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Systematic review of the incidence and consequences of uterine rupture in women with previous caesarean section

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Abstract

Objective To evaluate the incidence and consequences of uterine rupture in women who have had a delivery by caesarean section.

Design Systematic review.

Data sources Medline, HealthSTAR, Cochrane Database of Systematic Reviews, Cochrane Controlled Trials Register, National Centre for Reviews and Dissemination, reference lists, and national experts. Studies in all languages were eligible if published in full.

Review methods Methodological quality was evaluated for each study by using criteria from the United States Preventive Services Task Force and the National Health Service Centre for Reviews and Dissemination. Uterine rupture was categorised as asymptomatic or symptomatic.

Results We reviewed 568 full text articles to identify 71 potentially eligible studies, 21 of which were rated at least fair in quality. Compared with elective repeat caesarean delivery, trial of labour increased the risk of uterine rupture by 2.7 (95% confidence interval 0.73 to 4.73) per 1000 cases. No maternal deaths were

related to rupture. For women attempting vaginal delivery, the additional risk of perinatal death from rupture of a uterine scar was 1.4 (0 to 9.8) per 10 000 and the additional risk of hysterectomy was 3.4 (0 to 12.6) per 10 000. The rates of asymptomatic uterine rupture in trial of labour and elective repeat caesarean did not differ significantly.

Conclusions Although the literature on uterine rupture is imprecise and inconsistent, existing studies indicate that 370 (213 to 1370) elective caesarean deliveries would need to be performed to prevent one symptomatic uterine rupture.

Introduction

In the past 20 years, trial of labour has been encouraged for women who have had a caesarean delivery. Recent studies reporting that mother and

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This is an abridged version; the full version is on bmj.com



A table with details of included studies is on bmj.com

fetus may be at greater risk than previously thought, largely because of uterine rupture,^{1,2} have stirred controversy about the safety of vaginal birth after caesarean section.³⁻⁵

We sought to determine the incidence and consequences of uterine rupture for women with a low transverse caesarean section scar or unclassified scar (for which the direction of incision on the uterus is uncertain). We also searched for evidence about the effect of medical induction, and augmentation on maternal and infant morbidity and mortality. This review derives from an evidence based report conducted for the US Agency for Healthcare Research and Quality.⁶

Methods

Searching

We searched the following data sources: Medline, HealthSTAR (1980 to 2002), the Cochrane Database of Systematic Reviews, Cochrane Controlled Trials Register, the Database of Abstracts of Reviews of Effectiveness, reference lists of pertinent studies, reviews, and expert recommendations. The search was limited to 1980 or later, as in 1980 a National Institutes of Health consensus conference established vaginal birth after caesarean as an acceptable choice.⁷

Selection

We considered controlled trials, cohort studies, case-control studies, and case series with at least 10 cases. We sought comparative and non-comparative studies reporting uterine rupture rates and sequelae in women with low transverse caesarean scar or unclassified scar who chose trial of labour or elective repeat caesarean delivery (ERCD). Our exclusion criteria for studies are shown in figure 1.

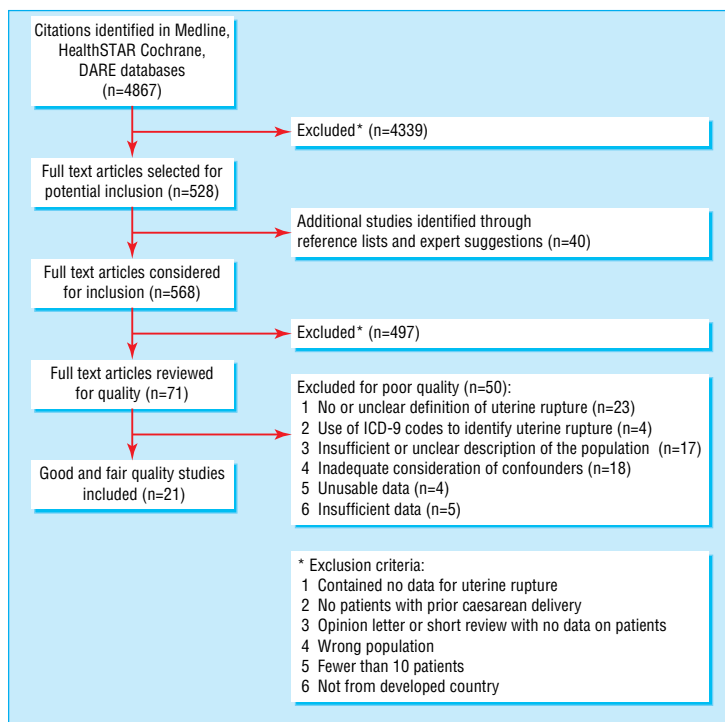


Fig 1 Eligibility of studies for inclusion in systematic review

Validity assessment

Two investigators independently rated the quality of each study, using criteria from the US Preventive Services Task Force and the NHS Centre for Reviews and Dissemination.^{8,9} Reasons for exclusion on grounds of poor quality are given in figure 1.

All studies needed to define uterine rupture, or to provide enough information about rupture events to allow for classification and determination of likely association to prior caesarean section. We excluded studies that had used ICD-9 codes to identify uterine rupture because ICD-9 codes are inaccurate: in one study, only 480 (39.8%) of 1244 suspected ruptures identified from ICD-9 codes were confirmed as true ruptures after records were reviewed.¹⁰

Data abstraction and study characteristics

From each study, two reviewers independently abstracted study design and setting; patients' characteristics; definition, rates, and predictors of uterine rupture; maternal and fetal outcomes; and methods of assessing or adjusting for confounders. When reviewers disagreed, agreement was reached by consensus.⁶

Terminology for rupture was inconsistent among studies, yet was crucial for understanding the incidence and consequences of the condition. We used "symptomatic uterine rupture" when uterine separation was diagnosed at laparotomy performed for maternal or fetal signs or symptoms associated with uterine rupture, such as fetal heart rate disturbances or maternal bleeding, and "asymptomatic uterine rupture" for uterine separation without signs or symptoms.

Quantitative data synthesis

We conducted several meta-analyses to estimate the risks associated with trial of labour and clinical factors that influence risk. Our primary outcomes of interest were the additional absolute risks of symptomatic uterine rupture, and of maternal or perinatal death, or hysterectomy, related to rupture, when trial of labour rather than repeat caesarean delivery was chosen. We were also interested in risks associated with management techniques such as induction or augmentation of labour, as well as signs or symptoms predicting poor outcomes from uterine rupture. Absolute risk differences and rates were calculated and pooled. Our analysis gave more weight to precise studies. To reduce bias, we included only studies of fair to good quality (see bmj.com).

Results

We identified 4867 citations, reviewed 568 full text articles, and identified 21 studies of fair to good quality (fig 1). Of the 71 studies considered potentially eligible, 50 received a poor rating (16 for two or more reasons).

Study characteristics

The included studies consisted of two large, population based retrospective studies,^{11,12} 15 prospective cohort studies,¹²⁻²⁶ two case-control studies,^{27,28} and two case series.^{29,30} There were no consistent definitions for symptomatic or asymptomatic uterine rupture in included studies. See bmj.com for a table listing the definitions in individual studies. There were also inconsistencies in the way cohort studies defined trial of labour, and elective repeat caesarean delivery.

Results of studies comparing trial of labour and emergency repeat caesarean delivery

Study	Characteristics of population	Sample size		Uterine exploration	No (%) of uterine ruptures		Reported associated major morbidity
		TOL	ERCD		Symptomatic	Asymptomatic	
Cowan 1994 ¹²	All vertical scars excluded; unclassified scars and more than 1 previous caesarean allowed	593		Not reported	TOL - 5 (0.8)	Not reported	1 fetus with severe neurological sequelae
Flamm 1994 ¹⁵	All vertical scars excluded; unclassified scars allowed	5022	2207	Discretion	TOL - 39 (0.8)	Not reported	0 maternal and neonatal deaths, 3/39 hysterectomies
Duff 1988 ¹³	One prior LTCD and unclassified scar not allowed	227*		Yes	TOL - 1 (0.4)	Not reported	0 maternal or perinatal deaths
Flamm 1988 ¹⁴	LTCD, unclassified scar and more than 1 previous caesarean allowed	1776†		Yes (discretion?)	TOL - 3 (0.2)	TOL - 11 (0.6)	Symptomatic UR: TOL - 0 maternal and neonatal deaths, 1 hysterectomy
Flamm 1990 ¹⁶	LTCD, unclassified scars and more than 1 previous caesarean allowed	3957		Majority no longer did	TOL - 7 (0.2)	Not reported	0 maternal deaths; 1 hysterectomy with infant born vaginally, Apgar 9; 3 infants with Apgar <7 (one cerebral palsy at 15 months); 1 perinatal death related to rupture
Phelan 1987 ²¹	Low vertical scars, unclassified scars, LTCD during 2nd year and more than 1 previous caesarean allowed	1796	314	Yes	TOL - 5 (0.3)	TOL - 34 (1.9) ERCD - 7 (2.2)	Symptomatic UR: TOL - 1 neonatal death, post rupture, scar intact, fetal bradycardia (sign), 4600g Apgar 0,0,3; none in transverse scar
Stoval 1987 ²²	More than 1 LTCD or LVCD allowed; not clear what was done with unclassified scars	272		Yes	TOL - 1 (0.4)	TOL - 6 (2.2)	Symptomatic UR: TOL - 0 maternal or fetal deaths
Paul 1985 ²⁰	Not more than 1 previous caesarean allowed; low vertical scars, unclassified scars and LTCD allowed	751	157	Yes	TOL - 5 (0.7)‡	TOL - 11 (1.5)‡ ERCD - 4 (2.5)‡	Symptomatic UR: TOL - 0 maternal deaths, 2 fetal deaths (classical incision 3 prior CD, fundal incision), 0 hysterectomies
Martin 1983 ¹⁷	1 or more LTCD or LVCD allowed, no rupture occurred in the 76 with prior vertical scars	162	555	Yes	TOL - 1 failed (0.6) ERCD - 2 (0.4)	TOL - 1 successful, 3 failed (2.5) ERCD - 4 (0.7)	Symptomatic UR: TOL - 0 maternal or fetal deaths ERCD - 0 maternal or perinatal deaths, 0 hysterectomies
Meier 1982 ¹⁹	1 or more LTCD allowed, no "obvious CPD" allowed	207	62	Not reported	Not reported	TOL - 1 (0.48) ERCD - 1 (1.6)	Symptomatic UR: TOL - 0 maternal and fetal deaths
McMahon 1996 ¹	1 LTCD allowed; not clear what was done with unclassified scars	3249	2889	Not reported	TOL - 10 (0.3) ERCD - 1 (0.03)	Not reported	TOL - 0 maternal deaths, 2 perinatal deaths, 2 hysterectomies; ERCD - 0 maternal or perinatal deaths, 0 hysterectomies

CPD=cephalopelvic disproportion; ERCD=elective repeat caesarean delivery; LTCD=low transverse caesarean delivery; LVCD=low vertical caesarean delivery; TOL=trial of labour; UR=uterine rupture.

*Called dehiscence but symptomatic.

†One third still had thin layer of peritoneum over scar.

‡ Included in Phelan 1987²¹

Data synthesis

Symptomatic uterine rupture

Ten of 11 observational studies provided the best evidence on the occurrence of symptomatic rupture (table).^{1 12-17 19 21 22} Symptomatic rupture rates in prospective cohort studies ranged from 0/1000 in a small study¹⁹ to 7.8/1000 in the largest,¹⁵ with a pooled rate of 3.8 (95% confidence interval 1.3 to 6.2) per 1000 trials of labour. Only two studies provided comparative data for symptomatic rupture in trial of labour versus elective repeat caesarean (fig 2).^{1 17} When combined, these data show an additional risk of 2.7 (0.73 to 4.73) symptomatic ruptures per 1000.

Perinatal deaths—Classification and reporting inconsistencies make it difficult to assess the risk of perinatal death due to rupture. Overall, nine cohort

studies and the two case series reported six deaths in 74 symptomatic ruptures, corresponding to an additional 1.4 (0 to 9.8) perinatal deaths per 10 000 trials of labour.^{1 12-17 19 21 22 29 30} A large data linkage study from Scotland reported a rate nearly 10 times higher than this (12.9 (7.9 to 19.9) additional perinatal deaths per 10 000 trials of labour).¹¹ But misclassification of women (as trial of labour or elective repeat caesarean delivery) could have made their estimate spuriously high.

Hysterectomy—In the five cohort studies reporting on hysterectomies related to rupture, seven hysterectomies occurred in 60 symptomatic ruptures (13%; 4% to 27%).^{1 13-16} These data indicate that 3.4 (0 to 12.6) per 10 000 women choosing trial of labour sustain a rupture that would necessitate hysterectomy.

Asymptomatic uterine rupture

Eight prospective cohort studies reported performing uterine exploration after vaginal birth after a previous caesarean (table).^{13-17 20-22} Five reported routinely performing manual uterine exploration after vaginal birth.^{13 14 18 21 22} In these studies, rates of asymptomatic uterine rupture, or dehiscence, ranged from 5/1000 to 20/1000,^{19 22} with a mean weighted average rate of 13 per 1000 trials of labour. In three comparative studies the rates for asymptomatic rupture in trial of labour and elective repeat caesarean were not significantly different (16 (5.4 to 28.4) per 1000 *v* 13 (4.3 to 26.2) per 1000; fig 3).^{17 19 21}

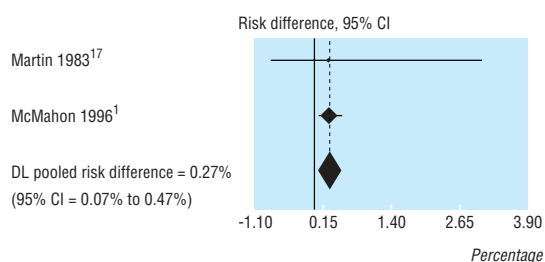


Fig 2 Symptomatic uterine rupture: trial of labour versus elective repeat caesarean delivery

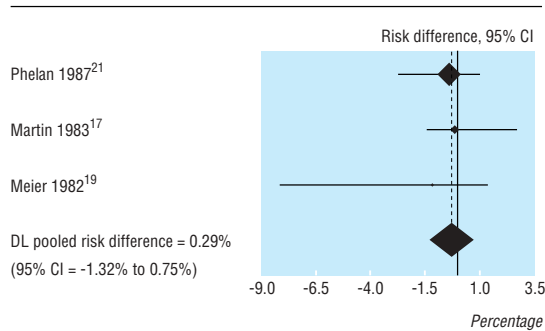


Fig 3 Asymptomatic uterine rupture: trial of labour versus elective repeat caesarean delivery

Increased incidence with induction

Oxytocin use was associated with a twofold to fourfold increased risk of uterine rupture in two case-control studies.^{27 28} This finding has not been confirmed in cohort studies or controlled trials. In prospective cohort studies, the use of oxytocin^{12 20 22-24} or prostaglandin^{25 26} was not associated with a higher risk of uterine rupture.

Predictors of major morbidity from rupture

Abnormalities in fetal heart rate were the most common sign of rupture, occurring in 55-87% of uterine rupture events. Other signs reported were vaginal bleeding, pain, and disturbances of uterine contractions.

No properly designed studies have directly evaluated whether fetal heart rate signs predict—or whether acting on them prevents—mortality and major morbidity related to uterine ruptures. Two case series that examined whether delays in delivery after fetal bradycardia were associated with infant morbidity had conflicting results.^{29 30}

Discussion

This report aimed to answer a question on the minds of patients, providers, and policy makers: what additional risks does a woman who has had a caesarean delivery assume if she chooses to attempt vaginal delivery rather than have a caesarean section? Most of the literature focuses on the risk of uterine rupture in the trial of labour group, with an implicit assumption that this risk would be eliminated by elective repeat caesarean delivery. If this assumption is true, it would take 263 elective repeat caesareans to prevent one uterine rupture due to trial of labour. However, elective repeat caesarean delivery is not guaranteed to prevent uterine rupture. In two comparative studies, trial of labour posed an additional risk of 0.27% (2.7/1000; 95% confidence interval 0.73 to 4.73)^{1 17}; thus 370 (213 to 1370) elective repeat caesareans would prevent one symptomatic uterine rupture due to trial of labour.

Morbidity

Patients are also concerned about additional morbidity. About 5% of symptomatic uterine ruptures were associated with perinatal mortality and 13% with hysterectomy. This translates to 7142 elective repeat caesareans to prevent one rupture related perinatal death and 2941 to prevent one rupture related hyster-

ectomy. It would take only one misclassified case of symptomatic uterine rupture in the smaller study and five in the largest¹ to entirely negate the observed difference in symptomatic uterine rupture between groups. Caution must be used in interpreting these results.

Serious morbidity or mortality due to uterine rupture is rare, making it difficult to study. As a result, studies have focused on the occurrence of uterine rupture rather than how often bad outcomes result from it. The existing evidence is sufficient to conclude there is an increased risk of symptomatic uterine rupture for trial of labour over elective repeat caesarean and that caesarean delivery is not completely protective. However, most uterine ruptures do not have serious consequences, and patients and clinicians may wish to base decisions on the likelihood of significant morbidity or mortality for the mother and baby rather than on the occurrence of uterine rupture itself.

Induction

We found insufficient evidence to make a reliable estimate of the risk of uterine rupture when oxytocin or prostaglandins are used during labour. There is a temptation to make a conclusion on the use of prostaglandins to induce trials of labour, especially with the large effect reported by Lydon-Rochelle et al (relative risk of uterine rupture 15.6; 8.1 to 30).² We excluded this study because the use of ICD-9 codes to identify uterine rupture has been shown to be only about 40% accurate.¹⁰ If the estimate reported in the Lydon-Rochelle study is off by 60%, we would expect to find a significant increase in uterine ruptures among those women receiving prostaglandins, a relative risk of approximately 6. Prostaglandins did not increase the risk of uterine rupture in other observational studies using better methods of identifying uterine ruptures. Whether prostaglandins really increase the risk is still open to question. The relation between fetal heart rate disturbances and uterine rupture also remains unclear.

Methodological issues

Existing studies do not permit a precise estimate of the frequency of serious events, which occur once in every 1000-10 000 deliveries. A randomised trial to answer this question would have to be huge and might fail because of participants' strong preference for one or other mode of delivery. For an observational study, the major challenges are to accurately classify exposures (trial of labour, elective repeat caesarean, induction, and augmentation) and outcomes (rupture related events). Attempts have been made to classify a labour after delivery as a trial of labour or elective repeat caesarean, but these efforts are fraught with bias. For example, women who intend to have a trial of labour but undergo early labour and decide on caesarean section are difficult to distinguish from women who "fail" trial of labour. Accounting for differences in the time of exposure is important, since women who choose elective repeat caesarean commonly deliver before 40 weeks whereas women choosing trial of labour may deliver up to 43 weeks.

Although degrees of measurement bias and misclassification are unavoidable, a multicentre prospective cohort study or national registry would offer

What is already known on this topic

Perceptions of high risk for uterine rupture cause many patients and practitioners to avoid vaginal birth after caesarean delivery

Epidemiological studies show an association between previous caesarean section and uterine rupture

What this study adds

Symptoms of uterine rupture were more common in women undergoing trial of labour than planned repeat caesarean delivery, but the additional risk is less than previously thought

For every 10 000 women attempting trial of labour there would be 27 additional symptomatic uterine ruptures, 1.4 perinatal deaths related to rupture, and 3.4 hysterectomies related to rupture

Studies need to use standard and precise definitions for uterine rupture and related outcomes

the best opportunity to guide the design of effective preventive strategies. Meanwhile, this review indicates that there is less than a 1% chance that a woman with a low transverse caesarean scar or scar of unclassified origin will sustain a uterine rupture as a consequence of attempting vaginal delivery; that elective repeat caesarean does not always prevent uterine rupture; and that for more than two thirds of women who experience a uterine rupture, neither they nor their infant will have severe health consequences related to uterine rupture.

Contributors: See bmj.com

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Endpiece

Learning from the world

There is no end to the learning of Ayurveda. Hence you should carefully and constantly devote yourself to it. You should increase your skill by learning from others without jealousy. The wise regard the whole world as their teacher, whereas the ignorant consider it to be their enemy.

From Charaka Samhita, one of the most important fundamental works on Ayurveda. It is based on the teachings of the sage Atreya, initially written by Agnivesa around 800 BC, and rewritten by sage Charaka around 200 BC. (www.vedicworld.org/vedas.html)

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