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DOES SURGICAL APPROACH MATTER? RISK OF UTERINE RUPTURE AFTER LAPAROSCOPIC VERSUS OPEN MYOMECTOMY – A CONTEMPORARY REVIEW

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ABSTRACT

Background: Uterine rupture is a rare but potentially life-threatening complication of pregnancy following surgical procedures involving the uterine corpus, including myomectomy. The increasing number of laparoscopic procedures raises concerns regarding the safety of this approach in subsequent pregnancies.
Objective: To assess the risk of uterine rupture during pregnancy following laparoscopic myomectomy compared with open abdominal myomectomy based on current literature.
Materials and Methods: A literature review was conducted using the PubMed/MEDLINE database, including publications from 2014 to 2025. Cohort studies, population-based analyses, and systematic reviews comparing obstetric outcomes after laparoscopic and open myomectomy were included.
Results: The incidence of uterine rupture after myomectomy is low and does not exceed 1% in most analyses. Most comparative studies did not demonstrate significant differences between surgical approaches. Some population-based studies suggested a potentially higher risk following laparoscopic procedures; however, these findings are limited by methodological constraints.
Conclusions: Current evidence does not confirm a clearly increased risk of uterine rupture after laparoscopic myomectomy. The technique of uterine wall reconstruction and appropriate patient selection appear to be more important for obstetric safety than the surgical approach itself.

KEYWORDS

Myomectomy, Uterine Rupture, Laparoscopy, Laparotomy, Pregnancy Outcomes, Uterine Fibroids

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Introduction

Uterine fibroids (leiomyoma uteri) are the most common benign tumors of the female reproductive tract in women of reproductive age, occurring in up to 60–70% of this population. In many cases they remain asymptomatic; however, in some patients they lead to significant clinical symptoms, including abnormal uterine bleeding, pelvic pain, and impaired fertility. Their presence may also affect the course of pregnancy, increasing the risk of obstetric complications such as preterm birth, premature rupture of membranes, placenta previa, placental abruption, fetal malpresentation, low birth weight, and pregnancy loss. Uterine fibroids are also associated with an increased rate of cesarean delivery (20,21).

In women planning future pregnancy, myomectomy remains the treatment of choice, as it allows preservation of the uterus and reproductive potential. The procedure may be performed via laparotomy or minimally invasive techniques, primarily laparoscopy.

In recent years, a significant increase in laparoscopic procedures has been observed, largely due to their favorable perioperative profile, including reduced blood loss, shorter hospital stay, lower postoperative pain, decreased incidence of postoperative fever, and faster recovery of bowel function (6,8). At the same time, advances in surgical techniques and increasing operator experience have broadened the indications for minimally invasive approaches.

Despite these advantages, the safety of subsequent pregnancies after myomectomy remains an important clinical concern. Particular attention is given to the risk of uterine rupture, which, although rare, is a potentially catastrophic complication for both mother and fetus. Its incidence is estimated to be below 1%, although available data are mainly derived from retrospective and observational studies (11,12).

The main controversy concerns the impact of surgical technique on uterine scar integrity during pregnancy. Some studies report no significant differences in rupture risk between laparoscopic and open myomectomy (2,5,7), whereas others suggest a potentially higher risk associated with minimally invasive

approaches, possibly due to differences in surgical technique or patient selection (1,4). Additional factors such as fibroid location, depth of myometrial incision, number of uterine incisions, and method of uterine reconstruction are also considered relevant (3). Moreover, higher patient satisfaction has been reported following laparoscopic procedures, although therapeutic decision-making remains complex (7).

Given the increasing number of myomectomies performed and the lack of clear clinical guidelines, an updated evaluation of obstetric safety after this procedure is warranted. In particular, it is crucial to determine whether the choice of surgical approach influences the risk of uterine rupture or whether other factors play a more significant role.

The aim of this study is to critically analyze current evidence regarding the risk of uterine rupture in pregnancy following myomectomy, with particular emphasis on the comparison between laparoscopic and open surgical techniques.

Materials and Methods

A literature review was conducted using the PubMed/MEDLINE database to identify studies addressing the risk of uterine rupture during pregnancy after myomectomy. Publications from January 1, 2014 to December 31, 2025 were included.

Search strategy

The search strategy included combinations of MeSH terms and keywords such as “myomectomy”, “uterine rupture”, “pregnancy”, “laparoscopic”, “laparotomy”, and “pregnancy outcomes”. Boolean operators AND and OR were applied to refine the search results. The strategy was designed to identify both comparative studies and those evaluating pregnancy outcomes after myomectomy.

Inclusion and exclusion criteria

Included studies:

- original research articles, cohort studies, retrospective analyses, population-based studies, and systematic reviews
- studies evaluating pregnancy outcomes after myomectomy
- studies comparing laparoscopic and open approaches or reporting uterine rupture rates
- articles published in English

Excluded:

1. case reports and case series including fewer than 5 patients
2. studies lacking obstetric outcome data
3. conference abstracts without full text
4. duplicate publications

Study selection

The initial search identified 91 publications. After removing duplicates and screening titles and abstracts, 45 studies were excluded. Full-text assessment was performed for 33 articles, and 21 studies were included in the final analysis.

Data extraction

Extracted data included:

- study type and publication year
- sample size
- surgical technique
- obstetric outcomes
- incidence of uterine rupture
- identified risk factors

Due to heterogeneity, qualitative analysis was performed.

Quality assessment

Given the narrative design, no meta-analysis was conducted. However, study quality was assessed descriptively, focusing on study design, sample size, and completeness of clinical data.

Results

Incidence of uterine rupture after myomectomy

Based on the analyzed studies, the incidence of uterine rupture after myomectomy remains low. In most systematic reviews and cohort studies, it does not exceed 1%, confirming that this is a rare complication (11,12). Similar findings were reported in retrospective studies and population-based analyses, in which the number of reported cases was low despite large study populations (1,2,5).

Some differences in reported rates were observed depending on study design. Population-based analyses and studies with large sample sizes occasionally reported slightly higher rates, which may reflect greater sensitivity in detecting complications or inclusion of higher-risk populations (1,4). Despite these differences, uterine rupture remains an uncommon event.

Laparoscopic versus open myomectomy

Most comparative studies did not demonstrate statistically significant differences in the risk of uterine rupture between laparoscopic and open abdominal myomectomy. Cohort studies and retrospective analyses reported comparable obstetric outcomes, including similar rates of this complication (2,5,7).

More recent analyses also indicate that minimally invasive techniques do not increase the risk of uterine rupture, particularly when the procedure is performed by an experienced surgeon (6,8). These findings suggest that laparoscopic myomectomy may be a safe alternative to open surgery in appropriately selected patients.

In contrast, some population-based studies have suggested a potentially higher risk of uterine rupture after laparoscopic procedures (1,4). However, these studies often lacked detailed operative data, such as the number and location of fibroids or the suturing technique used. This limits the ability to draw definitive conclusions from their findings.

Risk factors for uterine rupture

The analyzed studies identified several potential risk factors for uterine rupture after myomectomy. The most commonly reported factors include:

- intramural location of fibroids;
- large size or high number of removed fibroids;
- entry into the uterine cavity during surgery;
- suboptimal uterine wall closure technique.

These findings were consistent across observational and comparative studies (3,4,5). Particular importance is attributed to the depth of the myometrial incision and the extent of structural damage to the uterine wall, as these factors may affect the strength of the resulting scar.

Technical factors, such as excessive use of electrocoagulation or single-layer closure, have also been suggested to negatively affect the healing process. However, the available data do not allow their clinical significance to be clearly determined.

Summary of results

Overall, the available evidence indicates that uterine rupture after myomectomy is a rare complication, with rates below 1% in most studies. Most analyses do not confirm significant differences between laparoscopic and open abdominal myomectomy regarding the risk of this complication.

The discrepancies observed in some studies are most likely related to heterogeneity of the analyzed populations, methodological differences, and lack of detailed data on surgical technique. Factors related to fibroid characteristics and uterine wall reconstruction appear to be more important than the surgical approach alone.

Table 1. Summary of studies evaluating the risk of uterine rupture after myomectomy

Author (year)	Study type	Population	Comparison	Main findings	Risk of rupture
Ginod et al. (2025)	Population-based analysis	Large database	Laparoscopy vs laparotomy	No significant differences; limited operative data	<1%
Haviv et al. (2022)	Retrospective study	Patients after myomectomy	Laparoscopy vs laparotomy	Comparable obstetric outcomes	Low
Ordás et al. (2022)	Comparative study	Women with fibroids	Laparoscopy vs laparotomy	No differences in surgical and obstetric outcomes	Low
Gil et al. (2020)	Population-based analysis	Large population	Laparoscopy vs laparotomy	Higher risk after laparoscopy; data limitations	Low
Kundu et al. (2018)	Cohort study	Operated patients	Laparoscopy vs laparotomy	No differences in obstetric outcomes	<1%
Giannini et al. (2024)	Comparative study	Patients after myomectomy	Laparoscopy vs laparotomy	No significant differences	Low
Otten et al. (2025)	Retrospective study	Patients	Laparoscopy vs laparotomy	Similar clinical outcomes	Low
Claeys et al. (2014)	Systematic review	Multiple studies	Various techniques	Overall low risk	<1%
Gambacorti-Passerini et al. (2016)	Systematic review	Multiple studies	Various techniques	Trial of labor may be possible	<1%
Fu et al.	Meta-analysis	Multiple studies	Laparoscopy	Identification of risk factors	Low

Table 2. Risk factors for uterine rupture after myomectomy

Risk factor	Potential mechanism
Intramural fibroid location	Weakening of the myometrial structure
Large fibroid size	Greater damage to the uterine wall
Multiple fibroids	Multiple uterine incisions
Entry into the uterine cavity	Disruption of uterine integrity
Single-layer closure	Reduced scar strength
Excessive electrocoagulation	Tissue necrosis

Discussion

Summary of main findings

The present review indicates that uterine rupture after myomectomy is a rare complication, with an incidence below 1% in most studies (11,12). These findings are consistent across systematic reviews, cohort studies, and population-based analyses. At the same time, most comparative studies do not demonstrate significant differences in the risk of uterine rupture between laparoscopic and open abdominal myomectomy (2,5,7).

Although some reports suggest a potentially higher risk after laparoscopic procedures (1,4), the overall body of evidence does not allow this association to be clearly confirmed. This suggests that the surgical approach itself may not be the key factor determining the safety of subsequent pregnancy.

Interpretation of findings

The absence of clear differences between surgical techniques suggests that factors related to the procedure itself and the quality of uterine wall reconstruction may be more important than the surgical approach alone. Particular importance should be attributed to the method of myometrial closure, the number of suture layers, and the precision of anatomical reconstruction.

In the past, laparoscopy was considered a technique potentially associated with a higher risk of complications due to the technical difficulty of precise suturing. However, technological progress and increasing surgical experience have significantly changed this perspective. Contemporary laparoscopic

techniques allow precise multilayer suturing, making it possible to achieve a quality of reconstruction comparable to that obtained with laparotomy.

Surgeon experience also remains an important factor. Results from highly specialized centers suggest no major differences between approaches, indicating that the risk of complications may be more closely related to the learning curve than to the surgical method itself.

Comparison with the literature

Most of the analyzed studies confirm the absence of significant differences in uterine rupture risk between laparoscopic and open abdominal myomectomy (2,5,7). These findings are consistent across cohort studies and retrospective analyses. Systematic reviews also emphasize the safety of minimally invasive techniques, particularly in appropriately selected patients (6,8).

On the other hand, some population-based analyses suggest a potentially higher risk of uterine rupture after laparoscopic procedures (1,4). However, these studies often fail to include important clinical variables, such as the number, size, and location of fibroids or details of surgical technique. The absence of these data substantially limits interpretation of the results.

Differences between studies may also result from variation in patient selection for particular surgical approaches. In clinical practice, more complex cases are often treated by laparotomy, which may affect the comparability of study groups. At the same time, the lack of standardized definitions of uterine rupture across studies further complicates direct comparison of findings.

Pathophysiological considerations

The pathophysiology of uterine rupture after myomectomy is complex and primarily related to the healing process of the myometrium and the quality of the resulting scar. This process includes inflammatory, proliferative, and remodeling phases, during which collagen fibers are reorganized and muscle structure is restored.

During pregnancy, the uterine wall undergoes substantial stretching and increased tension, particularly in the third trimester. In weakened areas, such as postoperative scars, forces may be distributed unevenly, increasing the risk of tissue disruption. Abnormal healing may result in tissue with reduced mechanical strength and lower elasticity.

Factors related to the surgical procedure are also important. The depth of the myometrial incision, fibroid location, and possible entry into the uterine cavity may influence scar quality. Excessive use of electrocoagulation may lead to tissue damage and areas of necrosis, thereby impairing regeneration.

The suturing technique plays a key role as well. Multilayer closure of the uterine wall allows better restoration of uterine structure and increases the mechanical strength of the scar. Therefore, the quality of uterine wall reconstruction, rather than the surgical approach alone, appears to be the main determinant of uterine rupture risk.

Clinical implications

From a clinical perspective, these findings are important for therapeutic decision-making. Available data suggest that laparoscopic myomectomy may be safely performed in patients planning pregnancy, provided that patient selection is appropriate and the surgeon is experienced.

Management of pregnancy after myomectomy should be individualized, taking into account operative details and the characteristics of the removed fibroids. Despite the low risk of uterine rupture, increased clinical vigilance and appropriate delivery planning are necessary.

The mode of delivery should be determined individually. Although elective cesarean delivery is often considered, available evidence suggests that vaginal delivery may be possible in selected patients. This requires careful monitoring and individualized risk assessment.

Limitations of available evidence

The interpretation of the findings of this review is limited by the nature of the available evidence. Most studies are retrospective or observational, which introduces a risk of bias and limits the ability to control for confounding factors.

In addition, many studies do not provide detailed operative data, such as suturing technique, number of closure layers, or extent of energy use. The lack of this information makes it difficult to identify which factors have the greatest impact on uterine rupture risk.

Another important limitation is the small number of events, resulting from the rarity of uterine rupture. This reduces statistical power and makes it difficult to formulate definitive conclusions.

Future directions

Further prospective studies are needed to better assess the impact of surgical technique on the safety of subsequent pregnancies. Standardization of surgical procedures and identification of clinically useful risk factors are particularly important.

Conclusions

The risk of uterine rupture after myomectomy remains low and does not exceed 1% in most analyses. Current evidence does not clearly demonstrate an increased risk following laparoscopic compared with open myomectomy.

Factors related to surgical technique, particularly the quality of uterine reconstruction, appear to be more important than the surgical approach itself.

Laparoscopic myomectomy may be considered a safe option in appropriately selected patients planning pregnancy. However, individualized risk assessment and careful obstetric management are essential.

Further prospective studies are needed to establish clear clinical recommendations.

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