

OBSTETRICS

The relationship between primary cesarean delivery skin incision type and wound complications in women with morbid obesity

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OBJECTIVE: We sought to evaluate the relationship between skin incision, transverse or vertical, and the development of wound complications in women with morbid obesity requiring primary cesarean delivery (CD).

STUDY DESIGN: Morbidly obese women (body mass index ≥ 40 kg/m²) undergoing primary CD at ≥ 24 weeks' gestation were studied in a secondary analysis of a multicenter registry. Clinical characteristics and outcomes were compared between women who had transverse vs vertical skin incision. The primary outcome was composite wound complication (infection, seroma, hematoma, evisceration, fascial dehiscence) and composite adverse maternal outcome (transfusion, hysterectomy, organ injury, coagulopathy, thromboembolic event, pulmonary edema, death). Multivariable logistic regression analyses were performed to adjust for confounding factors.

RESULTS: In all, 3200 women were studied: 2603 (81%) had a transverse incision and 597 (19%) had a vertical incision. Vertical skin incision was associated with lower risk for wound complications (adjusted odds ratio, 0.32; 95% confidence interval, 0.17–0.62; $P < .001$) but not with composite adverse maternal outcome (adjusted odds ratio, 0.72; 95% confidence interval, 0.41–1.25; $P = .24$).

CONCLUSION: In morbidly obese women undergoing a primary CD, vertical skin incision was associated with a lower wound complication rate. Due to the selection bias associated with utilization of skin incision type and the observational nature of this study, a randomized controlled trial is necessary to answer this clinical question.

Key words: cesarean delivery, morbid obesity, obesity, skin incision, wound complication

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Cesarean delivery (CD) is a common surgical procedure, responsible for 31.3% of US births in 2011.¹ It is on the rise: the CD rate increased by nearly 60% from 1996 through 2009.² In addition,

the prevalence of adult obesity is high, 36% in the United States in 2009 through 2010.³ A recent systematic review of 11 cohort studies reported that the risk of CD increased by 50% in women with a body mass index (BMI) of 30–35 kg/m² and more than doubled in women with a BMI > 35 kg/m² compared to women with a normal BMI.⁴ The frequency of wound complications following CD ranges from 3–17%^{5–10}; however, in women with morbid obesity it is as high as 30%.¹¹ Finally, wound complications are a burden for the patient, her family, and the health care system; 1 study estimated that a postdischarge wound complication on average costs an additional $\geq \$3000$.¹²

There are no randomized clinical trials comparing the risks and benefits of skin incision type (vertical or transverse) for CD in obese women. Current practice is largely based on surgeon or institutional preference. For reasons of aesthetics and postoperative pain, transverse incision is generally favored

for the normal weight woman undergoing a nonemergent CD. However, the optimal skin incision type for the morbidly obese woman is unknown. With a transverse incision, there is concern for poor wound healing due to the incision being covered by a large panniculus with greater exposure to microbial flora and low oxygen tension. On the other hand, a vertical incision could theoretically heal poorly due to a longer incision, a deeper subcutaneous layer and because of more wound tension. The objective of our study was to determine which type of skin incision was associated with a lower wound complication rate in morbidly obese women undergoing primary CD.

MATERIALS AND METHODS

Study design

This was a secondary analysis of a multicenter cesarean registry of the Eunice Kennedy Shriver National Institute of Child Health and Human Development Maternal-Fetal Medicine

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Units Network conducted from 1999 through 2002 at 19 academic medical centers.

Our analysis focused on a cohort of morbidly obese ($\text{BMI} \geq 40 \text{ kg/m}^2$) women with gestational age ≥ 24 weeks who had primary CD. Exclusion criteria were stillbirth and unknown skin incision type. Clinical characteristics and outcomes were compared between women who had a transverse or vertical skin incision.

The labor and delivery logbook or database at each participating center was screened daily to identify all cases. Trained study nurses who were not blinded to the mode of delivery reviewed the medical records for each woman and infant. Demographic data, details of the obstetrical history, and information about intrapartum and postpartum events until time of discharge plus any readmissions until 6 weeks' postpartum were recorded. Emergency room and outpatient records were not reviewed. If the patient was known to have been readmitted at an outside facility, attempt was made to obtain those records for review. Neonatal data were collected up to 120 days after delivery or at the time of hospital discharge.

Uniform definitions were established at the study design. The same definitions were followed at the 19 centers and prospectively reviewed at time of collection, and data clarification was established by direct communication with the providers.

BMI data were obtained as prepregnancy BMI as well as BMI at delivery. For the purpose of our study, BMI at delivery was used for inclusion and statistical analysis. A list of indications for CD, as well as type with skin incision description, was determined at the study design. Derived maternal complication variables including infectious complications were also well defined prior to data collection. Full details of the study design and technique of data collection have been previously described.¹³

Outcomes analyzed

The primary outcome was a composite of wound complications: infection, seroma, hematoma, wound evisceration,

and fascial dehiscence. Secondary outcomes included a composite of maternal complications: blood transfusion, hysterectomy, organ injury, coagulopathy, thromboembolic event, pulmonary edema, and death. Length of surgery, maternal intensive care unit admission, and organ injury including cystotomy, bowel injury, as well as ureteral injury were also evaluated.

Statistical analysis

Statistical analysis was performed with software (SPSS, version 20.0; IBM Corp, Armonk, NY). Maternal demographics, clinical characteristics, and outcomes were described and compared between study groups (transverse skin incision vs vertical skin incision) using χ^2 , Student *t* test, and Mann Whitney *U* test

as appropriate. Multivariable analyses were performed using logistic regression for the development of wound complications, maternal adverse composite outcome, and vertical skin incision. The model was constructed using independent variables with clinical significance or those that had $P < .25$ on univariate comparison. Nominal 2-sided *P* values are reported with statistical significance defined as $P < .05$. The study was submitted to the University of Texas Institutional Review Board and considered exempt.

RESULTS

A total of 3200 women met study criteria: 2603 (81%) had transverse incisions and 597 (19%) had vertical incisions. Table 1 compares the

TABLE 1
Comparison of demographic and clinical characteristics

Characteristic	Transverse skin incision (n = 2603)	Vertical skin incision (n = 597)	P value
Age, y	26.9 $\pm$ 6.3	26.9 $\pm$ 6.3	.78
Race			< .001
Black	1256 (48.3)	288 (48.2)	
White	1057 (40.6)	104 (17.4)	
Hispanic	218 (8.4)	188 (31.5)	
Other	72 (2.8)	17 (2.9)	
Maternal BMI, kg/m^2	45.3 $\pm$ 5.2	47.2 $\pm$ 6.4	< .001
Gestational diabetes	344 (13.2)	78 (13.1)	1.00
Pregestational diabetes	124 (4.8)	44 (7.4)	.01
Smoker	428 (16.0)	57 (13.0)	.02
Gestational age, wk	39.0 (37.0–40.4)	38.9 (36.4–40.4)	.20
Government or self-pay	1374 (52.8)	487 (81.6)	< .001
ASA score	2 (2–3)	2 (2–3)	.01
Singleton	2268 (87.0)	504 (84.4)	.08
Prophylactic antibiotics	2564 (74.0)	473 (85.0)	< .001
Chorioamnionitis	243 (9.0)	75 (13.0)	.02
Laboring prior to cesarean	1991 (76)	438 (74)	.15
Emergency cesarean	343 (13.0)	139 (23.0)	< .001
Arrest disorder as indication	1041 (40.0)	206 (34.5)	.01
Low transverse hysterotomy	2489 (95.6)	492 (82.4)	< .001

Data expressed as n (%), mean $\pm$ SD, and median (interquartile range).

ASA, American Society of Anesthesiologists; BMI, body mass index.

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