

Uterine rupture following laparoscopic myomectomy: an overview

Abstract

Background: Laparoscopic myomectomy has become popular and an attractive approach for the treatment of uterine myoma. Despite its unquestionable benefit to the patient concern has also been raised about its safety during pregnancy labour. The potential risks of uterine rupture are believed to be high.

Aim: To assess the magnitude of uterine rupture during pregnancy and labor and possible causal factors following laparoscopic myomectomy.

Methods: A literature search performed using web browser Google, and web sites as, High wire press, world laparoscopy hospital, Springer link and PubMed, Medline.

Results: There were few references for incidents of uterine rupture after laparoscopic myomectomy in this article review. There are no enough data comparing transverse and vertical incisions, single or multilayer wound closure with respect to scar integrity. These seemingly remote but possible causal factors are discussed.

Conclusion: Uterine rupture during pregnancies following laparoscopic myomectomy is possible but rare. The following review article shows that doesn't prove the suspicion that the laparoscopic myomectomy approach increases significantly the risk for uterine rupture during pregnancy. Even with this rarity, there is need to investigate this matter in-depth

Keywords: Laparoscopic myomectomy, Pregnancy outcome, Uterine rupture, Contralateral port position, Ipsilateral port position, Horizontal incision, Vertical incision

Volume 6 Issue 4 - 2017

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Received: September 01, 2016 | **Published:** March 27, 2017

Introduction

Minimal Access Surgery is increasingly becoming popular in almost all areas of surgery. Likewise laparoscopic myomectomy in carefully selected cases is becoming the method of choice over the conventional open approach for treatment of uterine myoma. The advantages of Laparoscopic myomectomy cannot be over emphasized.^{1,2} However, the main concern has been the integrity of the scar in subsequent pregnancies and labor since myomectomy is mainly performed to preserve uterus for future pregnancy.³

For adequate healing the layers must be brought in to correct approximation and there should be no haematoma in the cavity created after myoma enucleation. This may be a difficult task to achieve in the absence of tactile feedback. The difficult maneuvers during laparoscopic myomectomy requires a greater degree of skill and should be only be performed by experienced laparoscopist with sound laparoscopic suturing skills. The number of instruments and various insertion angles to approach the surgical site are limited and therefore certain myomas may be technically difficult to handle leading to scar weakness and thus rupture prone in future pregnancies. Vertical or transverse incisions are executed for the convenience of the difficult surgical maneuvers to close the cavity and the cavity is closed in single or multiple layers depending on the satisfaction of the operator. Electrocautery has been used to control bleeding but has been implicated for causing scar weakness. It is important to note that there are few cases of reported uterine rupture during pregnancy and labor.

Duboisson et al.³ has reported an incidence of 1% compared to open myomectomy which is 0.07%.³ But rupture of uterus in obstetric

practice is a catastrophic nightmare and if it happens to be linked to laparoscopic myomectomy it becomes a Damocles sword to the proponents of this important surgical approach. It is in the interest of this view that the authors decided to look into some aspects of pregnancy outcome following laparoscopic myomectomy.

Procedural details of laparoscopic myomectomy

Removal of pedunculated subserous myomas

The myoma is grasped and held in a position to allow bipolar cautery paddles to be placed across the pedicle. If the myoma stalk is thin, an extracorporeal knot can be placed and secured at the base. For a thicker stalk, a suture placed through the base of the stalk, tied fore and aft will ensure haemostasis. The bipolar instrument is then passed through the incision opposite the retracting instrument and placed over the entire pedicle. Alternatively, base can be coagulated in two or more sections. The bipolar cautery is activated until coagulation has stopped and there is no current flow. The stalk is then sharply resected. Alternatively, monopolar cutting current can be used to divide the pedicle between two secured ligatures on the stalk. Any subsequent bleeding points are secured with bipolar coagulation. Use of dilute vasopressin injection (5I.U in 20ml N/S) helps control uterine bleeding is recommended by Dr. R.K.Mishra. A fibroid less than one centimetre in diameter can be pulled directly through the 10 mm trocar with a grasping forceps or a myoma screw. For a larger myoma sharp morcellation can be attempted. Shaving should be performed with the myoma to the morcellator to avoid serious injuries to the bowel. Alternatively, myoma can be grasped with one instrument and progressively cut into smaller pieces with a monopolar cautery or

scissors. Fragments can be removed through the 10 mm laparoscope channel. Other options include removal through a colpotomy or an abdominal incision.

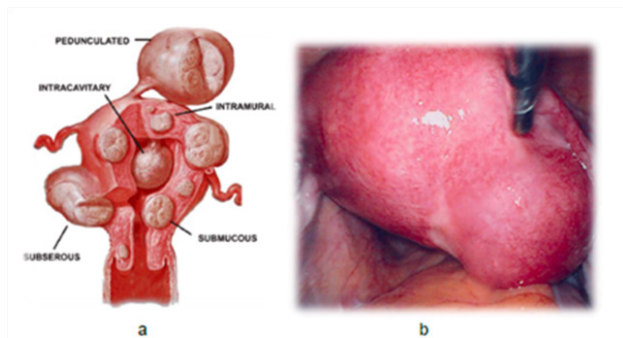


Figure 1 Uterine myoma before myomectomy.

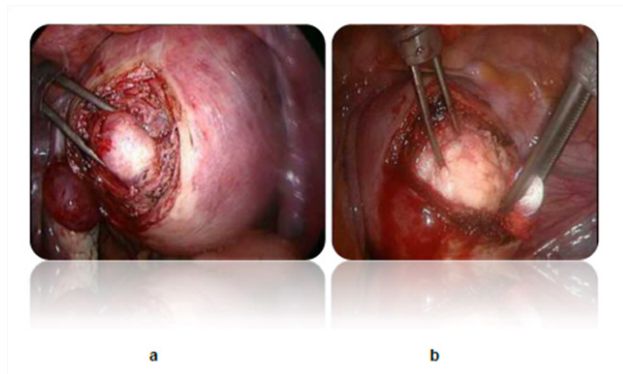


Figure 2 Uterine myoma during myomectomy.

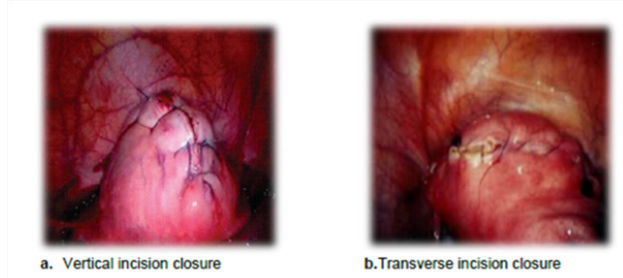


Figure 3 Uterus after laparoscopic myomectomy.

Intramural Myomas

For intramural myomas, dilute vasopressin is injected in multiple sites between the myometrium and the fibroid capsule. An incision is made in the serosa overlying myoma, using a monopolar electrode, a fibre laser or a harmonic scalpel. The incision is extended until it reaches the myoma capsule. Two grasping, toothed forceps are used to hold the edges of the myometrium/fibroid capsule. The suction irrigator is used as a blunt probe to shell the leiomyoma from its capsule; sharp scissors may be used as required. A myoma screw is inserted into the tumour to apply traction while the dissection is being carried out. If there are multiple myomas, efforts should be made as far as possible to remove them through one incision. 4-0 Polydioxanone for superficial suturing approximates the edges of the uterine defect. If the myometrial defect is deep or large, it is repaired with 1-0 or 2-0 Polygalactin suture followed by serosal repair with 4-0 Polydioxanone. Though difficult, at times myometrium is required to be sutured in two layers and sometimes even three layers. The sutures are applied at 1 cm increments using extracorporeal or

intracorporeal knot tying. The use of vasopressin has been reported to be associated with severe cardiopulmonary complications. There are also some specific procedural difficulties. The location of uterine incision is very important as it affects the whole of the operation. The second difficulty lies in planning the type of myometrial incision. The standard approach is a vertical incision in the uterus. The third practical difficulty is proper uterine repair. Stringer et al have reported the Endostitch to be the best instrument for laparoscopic closure of uterine defects. Recently a continuous spiralling suture for uterine wall reconstruction after laparoscopic myomectomy has been reported. Long term safety however is yet to be proved. Removal of myoma from abdomen is time consuming and no method is ideal. Growth of myomas in the trocar incision has been reported.

Material and methods

A literature search was performed using world laparoscopy hospital, High wire press, Pubmed, Springer, the browser Google.

The following search terms were used: "Laparoscopic myomectomy", "Pregnancy", "Uterine rupture", "Laparoscopic myomectomy and Pregnancy outcomes", "pregnancy and uterine rupture", "contralateral port position in laparoscopic myomectomy", "ipsilateral port position in laparoscopic myomectomy", horizontal incision in laparoscopic myomectomy, vertical incision in laparoscopic myomectomy Selected papers were screened for further references. Criteria for selection of literature were reported cases with uterine rupture, methods of analysis statistical or non-statistical and operative procedure. Only universally accepted procedures were selected and the Institution where the study was done.

Results

R J Lourens et al.⁴: A total of 87 patients were studied, underwent for laparoscopic myomectomy 71 of whom were treated for infertility and 16 for menorrhagia. 71 patients were eligible to evaluate fertility as a secondary outcome. Of these, 7 (9.9%) were excluded owing to lack of information, leaving 64 (90.1% of the 71) who could be evaluated to determine fertility outcome. The following fertility outcomes were observed. The overall pregnancy rate after myomectomy was 29/64(45.3%). In all cases conception was achieved within 12 months postoperatively. The average size of the fibroids in the pregnant group was 30.9 mm (SD 15.47 mm) (95% CI 25.17 - 36.63 mm), and in the non-pregnant group it was 28.48 mm (SD16.41 mm) (95% CI 22.88 - 34.08 mm). The mode of delivery in all patients but one was caesarean section. There were no reported uterine ruptures.

Nutan Jain et al.⁵: From September 2005 to September 2010, 417 patients, with large and moderate size myomas, were managed by laparoscopic myomectomy. Indications were subfertility, menorrhagia and abdominal mass. The myomas were enucleated and retrieved laparoscopically. myoma beds were sutured in multiple layers by endoscopic intracorporeal suturing. The maximum diameter of a myoma was 9 cm.317 patients pressed with subfertility, 198 of them conceived after surgery and had an uneventful antenatal and intranatal course. No patient had rupture of the myomectomy scar.

Jon I Einarsson⁶: In a recent study involving 2,050 laparoscopic myomectomies, investigators tracked 386 post-myomectomy pregnancies, 309 deliveries in all, of which 68 were vaginal deliveries. It found one case of uterine rupture documented at 33 weeks in a woman who had undergone adenomyomectomy. Overall, the literature suggests that uterine rupture after laparoscopic myomectomy is a rare event, occurring in fewer than 1% of

pregnancies. Some surgeons use a somewhat arbitrary rule of thumb requiring cesarean delivery if the uterine cavity is entered at myomectomy. This practice is not based on hard evidence, but it does make intuitive sense. If the uterine cavity is entered during myomectomy, it creates a transmural defect that may be more difficult to repair and could carry a higher risk of rupture. Uterine rupture has also occurred several years after removal of a pedunculated fibroid, suggesting that the use of electrosurgery may weaken the uterine muscle and increase the risk of rupture. In general—and regardless of the depth of the hysterotomy— it is advisable to counsel patients who have undergone laparoscopic myomectomy that the uterus heals with a scar that may be slightly weaker than the normal myometrium and that elective cesarean delivery may be the optimal strategy. However, a trial of labor is a reasonable alternative, provided the patient receives careful surveillance in a hospital setting.

William H Parker et al.⁷: They were identified 19 cases of uterine rupture after laparoscopic myomectomy. 13 procedures uterine incision were made monopolar electrosurgery. 2 surgeons used bipolar scissors. 1 used cold scissors and 1 surgeon used ultrasonic scissors. 5 cases involved entry into the endometrial cavity. In 6 cases haemostasis was obtained by using monopolar electrosurgery, in 7 cases bipolar, in 3 cases bipolar and suturing and in 2 only suturing. Uterine wounds were closed with only 1 suture in 3 patients, 1 layer sutures in 4 patients, only closing the serosa in 1 patient and 3 patients without closing the uterine wound. Multilayer closure was performed in 3 patients. Analysis revealed factors leading to uterine defect because poor healing of the wound. Haemostasis was performed by electrosurgery except 2 cases. Only 3 cases involved multilayer closure. In 1 case there was no visible factor lead to poor healing of the uterine wound.

Trivedi & Abreo⁸: A retrospective research study was carried out on 2540 women at the National Institute of laser and Endoscopic surgery and aakar IVF Center, Mumbai e referral center in India. This study was done over a period of 14 years. Women varied in age from 23 to 51 years old and infertility of at least more than 3 years. The woman had fibroids from 1 to 17 in number and 2 cm to 18 cm in size were either submucous, intramural, serosal, cervical or broad ligament. The pregnancy rate after removal of fibroids with active fertility treatment was 42% and in donor oocyte IVF was 50%, abortion rate 5%, 64% LSCS and 31% vaginal delivery. There was no scar rupture in all pregnancies post laparoscopic myomectomy.

Kucera E et al.⁹ in their report analyzed 69 patients after Laparoscopic Myomectomy. The conception rate after Laparoscopic Myomectomy was 56.5%. There was no uterine rupture after Laparoscopic Myomectomy in their group. The cesarean section was rate 44.8%. The appropriate surgical management of uterine scar is mandatory. Skilled reproductive surgeon must perform this operation.

Paul PG et al.¹⁰ reported that uterine rupture during pregnancies following laparoscopic myomectomy is rare following single-layer myometrial closure. Of the 217 women followed up, 115 had pregnancies subsequent to a laparoscopic myomectomy. Of 141 pregnancies, there were 87 Caesarean sections, 19 vaginal deliveries, 29 abortions and 6 ectopic pregnancies. There were no incidents of uterine scar rupture in any of these pregnancies.

Seracchioli R et al.¹¹ reported that of the 514 women followed up, 158 pregnancies were achieved. Only 27 patients (25.5%) had vaginal deliveries, whereas 79 (74.5%) underwent cesarean section. No instances of uterine rupture were recorded. Their preliminary results confirmed that Laparoscopic Myomectomy, performed by an expert

surgeon, could restore reproductive capacity, allowing patients to have a successful pregnancy.

Campo S et al.¹² analyzed that myomectomy significantly improves pregnancy outcome in patients with subserous or intramural fibroids, probably removing a plausible cause of altered uterine contractility or blood supply. Out of 128 patients submitted to myomectomy, we considered eligible for this study only the 41 patients wishing to conceive after surgery and who did not present any plausible infertility factor, apart from the removed myomas. Their results suggest that the main determinants of pregnancy rate after surgery are patient age, diameter and intramural localization of the myomas and type of surgery.

Soriano D et al.¹³ found that of 106 infertile women with uterine leiomyomas, of whom 88 women underwent laparoscopic myomectomy and 18 laparoconversion. No difference in the pregnancy rate was noted between the laparoscopic and laparoconversion groups (48 and 56%, respectively). There was no difference between the two groups as regards the rates of pregnancy-related complications and vaginal delivery. No uterine rupture occurred. They concluded that laparoscopic myomectomy is feasible and safe, and should be considered for infertile women with uterine fibroids. Fertility and pregnancy outcomes following laparoscopic myomectomy are comparable with those following myomectomy after laparoconversion.

Landi S et al.¹⁴ described that of 72 women were pregnant at least once after laparoscopic myomectomy. 31 women had vaginal delivery at term and 26 were delivered by cesarean section. No case of uterine rupture or dehiscence occurred.

Stringer NH et al.¹⁵ found that Laparoscopic suturing of the endometrial cavity in three layers does not prevent future pregnancies, and pregnancies can progress to term and in some cases be delivered vaginally without dehiscence.

Seracchioli R. et al.¹⁶: The purpose of this study was to compare, in infertile patients, the efficacy of laparoscopic myomectomy versus abdominal myomectomy, in restoring fertility and to evaluate the obstetric outcome. They were analyzed 131 patients with anamnesis of infertility, underwent because of the presence of at least one large myoma (diameter ≥ 5 cm) Patients were randomly selected for treatment by laparotomy (n=65) or laparoscopy (n=66) No significant differences were found between the two groups as concerns pregnancy rate (55,9% after laparotomy, 53,6% after laparoscopy). Caesarian section (77,8% versus 65%). No case of uterine rupture during pregnancy or labour was observed.

Dubuisson JB et al.¹⁷ found that 98 patients became pregnant at least once after Laparoscopic Myomectomy, giving a total of 145 pregnancies. Among the 100 patients who had delivery, there were 3 cases of spontaneous uterine rupture. Because only one of these uterine ruptures occurred on the Laparoscopic Myomectomy scar, the risk of uterine rupture was 1.0% (95% CI 0.0-5. 5%). Seventy-two patients (72.0%) had trials of labour. Of these, 58 (80.6%) were delivered vaginally. There was no uterine rupture during the trials of labour. Spontaneous uterine rupture seems to be rare after LM. When performing LM, particular care must be given to the uterine closure.

Seinera et al.¹⁸ described that the pregnancy outcome of 54 patients submitted to laparoscopic myomectomy at their Institution and prospectively followed during subsequent pregnancies. A total of 202 pregnancies occurred in 54 patients who became pregnant following surgery. No cases of uterine rupture occurred. A Caesarean section

was performed in 45 cases. In terms of the safety of laparoscopic myomectomy in patients who become pregnant following surgery, their results were encouraging. They suggested that further studies are needed to provide reliable data on the risk factors and the true incidence of uterine rupture.

Nezhat CH et al.¹⁹ analyzed that of the 115 women, there were 42 pregnancies in 31 patients. Two women were lost to follow-up. Of the remaining 40 pregnancies, 6 ended with vaginal delivery at term. Caesareans were performed in 22 cases, including 21 at term and one at 26 weeks gestation. Two pregnancies were associated with a normal delivery, but the mode of delivery is unknown. Spontaneous uterine rupture was not noted during pregnancy or at term in any of the cases. Our series did not confirm the hypothesis that laparoscopic myomectomy is associated with an increased risk for uterine dehiscence during pregnancy.

Ribeiro SC et al.²⁰: Laparoscopic myomectomy can be offered to patients who want to have children and who refuse to undergo an abdominal myomectomy. Patient selection as well as meticulous surgical technique is the key factors in achieving a successful outcome.

Arcangeli & Pasquarrette²¹: Electrosurgery was used to remove the myoma and obtain haemostasis in 5 out of 6 reported uterine ruptures. In 1 case the uterus ruptured at 26 weeks following laparoscopic myolysis of a 3 cm intramural myoma.

Elkis et al.²², **Nezhat et al.**²³: One possible cause of uterine rupture after laparoscopic myomectomy is the wide use of electrosurgery which may result in poor vascularization and tissue necrosis with an adverse effect on scar strength.

Dubuisson JB et al.²⁴ reported 21 infertile patients who underwent laparoscopic myomectomy. The overall rate of intrauterine pregnancy after laparoscopic myomectomy, was 33.3% (7 patients). In the 4 patients who gave birth by Caesarean section, no adhesions were found on the myomectomy scar. From these preliminary results, laparoscopic surgery for myomas seems to offer comparable results with those obtained by laparotomy. No uterine rupture was observed.

Darai E et al.²⁵ reported that of 19 pregnancies were obtained in 17 patients after laparoscopic myomectomy (38.6%): 8 vaginal deliveries, 3 Caesarean sections. No uterine rupture was noted. Their preliminary results indicate that laparoscopic myomectomy is a useful technique.

Discussion

There are obviously a number of post laparoscopic myomectomy complications like fistula formation and adhesions but the most dreaded one is uterine rupture. This is a serious catastrophic situation which may result into death of the expectant mother and her infant at one extreme or morbidity to the same. It may present in the form of full thickness separation or dehiscence which ever situation this is an undesirable outcome of a pregnancy even in conditions where the uterus is native. Only a few sporadic cases of uterine rupture following laparoscopy myomectomy have been reported so far and since the first case was reported laparoscopists have been on the alert and especially where the issue of spontaneous rupture was brought into their attention. Some procedures to evaluate the scar integrity following laparoscopic myomectomy have been advocated including Doppler ultrasonography, hysterosalpingography and even second look laparoscopy and some of these procedures are rather too invasive and their benefits remains questionable.

Both doctors and patients are caught unawares when rupture occurs before labour since the risks to the patients are higher as this may occur outside of the hospital context where immediate intervention may not be available. The actual magnitude may not be clear as only a few authors have tried to look into the extent of the problem from some sporadic reported cases and only Dubuisson et al.²⁴ compares two myomectomy approaches statistically.²⁴ One of the difficulties lies in the choice of the incision. The standard option is a vertical incision into the uterus.²⁶

However, given the fact that the arteries and arterioles of the myometrium run almost transversely and not vertically,^{27,28} it seems more logical to make a transverse incision. This type of incision enables blood loss to be reduced, especially when the intramural myoma is deep and richly vascularized. But a resented and attractive method to reduce blood loss by temporary clipping of uterine and infundibular vessels may be a good option if this has a useful value to the integrity of scar.²⁹

The type of incisions whether vertical or transverse may be executed more conveniently from the port positions or even by the experience and discretion of the operating surgeon. All these are reasonable procedural considerations which also deserve ergonomic considerations as well, but the long term effects with respect to the myomectomy scar integrity are important too. It is important to consider one basic surgical philosophy as pronounced by prof. Cohen that the surgeons must work in harmony with the body's anatomy and physiology. Which of the two incisions obey this philosophy? Single layer closure¹⁰ or multilayer closure^{5,30} of the myomectomy wound has also been an area of great controversy.

Some authors have showed that single layer or multilayer closure may or may not be associated with uterine rupture., But it must sound logical to say that for large intramural myoma single layer closure may be difficult to approximate the tissues adequately thus leading to scar weakness and pose risk to subsequent rupture. Another possible cause of uterine rupture after laparoscopic myomectomy is the wide use of electrosurgery that may result in poor vascularization and tissue necrosis with an adverse effect on scar strength.²³

Although there are case studies that show that when using this surgical modality there is an increased risk, it is still frequently employed to control bleeding in the pedunculated and subserous myomas.

Conclusion

Uterine rupture following laparoscopic myomectomy is real but rare. There are few areas surrounding this subject that need review and re-evaluation. The actual magnitude of the uterine rupture following laparoscopic myomectomy needs to be dealt with more aggressively to justify the worries that have intrigued the surgeons for about twenty years since its first inception. It is even possible that the incidences are under reported. There are no enough evidence to compare transverse versus vertical incisions regarding the integrity of the scar. There is equally no enough evidence to compare single versus multiple closure with regard to scar integrity. Large control studies are required to resolved this conflicting views. Electrocoagulation, though very useful in the control of bleeding must be used as sparingly as possible to achieve haemostasis of the edges after myomectomy. This is necessary to avoid necrosis of the myometrium as it is possible according the principle "less necrosis of the myometrium better postoperative scar results". But it is obvious that laparoscopic myomectomy in carefully selected patients has revolutionized the approach to myomectomy and

the benefits to patients are unquestionable. The era of “mutilation” in carefully selected patients by skilled and experience surgeons should be written as past history.

Acknowledgments

None.

Conflicts of interest

None.

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