



Laparoscopic inguinal ligament suspension: a novel procedure to repair uterine prolapse

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Abstract

Introduction and hypothesis Traditionally, surgical treatment for uterine prolapse has included hysterectomy. However, more patients now prefer a uterine-preserving operation because of concerns about fertility or sexual dysfunction. In this video, we describe a novel approach to correcting uterine prolapse in an attempt to demonstrate an alternative option for patients.

Methods A 42-year-old woman with symptomatic stage I-IV uterine prolapse (POP-Q: Aa +2, Ba +2, C +3, gh 6.5, pb 3, TVL 8.5, Ap 0, Bp 0, D 0) underwent inguinal ligament suspension. The principle steps and techniques to complete the operation are outlined in the video.

Results Prolapse repair was successfully completed without any intraoperative complications. The uterus was restored to its anatomic position. During the 12-month follow-up, neither recurrence nor postoperative complications, such as mesh exposure, de novo incontinence or bowel obstruction, etc., occurred.

Conclusions Laparoscopic inguinal ligament suspension is a safe and feasible alternative for correcting the uterine prolapse. This surgery could be an attractive choice for patients who prefer a uterine-sparing surgery.

Keywords Inguinal ligament suspension · Laparoscopic route · Pelvic organ prolapse · Uterine prolapse · Uterine-sparing surgery

Aim of the video

Here we demonstrate the principle steps of laparoscopic inguinal ligament suspension, a novel uterine-preserving procedure, aiming to introduce a feasible, effective and less invasive procedure for uterine prolapse patients.

Zhiyuan Dai and Hui Li contributed equally to this work.

Electronic supplementary material The online version of this article (<https://doi.org/10.1007/s00192-018-3780-6>) contains supplementary material. This video is also available to watch on <http://link.springer.com/>. Please search for this article by the article title or DOI number, and on the article page click on ‘Supplementary Material.’

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Methods

The featured patient in the video is a 42-year-old multiparous woman with 3 years of symptomatic apical prolapse. Her physical examination revealed anterior stage III, uterine stage III and posterior stage II prolapse (POP-Q: Aa +2, Ba +2, C +3, gh 6.5, pb 3, TVL 8.5, Ap 0, Bp 0, D 0). The preoperative pelvic ultrasound and PAP smear were normal. The patient desired surgical management of POP with uterine preservation.

After detailed counseling, she chose to undergo the laparoscopic inguinal ligament suspension. The alternatives offered in our institution include laparoscopic sacrohysteropexy, sacrospinous ligament fixation, uterosacral ligament suspension and anterior pelvic floor reconstruction. We informed her about the novelty of the procedure and obtained informed consent.

The surgery is performed under general anesthesia, with the patient in a lithotomy position. A urethral catheter is inserted, and a uterine manipulator is used to facilitate anatomical exposure. First, the pneumoperitoneum is created, and then four laparoscopic ports are placed: one 12-mm umbilical port for the laparoscope, two 5-mm ports in the bilateral lower

quadrants and one 5-mm port lateral to the rectus muscle at 2–3 cm above the umbilicus.

The video outlines the principle steps and techniques necessary to complete the operation.

1. Open peritoneum along the anterior uterocervical junction. Push the bladder away and bluntly dissect a space (approximately $5 \times 4 \text{ cm}^2$) on the vesicovaginal septum.
Next, a dissection of the same size is made on the rectovaginal septum.
2. Open the broad ligament at the level of the uterocervical junction through the avascular area. A folded suture line passing through the opening is prepared for carrying mesh through the broad ligament.
3. A mesh is cut into two T-shaped pieces of the same size (approximately $5 \times 2 \text{ cm}$ for the mesh arms, $12 \times 2 \text{ cm}$ for the mesh leg). Women who presented with anterior vaginal wall prolapse (cystocele) or posterior vaginal wall prolapse (rectocele) are recommended to receive longer mesh arms.
4. One arm of the mesh is placed into the vesicovaginal space and sutured to the anterior vaginal wall with 2-0 non-absorbable sutures. Three to four sutures are made in total.
It is critical to place the sutures carefully, because transmucosal fixation will increase the risk of mesh exposure.
5. Another arm of the mesh is pulled through the opening of the broad ligament guided by the prepared suture line. The arm is then placed into the rectovaginal space and fixed on the posterior vaginal wall. Similarly, three to four sutures are made.
6. At the starting point of the round ligament on the uterus, a small window is opened on the broad ligament. Through

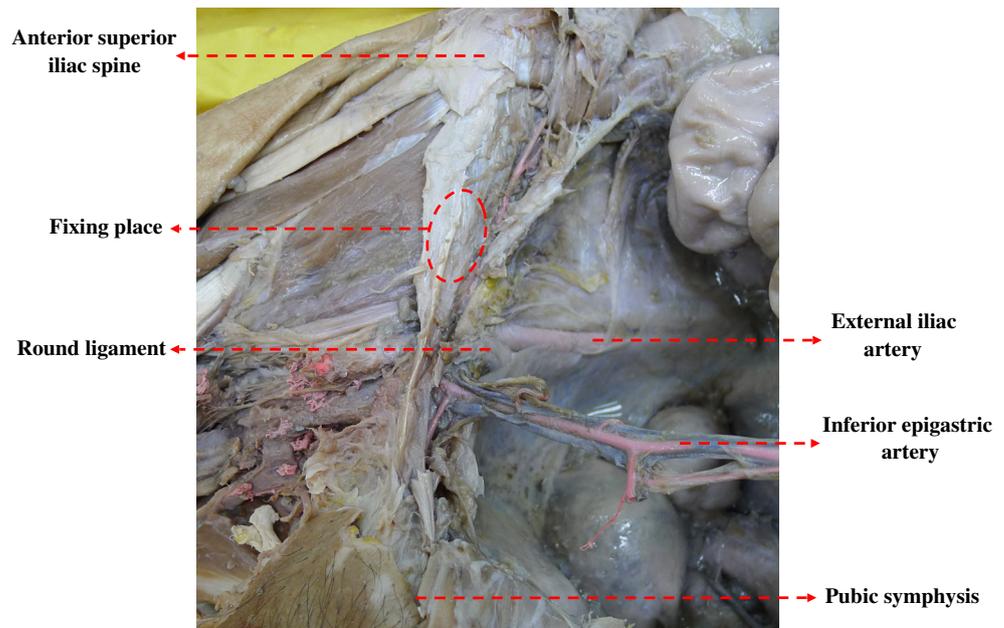
the window, the mesh leg is pulled up and fixed on the round ligament using one non-absorbable suture.

7. Identify the deep ring of the canalis inguinalis. This place can be confirmed inside the abdominal cavity by pressing the groin 3–4 cm away from the anterior superior iliac spine (Fig. 1).
8. Open the peritoneum at the deep ring. Pull out the mesh leg along with the round ligament. Therefore, the whole mesh is in a “ \perp ” position, with two arms fixing on the anterior and posterior vaginal walls respectively and a leg hanging along the round ligament.
9. The same operations are performed on the right side of the uterus.
10. Adjust the balance of the uterus. Cut excessive mesh tips, and anchor mesh legs on the inguinal ligaments in a tension-free manner by using non-absorbable 2-0 sutures.
11. Close the peritoneum with a continuous running suture using a 2-0 absorbable suture line. The whole mesh is peritonized to avoid adhesion with or extrusion to the bowel.

Results

The procedure was successfully completed with a total operative time of 130 min and estimated blood loss of 60 ml. The patient's pelvic floor prolapses, including the anterior, uterus and posterior prolapse, were all corrected (postoperative POP-Q: Aa -3, Ba -3, C -7.5, gh 4.5, pb 3, TVL 9.5, Ap -3, Bp -3, D -9.5). No surgical complications were observed. On postoperative day 4, the patient was discharged home. During the next 12 months of follow-up, neither recurrence nor complications of mesh exposure, de novo incontinence, bowel obstruction, etc., occurred.

Fig. 1 The anatomy of the right inguinal region. the mesh is fixed on the inguinal ligament, and the fixing point is near the internal inguinal ring (a place that the round ligament enters into the inguinal canal). The inguinal ligament here is not only far away from the femoral vessels, but also stable enough to sustain heavy pressure, which makes it an ideal place for uterine suspension



Discussion

Abdominal sacrohysteropexy has been regarded as the gold standard for treating apical prolapse. As described, the two leaves of a modified Y-shaped mesh are sutured to reinforce the anterior and posterior walls of the uterus, with the load-bearing part of the mesh fixed on the anterior longitudinal ligament of the sacrum [1]. Nevertheless, many blood vessels and nerves are distributed in the presacral region, for example, the right common iliac vein, presacral venous plexus, right hypogastric nerve and sacral portion of the sympathetic trunk. Once the vessels have been damaged, massive bleeding occurs during the operation. Meanwhile, the dysfunction of the pelvic viscera will appear postoperatively if there has been damage to the nerves. Thus, the high risks of vascular and nerve injuries have limited their usage, especially among unexperienced surgeons. However, the present inguinal ligament suspension successfully avoids dangerous areas. During the surgery, mesh is pulled up and fixed on the inguinal ligament. Anatomically, the fixing place is far away from both the external iliac vessels and inferior epigastric vessels. In addition, the weak areas of the abdominal wall such as the inguinal triangle and deep inguinal ring are undamaged, so the surgery does not add the risk of inguinal hernias. Actually, the mesh covers a part of the deep inguinal ring. It might work as a barrier to prevent the protrusion of abdominal contents. From this point of view, the surgery probably prevents the occurrence of indirect inguinal hernia. Therefore, the present procedure is safer and more feasible.

Up to now, several places have been described for suspending the prolapsed uterus. For example, the uterosacral ligament in uterosacral hysteropexy, sacrospinous ligament in sacrospinous hysteropexy, and anterior longitudinal ligament in sacral hysteropexy [2, 3]. In those surgeries, the uterus is fixed in a deflected position as it is pulled to the right or left side in the pelvis. In a previous report, bilateral anterior abdominal walls were used for transfixing a prolapsed uterus [4]. However, both muscles and fascia on the abdominal wall are elastic. So whether the place is tough enough to suspend a prolapsed uterus is doubtful. In one study, a T-shaped mesh was placed in the vesicovaginal septum and suspended bilaterally to the abdominal wall. This technique has the advantage of preserving the uterus, but it can only treat the anterior and apical compartment prolapse [5]. In the present procedure, the prolapsed uterus is hung to the bilateral inguinal ligaments. Theoretically, the uterus is pulled up, forward and laterally.

Therefore, the natural anatomic position of the uterus is restored. Furthermore, previous surgeries that used mesh as a supporting material were likely to encircle the whole anterior or posterior part of the uterus. As a result, the uterus is tightly strapped up. Those procedures might be not be suitable for young patients who have a birth plan in the future. To make an improvement, we cut the mesh arms into slim pieces. Therefore, enough gaps are left on the uterus. Once a patient becomes

pregnant after the surgery, the circulated mesh gives enough space for the enlarged uterus in the first trimester of pregnancy.

In the video, we mentioned several tips about the operation. First, instead of opening a long way to cover the mesh, we pull it through small windows on the peritoneum. This modification helps to reduce the operative time and also decrease the incidence of postoperative pelvic adhesion. Second, a folded suture line is used to guide the mesh through the broad ligament. This method not only minimizes the dissection of the ligament, but also makes pulling the mesh easier. Third, the depth of dissection on the vesicovaginal or rectovaginal space is about 5 cm. Women with concomitant cystocele or rectocele are recommended to have a deeper dissection. It should reach the lowest point close to the pelvic floor muscles or perineal body. The point was confirmed in surgery by measuring its distance from the hymen (2–3 cm) through transvaginal examination. Thus, the mesh could reach the Aa and Ba points (as the POP-Q score) on the vaginal wall. In this way, both cystocele and rectocele can be corrected after the surgery. In addition, we recommend three to four sutures to the mesh on the vaginal wall, as we speculate that fewer sutures might be associated with a short prolapse recurrence time.

We first performed inguinal ligament suspension in 2013. By now, more than 20 patients have undergone the operation. Although no complications have been observed so far, long-term follow-up should be continued to evaluate the efficacy of the procedure. In addition, none of those patients has tried to get pregnant after surgery. So data about the surgery's influence on fertility are still lacking. To make a comprehensive assessment of the procedure, further studies are ongoing at our institution.

Conclusion

Laparoscopic inguinal ligament suspension provides a feasible and less invasive procedure for correcting uterine prolapse. It restores the natural anatomical position of the uterus and has been proved a safe and effective procedure in our short-term observation. This surgery could be an attractive choice for patients who prefer a uterine-sparing surgery.

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Compliance with ethical standards

Conflicts of interest None.

Consent Written informed consent was obtained from the patient for publication of this case report and any accompanying images.

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