

Brief communication (Original)

Anesthesia for cesarean section in parturients diagnosed with placenta previa in a Thai university hospital: a retrospective analysis of 562 consecutive cases

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Background: Anesthesia for cesarean delivery in parturients diagnosed with placenta previa remains controversial.

Objectives: To investigate factors correlated with choice of anesthesia in these parturients and their outcomes.

Methods: Retrospective analysis of patients with placenta previa and cesarean delivery at King Chulalongkorn Memorial Hospital. Peri operative anesthetic and complication data were collected using a structured collection form. Univariate analysis and multivariate logistic regression were used. $P < 0.05$ was considered significant.

Results: Among 50,237 deliveries from July 1, 2005 to June 30, 2011, there were 562 cesarean sections in diagnosed cases of placenta previa. Cesarean deliveries (479) were performed under spinal anesthesia (81%), epidural anesthesia (1.8%), and if the effects spinal anesthesia dissipated, general anesthesia (2.3%). Among 46 cases of cesarean hysterectomy, 27 patients (58.7%) received regional anesthesia. However, 6 of 10 patients with planned cesarean hysterectomy underwent general anesthesia, while 1 of 4 of a group with regional anesthesia needed conversion to general anesthesia. There was no serious anesthesia-related complication. Factors related to general anesthesia were: a higher American Society of Anesthesiologists (ASA) physical status OR 2.7 (95% CI 1.7–4.3) $P < 0.001$; presentation with bleeding OR 1.8 (95% CI 1.0–3.1) $P = 0.033$; anterior site of placenta OR 1.8 (95% CI 1.1–3.2) $P = 0.025$; heart rate > 125 bpm OR 5.6 (95% CI 1.5–214) $P = 0.01$; and pack red cell transfusion OR 3.4 (95% CI 2.0–5.7) $P < 0.001$.

Conclusions: Most parturients received regional anesthesia. Neuroaxial anesthesia and general anesthesia are safe.

Keywords: Cesarean delivery, choice of anesthesia, complication, neuraxial anesthesia, placenta previa, spinal anesthesia

Placenta previa, is a major cause of massive hemorrhage and can result in maternal or fetal morbidity and mortality [1, 2]. Its incidence is 4.8 per 1000 deliveries with a mortality rate of 0.03% [3]. The best anesthesia for cesarean delivery remains controversial. General anesthesia is believed to be preferable for this group of patients [4]. There is also evidence that a majority of anesthesiologists consider using regional anesthesia for placenta previa [4–6].

Obstetric complications have recently been highlighted by the mass media in Thailand. This situation dramatically increased as referral of high

risk obstetric patients for medical services to tertiary care hospitals increased. Our institution developed guidelines for anesthesia for placenta previa, but technique was left to the discretion of the individual anesthesiologist. We performed a retrospective analysis of cases to investigate factors correlating with choice of anesthesia for cesarean delivery.

Methods

This study was approved by our institutional ethics committee and written informed consent was waived (IRB No.298/52). We investigated demographic, obstetric, and anesthetic data of all parturients with placenta previa (including placental adherence such as placenta increta, accreta, and percreta) who received anesthesia for cesarean delivery in a

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retrospective-cohort fashion (between July 1, 2005 and December 31, 2009 and prospectively between Jan 1, 2010 and June 30, 2011). The study was conducted at King Chulalongkorn Memorial Hospital, Bangkok, a 1500-bed tertiary-referral university teaching hospital. We extracted data from the hospital's computerized database, hand-written labor ward register, and the obstetric operating theatre register using a structured case-record form.

For each patient, the following information was recorded: gestation, previous cesarean delivery, type of placenta previa, position of placenta (from ultrasound reports or description at surgery), emergency or elective (as defined by the obstetrician), clinical presentation, preoperative vital signs, preoperative hematocrit, estimated blood loss during surgery, intraoperative and postoperative (within 24 h) blood transfusions, intraoperative administration of ephedrine or methylergometrine (Methergine), postoperative hematocrit, duration of anesthesia, admission to intensive care unit, length of hospital stay, and main anesthetic techniques for cesarean delivery. Main anesthetic techniques were classified into 2 groups: I: a general anesthesia (GA) group including general anesthesia and general anesthesia after failed or inadequate spinal anesthesia. II: A regional anesthesia (RA) group including spinal anesthesia, epidural anesthesia, and general anesthesia after the effects of spinal anesthetic had dissipated.

Data were analyzed using SPSS for Windows version 17. Factors potentially associated with choice of anesthesia were assessed by using a *t* test (for continuous data) and Chi-square test or Fisher's exact test (for categorical data). Multivariate logistic regression with a forward stepwise approach was then used to identify the magnitude of association in term of crude odds ratio with a 95% confidence interval (95% CI). In all cases, two-tailed tests were performed, and $P < 0.05$ was considered statistically significant.

Results

During the 6-year study period, there were 50,237 deliveries in our institution and 562 (1.1%) consecutive parturients with a diagnosis of placenta previa who underwent cesarean delivery. Seventy (12.4%) parturients received general anesthesia, and 14 (2.5%) parturients received general anesthesia after failure or inadequate spinal blockade and were classified in the general anesthesia (GA) group. In the regional

anesthesia (RA) group, there were 455 (81.0%) parturients who received spinal anesthesia, 10 (1.8%) parturients who received epidural anesthesia, and 13 (2.3%) parturients who received spinal anesthesia throughout with subsequent induction of general anesthesia. Three hundred eighty-nine of 471 (82.6%) parturients received regional anesthesia and were categorized in the RA group during the retrospective data collection period (July 1, 2003 to December 31, 2008), whereas 80 of 91 (87.9%) parturients received regional anesthesia during the prospective data collection period (January 1, 2009 to June 30, 2010), and the rates were not statistically significantly different ($P = 0.273$).

In the database, there were 46 cases (8.2%) of hysterectomy and 29 cases (5.2%) of abnormal placentation (placenta accreta, placenta percreta, or placenta increta). Twenty-seven patients undergoing hysterectomy (58.7% of 46 cases) and were in the RA group. However, there were 10 patients with planned cesarean hysterectomy, while 6 patients (60%) received general anesthesia. Among these, 4 of 10 were associated with preoperative diagnosis of placental adherence and 6 of 10 cases were associated with frank antenatal bleeding. Details of choices of anesthesia among the subgroup of patients with hysterectomy and/or placental adherence are shown in **Table 1**.

The demographic data of parturients in the GA and RA groups were comparable except for body weight ($P = 0.03$). The proportion of patients who underwent emergency cesarean section in the GA group (78.6%) was higher than that in the RA group (61.7%); $P = 0.004$. Univariate analysis of the preanesthetic characteristics of the patients are shown in **Table 2**. Types of placenta previa ($P < 0.001$), placental site or location ($P = 0.002$), and placental adherence ($P = 0.012$) were significantly different factors between the GA and RA groups in the univariate analysis. Duration of anesthesia of patients in the GA and the RA groups were 77.9 ± 47.9 min and 60.4 ± 26.8 min respectively ($P = 0.002$). The estimated blood loss in patients from the GA group was 1610.7 ± 1684.4 mL, which was higher than average of the RA group of 1161.2 ± 1104.2 mL ($P = 0.002$). Fourteen patients (16.7%) in the GA group required administration of ephedrine compared with 317 (66.3%) patients in the RA group; ($P = 0.001$). The proportion of patients receiving packed red cell, fresh frozen plasma, or platelet transfusion was

significantly higher in the GA group than in the RA group. The proportion of Apgar score was <7 at 1 min, at 5 min, the proportion of patients with a postoperative hematocrit <30% of the GA group was

also significantly higher than in the RA group. Details of the intraoperative and postoperative characteristics between the 2 groups are shown in **Table 3**.

Table 1. Anesthetic techniques used for patients with placenta previa undergoing cesarean delivery

	GA Group			RA Group		Total
	GA	GA because of failed SA	SA	SA dissipated	Epidural	
Placenta previa	70 (12.4%)	14 (2.5%)	455 (81.0%)	13 (2.3%)	10 (1.8%)	562 (100%)
Hysterectomy	18 (39.1%)	1 (2.2%)	15 (32.6%)	11 (23.9%)	1 (2.2%)	46 (100%)
Planned Cesarean hysterectomy	6 (60%)	0 (0%)	3 (30%)	1 (10%)	0 (0%)	10 (100%)
Unplanned Cesarean hysterectomy	12 (33.3%)	1 (2.8%)	12 (33.3%)	10 (27.7%)	1 (2.8%)	36 (100%)
Placental adherence	8 (27.6%)	1 (3.4%)	12 (41.4%)	8 (27.6%)	0 (0%)	29 (100%)
Placental adherence with hysterectomy	6 (30.0%)	1 (5.0%)	5 (25.0%)	8 (40.0%)	0 (0%)	20 (100%)
Placental adherence without hysterectomy	2 (22.2%)	0 (0%)	7 (77.8%)	0 (0%)	0 (0%)	9 (100%)

GA = general anesthesia, RA = regional anesthesia, SA = spinal anesthesia

Table 2. Univariate analysis of demographic and preanesthetic characteristics (n = 562)

	General anesthesia		Regional anesthesia		P
	n	%	n	%	
Age (y)	84	33.1 ± 4.6	478	32.7 ± 4.8	0.52
Weight (kg)	84	63.5 ± 10.4	478	65.9 ± 9.3	0.03
Height (cm)	84	157.4 ± 5.6	478	157.3 ± 5.4	0.99
Gestational age (wk)	84	33.4 ± 4.6	478	36.5 ± 2.6	<0.001
Preanesthetic systolic pressure (mmHg)	84	126.1 ± 17.5	478	121.8 ± 14.4	0.036
ASA physical status					<0.001
1	50	59.5%	401	83.9%	
2	26	31.0%	75	15.7%	
3	7	8.3%	2	4%	
4	1	1.2%	0	0%	
Surgical status					0.004
Emergency	66	78.6%	296	61.7%	
Elective	18	21.4%	183	38.3%	
Presentation					0.008
Bleeding	52	61.9%	205	42.9%	
Labor pain	4	4.8%	48	10%	
Contraction	3	3.6%	13	2.7%	
No symptom	17	20.2%	177	37%	
Bleeding + contraction	3	2.6%	4	0.8%	
Labor pain + contraction	1	3.6%	4	0.8%	
Bleeding + labor pain + contraction	1	1.2%	1	0.2%	
Previous C/S	24	28.6%	90	18.3%	0.057
Gravidity					0.199
1	21	25%	168	35.1%	
2	36	41.7%	175	36.6%	
3	22	26.2%	92	19.2%	
>3	6	7.1%	43	9.0%	

Values are shown as mean ± standard deviation, number (%)

Table 3. Univariate analysis of placental, intraoperative and postoperative characteristics (n = 562)

	General anesthesia		Regional anesthesia		P
	n	%	n	%	
Types of placenta previa					<0.001
Low lying	10	11.9%	141	29.5%	
Marginal	3	3.6%	30	6.3%	
Partialis	3	3.6%	41	8.6%	
Totalis	68	81%	266	55.6%	
Placental site					0.002
Posterior	42	50%	324	67.8%	
Anterior	34	40.5%	136	28.5%	
Anterior + posterior	8	9.5%	18	3.8%	
Placental adherence					0.012
No	75	89.3%	460	96.2%	
Accreta	4	4.8%	13	2.7%	
Increata	4	4.8%	4	0.8%	
Percreta	1	1.2%	1	0.2%	
Cesarean hysterectomy	19	22.6%	27	5.6%	<0.001
Number of patients receiving					
Blood transfusion	52		121		<0.001
Fresh frozen plasma	15	17.9%	17	3.6%	<.0001
Platelet	5	6%	2	0.4%	0.001
Apgar score < 7 at 1 min	34	40.5%	29	6.1%	<0.001
Apgar score < 7 at 5 min	15	11.3%	8	1.7%	<0.001
Number of patients receiving					
Methylergometrine	11	131%	96	20.1%	0.176
Ephedrine	14	16.7%	317	66.3%	<0.001
Amount of ephedrine (mg)	14	14.6 ± 13.6	317	15.8 ± 10.1	0.675
Estimated blood loss (mL)	84	1610.7 ± 1684.4	478	1161.2 ± 1104.2	0.02
Duration of anesthesia (min)	84	77.9 ± 47.9	479	60.7 ± 26.8	0.002
Intraoperative SP ≤ 70 mmHg	3	3.6%	19	4.0%	1
Intraoperative HR < 45 bpm	0	0%	1	0.2%	1
Intraoperative HR > 125 bpm	7	8.3%	5	1%	1
Postoperative Hct%	84	30.3 ± 5.4	478	32.5 ± 4.8	0.001
Postop Hct < 30%	38	40.9%	88	18.8%	<0.001

Values are shown as mean ± standard deviation, number (%); HR, heart rate; Hct, hematocrit.

When applying multivariate analysis, the factors associated with a choice of general anesthesia compared with regional anesthesia were identified; ASA physical status ($P < 0.001$), clinical presentation

with bleeding ($P = 0.033$), anterior site of placenta ($P = 0.025$) receiving packed red cell transfusion ($P = <0.001$), intraoperative heart rate higher than 125 beats per min ($P = 0.01$) as shown in **Table 4**.

Table 4. Factors related to general anesthesia for patient diagnosed with placenta previa undergoing cesarean delivery (multivariate analysis)

Factors	Adjusted OR 95% confident interval		P
American Society of Anesthesiologists physical status	2.7	1.7–4.3	<0.001
Bleeding presentation	1.8	1.0–3.1	0.033
Anterior site of placenta	1.8	1.1–3.2	0.025
Anterior + posterior site of placenta	2.2	0.8–6.0	0.102
Heart rate > 125 bpm	5.6	1.5–21.4	0.011
Packed red cell transfusion	3.4	2.0–5.7	<0.001

There were no anesthetic problems (**Tables 2 and 3**) and no major anesthesia related complications. However, there was one case of maternal mortality, which was reported as part of a multicenter registry of patients receiving spinal anesthesia in Thailand [7]. The case was in a 33 y-old parturient, scheduled for elective cesarean delivery. The attending anesthesiologist performed an uneventful spinal anesthesia before prolonged hemorrhage necessitated hysterectomy. Induction of general anesthesia was performed during the hysterectomy. Maternal fatality occurred after massive hemorrhage with disseminated intravascular coagulopathy and a ruptured bladder [7].

Discussion

Recent widespread use of ultrasound has facilitated early diagnosis of placenta previa. The present study revealed the incidence of placenta previa of 11 per 1000 in our institution, this is higher than the incidence of 4.8 per 1000 in the United States [3]. This high incidence might be because of increasing referral of high risk patients to our hospital. There was no significant difference between patients receiving regional anesthesia or general anesthesia between the retrospective and prospective data collection periods. The majority of parturients (85.3%) with diagnosis of placenta previa received regional anesthesia; particularly spinal anesthesia, while only 14.7% received general anesthesia. Another 13 (2.3%) parturients received general anesthesia because of inadequate or failed spinal blockade. Therefore, the present study showed that regional anesthesia was the anesthetic technique of choice for 87.6% of parturients. Most anesthesiologists prefer providing regional anesthesia for cesarean delivery for placenta previa, whereas others prefer general anesthesia in all circumstances [4, 8, 9]. In a retrospective review of 147 cases of placenta previa, only a quarter of cases received regional anesthesia. There were no complications associated with the anesthetic technique [1]. Arcario et al. suggested that regional anesthesia is not contraindicated even in cases of simple placenta accreta [10]. Parekh et al. in a retrospective review also revealed that regional anesthesia was used in 60% of cases [5]. Combined spinal epidural anesthesia has also been suggested as anesthetic technique for placenta previa [11].

There were subgroups of 46 cases (8.2%) of cesarean hysterectomy and 29 cases (5.2%) of placenta adherence. Similar to other studies, the

majority of hysterectomies were because of abnormal placentation and increased blood loss [12-15]. The present study found that attending anesthesiologists in our institution chose regional anesthesia for cesarean delivery in 58.7% of parturients with hysterectomy and 69.0% of parturients placental adherence. While the diagnosis of abnormal placentation cannot always be made by ultrasound, most placenta adherence in the present study was diagnosed intraoperatively. However, among 10 parturients set for possible cesarean hysterectomy, the attending anesthesiologists chose general anesthesia as main technique in 6 out of 10 cases. Moreover, 1 out of 4 patients received spinal anesthesia throughout with subsequent induction of general anesthesia. The reasons for choosing general anesthesia in elective cesarean hysterectomy is probably because of prolonged surgery, hemodynamic instability from massive blood loss, and patients discomfort. Chestnut and Redick reported 25 cases of using continuous epidural anesthesia for elective hysterectomy. While 28% of patients required intraoperative induction of general anesthesia [16].

In the univariate analysis, lower gestational age might be the explanation of significant lower body weight of parturients in the GA group. Moreover, there was a higher proportion of patients with a higher class of ASA physical status and emergency surgical status in the GA group. There were also several variables which were significantly different only in univariate analysis, but not in multivariate analysis, such as the types of placenta previa, presence of placental adherence, cesarean hysterectomy, number of patients receiving ephedrine, and number of newborns with an Apgar score <7 at 1 and 5 min. Other factors significant only in the univariate analysis level were a higher postoperative hematocrit, lower estimated maternal blood loss, and less patients receiving packed red cell, fresh frozen, and platelet transfusion. A Cochrane systematic review of anesthesia for cesarean delivery showed that women who had neuraxial anesthesia were found to have a significantly lower difference between pre- and postoperative hematocrit, lower estimated blood loss, but have no significant difference in terms of neonatal Apgar score of <6 at 1 and 5 min [17].

In the multivariate analysis the significant variables were ASA physical status, clinical presentation of bleeding, anterior site of placenta, intraoperative heart rate >125 bpm, and transfusion of packed red cells. The ASA physical status was a significant

factor related to general anesthesia ($P < 0.001$). Anesthesiologists are 2.7 times more likely to choose general anesthesia when the ASA physical status of parturients are higher. Many studies suggest that general anesthesia is the preferable choice of anesthetic technique in high risk patients [18, 19]. Moreover, there might be a bias toward general anesthesia in patients with coexisting medical conditions [20, 21].

The present study demonstrated that general anesthesia was preferable with an adjusted odds ratio of 1.8 when the clinical presentation of patients was associated with bleeding. Anterior site of placenta related to a 1.8-fold increase in receiving general anesthesia. Oyelese and Smullian stated that orientation of placenta to the anterior uterine wall and patient status are factors that should be considered when choosing the anesthetic for parturients with placenta previa [22]. Patients in the GA group were more likely to have intraoperative heart rates >125 bpm (with an adjusted odds ratio of 5.6) and to receive packed red cell transfusion (with an adjusted odds ratio of 3.3). During light general anesthesia, the sympathetic reflex relates to tachycardia. In animal studies, regional anesthesia caused slower heart rates, greater stroke volume, higher arterial pH, higher bicarbonate concentration, and lower catecholamine concentrations than general anesthesia [23]. The present study also showed an association between GA and higher frequency of blood transfusion. The possible explanations were selection bias for GA, which was frequently chosen for patients with an anterior placental site and presentation of bleeding. Hypotension was considered the most frequent side effect or complication related to regional anesthetic technique, particularly spinal anesthesia. However, hypotension can be controlled and did not lead to major adverse outcomes. There was no mortality and other serious complication related to the choice of anesthesia.

There are some limitations to the present study. First, this retrospective analysis was a nonrandomized, unblinded study that may be subject to some selection or observer bias. Second, there were some incomplete data because of the retrospective-cohort data collection. Third, the results of the present study represent only one tertiary referral center.

Conclusion

Most parturients in the present study received

spinal anesthesia. Both neuraxial anesthesia and general anesthesia are safe anesthetic techniques for cesarean delivery in parturients diagnosed with placenta previa. General anesthesia correlated with intraoperative tachycardia (>125 bpm) and higher frequency of packed red cell transfusion. High ASA physical status, presentation of antepartum bleeding and anterior site of placenta are preanesthetic factors favoring general anesthesia in this group of patients.

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