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Size of uterine leiomyoma is a predictor for massive haemorrhage during caesarean delivery

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ABSTRACT

Background: Uterine leiomyoma is a common benign tumour, and a risk factor for various complications during pregnancy and peripartum period. Peripartum haemorrhage is the most critical complication that can cause maternal death. Although the relationship of leiomyoma and peripartum haemorrhage has been indicated, little is known about the characteristics of leiomyoma as predictors for massive haemorrhage in caesarean delivery.

Objective: We examined whether characteristics of leiomyoma and pregnant patients could predict massive haemorrhage in women undergoing caesarean delivery.

Study design: This is a single-institution, retrospective cohort study. We reviewed singleton caesarean deliveries between January 2005 and December 2011. We excluded women with the following risk factors for massive haemorrhage: abnormality of placental position, abruptio placentae, haemorrhagic diseases, hydramnios, and labour arrest after induction. Myomectomy was not performed during delivery. Multivariate logistic regression analysis was performed to identify predictors of massive intraoperative haemorrhage (≥1000 ml). The following predictors were evaluated: maternal age, body mass index, parity, gestational week, birth weight, number of leiomyomas, and volume of the largest leiomyoma. Detailed characteristics of leiomyomas were evaluated using sonography or magnetic resonance imaging.

Results: Seven hundred and fifty-nine women were included; 55 women (7.25%) had leiomyoma. Thirty-eight women with leiomyoma underwent magnetic resonance imaging scan. The median intraoperative haemorrhage was 939 ml (395–5296 ml) in women with leiomyoma and 689 ml (129–3060 ml) in women without. Multivariate analysis revealed that a largest leiomyoma ≥175 cm^3 (odds ratio 6.4 [95% confidence interval: 1.5–27], P = 0.007), birth weight of ≥2500 g (2.3 [1.53.6], P < 0.001), and primipara (1.5 [1.1–2.1], P = 0.025) were significant predictors of massive intraoperative haemorrhage.

Conclusions: The presence of a leiomyoma of ≥175 cm^3, birth weight of ≥2500 g, and primipara were found to be predictors for massive intraoperative haemorrhage during caesarean delivery. A leiomyoma ≥175 cm^3 which is equivalent volume to a 7 cm diameter sphere can be diagnosed in the first trimester using sonography. In cases of cesarean delivery with these predictors, preparation for massive haemorrhage, including storage of autologous blood, may be considered.

Introduction

Uterine leiomyoma is one of the most common solid benign tumours of the uterus, developing in 20–40% of reproductive-age women [1]. The prevalence of leiomyoma during pregnancy was reported as approximately 11% in early studies [2–4], and seems to be increasing today due to improvements in diagnostic approaches. Several studies revealed that leiomyomas cause complications including miscarriage, preterm labour, and haemorrhage during pregnancy, labour, and delivery [5–8]. Among various complications in deliveries, haemorrhage is the most critical and can cause maternal death [9].

Leiomyoma is recognized as a risk factor for caesarean delivery. Some studies have reported that larger leiomyomas could increase the rate of caesarean delivery [4,10]. Caesarean delivery itself is a risk for massive peripartum haemorrhage when compared to transvaginal delivery[8]. As leiomyomas can cause haemorrhage during delivery, the risk of massive haemorrhage in caesarean deliveries in women with leiomyomas may be higher than that in

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women without leiomyomas. Although some studies examined the risk of peripartum haemorrhage in women with leiomyomas, they examined the risk in caesarean and transvaginal deliveries simultaneously [6,10]. One study reported the presence of leiomyomas can be a risk factor for massive haemorrhage in caesarean delivery [11]. However, a small uterine leiomyoma is unlikely to cause massive haemorrhage. If characteristics of leiomyomas are a predictor of intraoperative haemorrhage during caesarean delivery, it would be helpful to identify these features in order to decrease the risk of massive peripartum haemorrhage.

The aims of this study were, first, to examine whether the size and number of leiomyomas can predict massive haemorrhage during caesarean delivery, and second, to evaluate whether characteristics of the patient or baby could predict massive haemorrhage during caesarean delivery.

Materials and methods

Study population

This was a single-institution, retrospective cohort study. The study was approved by the institutional review board of our medical college (KAN-201, National Defense Medical College, Saitama, Japan); the board judged that written informed consent was not required since the data of this study was collected from hospital medical records.

We reviewed the medical records of women undergoing caesarean singleton delivery between January 2005 and December 2011. We excluded women who had an abnormality of placental position, abruptio placentae, and haemorrhagic diseases (such as HELLP syndrome, idiopathic thrombocytopenic purpura, and disseminated intravascular coagulation) [12]. We also excluded women who had hydramnios and women who experienced labour arrest, because these may result in massive postpartum haemorrhage due to uterine atony [13].

Clinical procedures

Leiomyoma was diagnosed by transvaginal sonography in all women during prenatal check-up. When a woman had a leiomyoma obstructing the birth canal or located in the area of uterine incision for caesarean delivery, magnetic resonance imaging (MRI) was performed at 34–35 gestational weeks. In these patients, we used the MRI findings to evaluate detailed characteristics of the leiomyomas, recognizing that MRI examination is not generally performed in pregnant women.

The uterine incision was performed in the same manner, avoiding incision into a leiomyoma. Simultaneous myomectomy at caesarean delivery was not performed, except in women who had small subserosal leiomyomas that could be excised easily without massive bleeding.

Collected variables

Based on the delivery records, we collected the following characteristics of women for our analysis: parity, age at delivery, maternal body weight, maternal height, body mass index (BMI), gestational week, birth weight, and intraoperative haemorrhage, which was determined as the sum of suction volume and gauze counting. We determined the three major axes of the leiomyoma based on MRI findings, and the number of leiomyomas based on MRI or sonographic findings during the pregnancy. We calculated the volume of the leiomyomas using the following equation:

$$\text{volume} = \frac{4\pi \cdot a \cdot b \cdot c}{3}$$

where a, b, and c are the lengths of the three major axes of a leiomyoma. We regarded subserosal leiomyomas not to be leiomyomas in the analysis because several studies have revealed that subserosal leiomyomas are usually asymptomatic and have little or no influence on intraoperative haemorrhage [14].

Multivariate logistic regression analysis

We selected the following dichotomous variables as factors examined with univariate logistic regression analysis: age at delivery >35 or ≤ 35 years, maternal BMI ≥ 25 or $<25\,kg\,m^{-2}$, primipara or multipara, gestational week ≥ 38 or <38, birth weight >2500 or $\leq 2500\,g$, volume of the largest leiomyoma in each patient $\geq x$ or $<x\,cm^3$ (where x was the cut-off value to predict intraoperative haemorrhage $\geq 1000\,ml$, which produced the maximum Youden index calculated as sensitivity plus specificity minus 1 in the receiver operating characteristic analysis), and number of leiomyomas ≥ 3 or <3. Univariate logistic regression analysis was performed to identify possible predictors for intraoperative haemorrhage $\geq 1000\,ml$, which was regarded as massive haemorrhage. Factors with P values <0.2 were considered as possible predictors and were applied to multivariate logistic regression analysis to find the significant predictors. In the multivariate logistic regression analysis, we used a stepwise backward deletion. In this approach, the initial model included all possible predictors, and the predictor with the largest P value by the likelihood ratio test was excluded in each step until all P values for remaining predictors in the model were less than 0.10. Odds ratios (OR) (95% confidence interval [CI]) were determined for all predictors in the final logistic regression model. The internal validity of the final model was evaluated using a bootstrap technique with 1000 replicates.

Statistics

Data are expressed as median (range). Mann Whitney *U* test or Fisher's exact test was used for the comparison between the groups. IBM SPSS Statistics version 23 (IBM Corporation, Somers,

Table 1
Patient and baby characteristics.

Characteristics	All patients (n = 759)	Leiomyoma (n = 55)	No leiomyoma (n = 704)	P value for Leiomyoma *vs* No leiomyoma
Age, year	33 (19–45)	35 (26–45)	33 (19–45)	<0.001
Maternal body weight, kg	63 (41–125)	63 (44–82)	63 (41–125)	0.994
Maternal height, cm	157 (140–190)	159 (150–172)	157 (140–190)	0.013
Maternal body mass index, kg/m^2	25 (17–49)	25 (20–34)	25 (17–49)	0.133
Gestational week	37 (27–42)	37 (31–41)	37 (27–42)	0.415
Primipara	267 (35%)	31 (56%)	236 (34%)	0.001
Birth weight of baby, g	2740 (400–4440)	2750 (1416–3725)	2738 (400–4440)	0.845
Intraoperative haemorrhage, mL	700 (129–5296)	939 (395–5296)	689 (129–3060)	<0.001
Intraoperative haemorrhage ≥1000 mL	182 (24%)	25 (45%)	157 (22%)	<0.001

Data are expressed as median (range). Primipara and intraoperative haemorrhage are expressed number (%).