อนเข้าสู่ระยะคลอดที่สอง โดยเฉพาะหญิงตั้งครรภ์ที่อ้วน และมีโรคประจำตัว