American Journal of Obstetrics and Gynecology (2005) **192**, 1458–61

ELSEVIER

American Journal of OBSTETRICS and GYNECOLOGY

www.ajog.org

Abnormal placentation: Twenty-year analysis

Serena Wu, MD, Masha Kocherginsky, PhD, Judith U. Hibbard, MD

Division of Maternal Fetal Medicine, Department of Obstetrics and Gynecology, and Department of Health Sciences, University of Chicago, Chicago, Ill

Received for publication August 31, 2004; revised December 4, 2004; accepted December 20, 2004

KEY WORDS
Placenta accreta
Abnormal placentation
Cesarean delivery
Placenta previa

Objective: This study was undertaken to determine whether the rate of abnormal placentation is increasing in conjunction with the cesarean rate and to evaluate incidence, risk factors, and outcomes.
Study design: Cases from 1982-2002 were identified by histopathologic or strong clinical criteria. Risk factors were assessed in a matched case-control study, and analyzed using conditional logistic regression models.
Results: There were 64,359 deliveries, with cesarean rates increasing from 12.5% (1982) to 23.5% (2002). The overall incidence of placenta accreta was 1 in 533. Significant risk factors for placenta accreta in our final analysis included advancing maternal age (odds ratio [OR] 1.13, 95% CI 1.089-1.194, $P < .0001$), 2 or more cesarean deliveries (OR 8.6, 95% CI 3.536-21.078, $P < .0001$), and previa (OR 51.4, 95% CI: 10.646-248.390, $P < .0001$).
Conclusion: The rate of placenta accreta increased in conjunction with cesarean deliveries; the most important risk factors were previous cesarean delivery, previa, and advanced maternal age.

The reported rate of cesarean delivery (CD) in the United States increased dramatically from 4.5% in 1965, to the current rate, 26.1%, reported for 2002.[1,2] Of great concern is that the incidence of placenta accreta has also increased at an alarming rate from less than 1 in 30,000 deliveries in the 1930s through the 1950s to 1 in 2500 in 1980.[3] Prior uterine surgery, myomectomy, and curettage, in addition to cesarean section, have all been associated with abnormal placentation, but more ominously, placenta previa has been associated with a high risk of placenta accreta.

Because the increasing rate of CDs may contribute significantly to the rising incidence of abnormal placental adherence, we wanted to first determine whether the CD rate at our center reflects an increased number of cases with abnormal placentation, in particular placenta accreta, increta, or percreta, and secondly, we sought to determine the greatest risk factors for gestations complicated by placenta accreta.

Material and methods

Data were abstracted from: OB File (delivery case records), ICD-9 codes, University of Chicago pathology database, and the Obstetrics and Gynecology ultrasound database, from January 1, 1982, to December 31, 2002. Abnormal placentation was defined histopathologically as well as clinically by one of the following: (1) histopathologic confirmation, criteria unchanged over a 20-year period, on a hysterectomy specimen; (2)

Poster presentation at 24th Annual SMFM meeting, New Orleans, La, February 2003.
Reprints are not available from the authors.

0002-9378/$ - see front matter © 2005 Elsevier Inc. All rights reserved.
doi:10.1016/j.ajog.2004.12.074

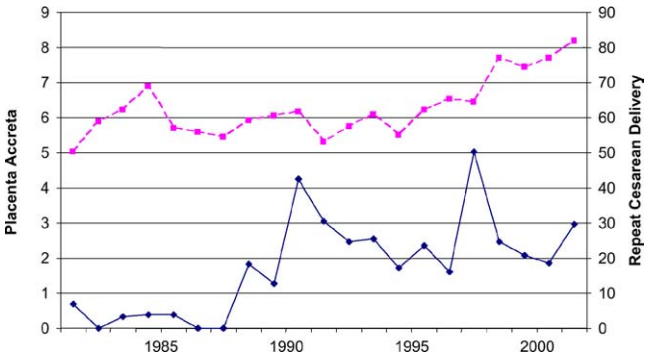

Figure 1 Rates of placenta accreta (*solid line*) and repeat cesarean delivery (*dashed line*) per 1000 deliveries at the University of Chicago, 1982-2002. Note that different scales for placenta accreta (left axis) and repeat CD (right axis) are used. ♦, Rate of accreta; ■, rate of repeat cesarean.

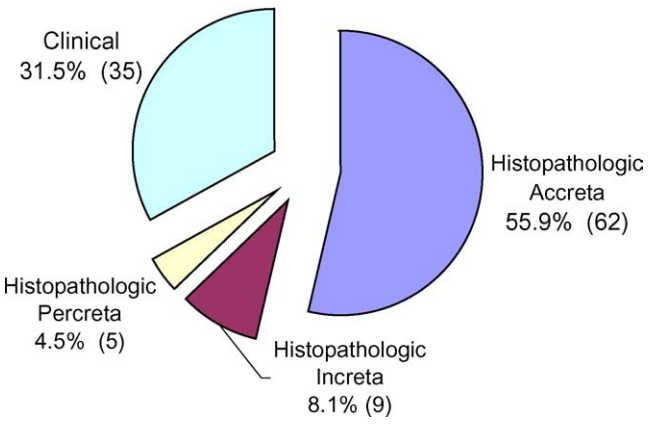

Figure 2 Diagnosis of abnormal placentation.

Table I Risk factors for cases and controls

	Case (n = 111)		Control (n = 339)		Conditional logistic regression *P* value
	No.	%	No.	%	
Prior CD	55	49.55	50	14.75	< .0001
Age >35 y	36	32.43	34	10.03	< .0001
Previa	35	31.53	3	0.88	< .0001
Multiparity ≥5	44	39.64	74	21.83	< .0001
History of abortion	52	46.85	124	36.58	.048
Prior curettage	27	24.32	111	32.74	.086
Myomectomy	0	0	4	0.294	*

$P < .05$ is significant.
* No cases had myomectomy.

difficult manual, piecemeal removal of the placenta, performed if there was no evidence of placental separation 20 minutes after parturition, despite active management of the third stage of labor (ie, intravenous oxytocin, massaging the uterus, drainage of blood from placenta, and gentle, controlled traction of the umbilical cord); (3) heavy continued bleeding from the implantation site of a well contracted uterus after placental delivery during CD. Patients with myomatous uteri or malignancy were excluded. Predictor variables included maternal age, gravidity, parity, prior CDs, previa, prior uterine surgery, and prior curettage or abortions.

After describing our case series, we performed a matched case-control analysis, matching on year of delivery. Three controls were randomly selected for each case by a computer technician, not involved in this study, who performed a random number generator program to query the OB File database on a yearly basis during the 20-year study period. Power analysis was focused on the odds ratio (OR) of developing placenta accreta in women with or without prior cesarean delivery. Assuming low correlation in exposure between cases and controls (20%), and a 15% or 20% rate of prior cesarean delivery among the controls, we would have 80% power ($\alpha = .05$) to detect an OR of 2.3 and 2.1, respectively, using 3 matched controls. The power gained by 4:1 matching would have been approximately 3%, and is small relative to the cost of collecting data for an additional 110 controls. Cases that were gravida 1 were excluded (n = 7), as they had no exposure to the risk of CD or abortion. Risk factors for placenta accreta were analyzed by using conditional logistic regression models, and OR, 95% CI, and *P*-values ($P \leq .05$ significant) were calculated.

Results

There were 64,359 deliveries at the University of Chicago during the study period, 7921 primary CDs and 4047 repeat CDs. Figure 1 illustrates the incidence of placenta accreta per 1000 deliveries in relation to the repeat CD rate. Overall incidence of placenta accreta was 1 in 533; 436 potential cases were identified and 121