American Journal of Obstetrics and Gynecology (2004) **190**, 1476–8

ELSEVIER

AMERICAN JOURNAL of OBSTETRICS and GYNECOLOGY

www.elsevier.com/locate/ajog

Risk of uterine rupture in labor induction of patients with prior cesarean section: An inner city hospital experience

Carol Lin, MD, B. Denise Raynor, MD

Department of Gynecology and Obstetrics, Emory University at Grady Healthcare System, Atlanta, Ga

Received for publication September 10, 2003; revised December 31, 2003; accepted February 4, 2004

KEY WORDS
Uterine rupture
Labor induction
Vaginal birth after cesarean section
Misoprostol

Objective: This study was undertaken to determine the risk of uterine rupture in patients induced with oxytocin or misoprostol after 1 or more previous cesarean sections.
Study design: Patients with 1 or more previous cesarean sections who delivered after 28 weeks' gestation between 1996 and 2002 were identified by database. Among 3533 total patients, rates of uterine rupture were compared among 4 groups: oxytocin induction (n = 430), misoprostol induction (n = 142), spontaneous labor (n = 2523), and repeat cesarean section without labor (n = 438). Statistical analysis included χ^2 test, Fisher exact test, unpaired *t* test, and Mantel-Haenszel test.
Results: Rate of rupture was increased in all inductions compared with that of the spontaneous labor group. Among patients with 1 prior cesarean, rupture rates with misoprostol and oxytocin induction were 0.8% and 1.1%, respectively.
Conclusion: Induction of labor with oxytocin or misoprostol is associated with a higher rate of uterine rupture compared with those who deliver after spontaneous labor. After 1 prior cesarean, rupture rate with misoprostol induction is not increased compared with oxytocin induction.

The risk of uterine rupture in an attempted vaginal birth after cesarean section is reported to range from 0.5% to 1.0%.[1-3] Although rare, uterine rupture has played a role in shaping obstetric practice, causing some to question the entire practice of trial of labor.[4]

Recent studies show an association between labor induction and uterine rupture.[2,3,5] However, systematic data on misoprostol as an induction agent are lacking. Studies have also been limited to patients with 1 prior cesarean section. This study aimed to determine the risk of uterine rupture in patients undergoing induction of labor with misoprostol or oxytocin after 1 or more previous cesarean sections.

Materials and methods

A database was used to identify patients delivering at 28 weeks or greater between January 1996 and July 2002 whose history included previous cesarean section. Incomplete records were excluded. Information was extracted on race, maternal age, parity, gestational age at delivery, mode of delivery, presentation, infant weight, induction agent, previous uterine scar, number and type of prior cesarean sections.

Four study groups were defined: (1) repeat cesarean without labor, (2) spontaneous labor, (3) oxytocin induction, and (4) misoprostol induction.

0002-9378/$ - see front matter © 2004 Elsevier Inc. All rights reserved.
doi:10.1016/j.ajog.2004.02.035

Table Patients by number and type of previous cesarean section

Previous cesarean sections (n = 3533)		Scar type (n = 3533)	
1	2763	Classical	145
2	515	Low transverse	1931
3	105	Low vertical	39
>3	44	Unknown scar	1312
Unidentified*	106	Unidentified*	106

* Unidentified patients were not included in analysis that required information about cesarean number or scar type.

Induction agents were selected by individual practitioners. General practice involved the use of misoprostol in patients with unfavorable cervix. However, misoprostol use varied throughout the study period. Similarly, the use of oxytocin with respect to cervical ripeness varied with the availability of other agents. Oxytocin induction was distinguished from augmentation by database variables. Information was validated by review of medical records.

Uterine rupture was defined as uterine scar separation associated with abnormal fetal heart rate tracing, extrusion of fetal parts, or hemorrhage. Operative reports were reviewed; cases that failed to meet criteria were reclassified as uterine dehiscence.

Statistical analysis included χ^2 test and Fisher exact test for categorical variables, unpaired *t* test for continuous variables, and Mantel-Haenszel test to calculate odds ratios (ORs). Approval was obtained from the Institutional Review Board.

Results

A total 29,919 patients delivered at our institution during the study period; of patients with previous cesarean sections, 3,659 delivered at 28 weeks or greater. After exclusions 3,533 patients remained in the study: 438 in the elective cesarean group; 2,523 in the spontaneous labor group; 430 in the oxytocin group; 142 in the misoprostol group. Table displays the patients by number of previous cesarean section and scar type. The study groups were similar in race, maternal age, number of prior cesarean sections, and infant birth weight. Demographics between ruptures and nonruptures were also similar.

The overall rate of rupture was 0.5% (19/3533). For all inductions the rate was 1.2% (7/572); rupture rates in the oxytocin and misoprostol groups were 1.2% (5/430) and 1.4% (2/142), respectively. Rupture occurred in 0.2% (1/438) of the repeat cesarean group, and 0.4% (11/2523) in the spontaneous labor group.

Risk of uterine rupture was increased in all inductions compared with women delivered by cesarean section without labor (OR 5.41 [95% CI 1.0-40.34]). The rupture risks were similar between oxytocin (OR 5.14 [95% CI 0.59-116.8]) and misoprostol (OR 6.24 [95% CI 0.44-175.2]). When inductions were compared with the spontaneous labor group, rupture risk was also increased but not statistically significant (OR 2.68 [95% CI 0.81- 8.39]). Laboring women, spontaneous or induced, were more likely to have uterine rupture compared with women undergoing cesarean section without labor (OR 3.58 [95% CI 0.96-19.7]).

With respect to the number of previous cesarean deliveries, rupture rates in patients with multiple prior cesarean sections were higher than those with 1 prior cesarean, although not statistically significant. In the spontaneous labor group, the rupture rate was 0.4% (7/2000) in patients with 1 prior cesarean, compared with 0.8% (4/523) for those with more than 1 cesarean section; in the oxytocin group, the rupture rates were 1.1% (4/376) and 1.9% (1/54), respectively; in the misoprostol group, rupture rates were 0.8% (1/123) and 5.3% (1/19), respectively.

Patients with a prior low transverse scar had a similar rupture rate compared with those with unknown scar (0.6% and 0.5%, respectively). No uterine ruptures occurred in patients with classical or low vertical scars.

Comments

Our study demonstrated a higher rate of uterine rupture in patients undergoing induction of labor after previous cesarean section when compared with that in spontaneous labor. The overall rupture rate was consistent with previous studies.[2] The rate of rupture in all induced patients was similar to a prior study,[2] but lower than the 2.3% in Zelop et al.[5] Our sample differed with the inclusion of a misoprostol group and patients with multiple cesareans.

This study is the first to evaluate rupture risk of patients undergoing misoprostol induced trial of labor compared with spontaneous labor or no labor. Prior studies have been case reports that included asymptomatic dehiscences, or did not include misoprostol as a single study group.[6,7] The largest study lacked data specific to misoprostol use and instead reported a rate of 2.3% for all prostaglandin inductions.[3] Ultimately, misoprostol use in patients with scarred uteri was discontinued without an estimate of uterine rupture risk.[8] Our rupture rate for misoprostol induction in patients with 1 prior cesarean section was similar to that for oxytocin induction.

Studies of oxytocin induction in vaginal birth after cesarean sections have conflicting results.[5,9] Zelop et al[5] found a 4-fold increase risk of rupture in patients receiving oxytocin for induction. Our study showed an

increased risk of rupture with oxytocin, but not to the same extent.

Past induction studies have been limited to patients with 1 prior cesarean section; ours is the first to include patients with multiple cesarean sections. Although not statistically significant, rupture rates in patients with multiple cesarean sections were consistently higher, similar to studies that did not focus on induction.[1]

Sample size was a limitation of this study. Also, exact dosages of induction agents could not be verified. Antepartum complications were not controlled for; however, a prior study found this was not a significant factor.[3] In addition we did not control for factors that may be important in rupture such as interdelivery interval and endometritis in index pregnancy.

To conclude, our study showed an increased uterine rupture rate in patients undergoing induction compared with patients in spontaneous labor, which seemed to be further increased in patients with multiple prior cesarean sections. Our data imply that rupture rate with misoprostol is similar to that with oxytocin induction. Misoprostol will likely never be used again in patients with uterine scarring, but it is possible that the risk of rupture is not increased compared with agents such as oxytocin that continue to be used in these patients.

References

1. Caughey AB, Shipp TD, Repke JT, Zeion CM, Cohen A, Lieberman E. Rate of uterine rupture during a trial of labor in women with one or two prior cesarean deliveries. Am J Obstet Gynecol 1999;181:872-6.
2. Ravasia DJ, Wood SL, Pollard JK. Uterine rupture during induced trial of labor among women with previous cesarean delivery. Am J Obstet Gynecol 2000;183:1176-9.
3. Lydon-Rochelle M, Holt VL, Easterling TR, Martin DP. Risk of uterine rupture during labor among women with a prior cesarean delivery. N Engl J Med 2001;345:3-8.
4. Phelan JP. VBAC: Time to reconsider? OBG Management 1996; 11:62-8.
5. Zelop CM, Shipp TD, Repke JT, Cohen A, Caughey AB, Lieberman E. Uterine rupture during induced or augmented labor in gravid women with one prior cesarean delivery. Am J Obstet Gynecol 1999;181:882-6.
6. Wing DA, Lovett K, Paul RH. Disruption of prior uterine incision following misoprostol for labor induction in women with previous cesarean delivery. Obstet Gynecol 1998;91:828-30.
7. Plaut MM, Schwartz ML, Lubarsky SL. Uterine rupture associated with the use of misoprostol in the gravid patient with a previous cesarean section. Am J Obstet Gynecol 1999;180:1535-42.
8. American College of Obstetricians and Gynecologists. Induction of labor for vaginal birth after cesarean delivery. Washington (DC): The College; 2002 ACOG Committee Opinion No. 271.
9. Flamm BL, Goings JR, Fuelberth NJ, Fischermann E, Jones C, Hersh E. Oxytocin during labor after previous cesarean section: results of a multicenter study. Obstet Gynecol 1987;70:709-12.