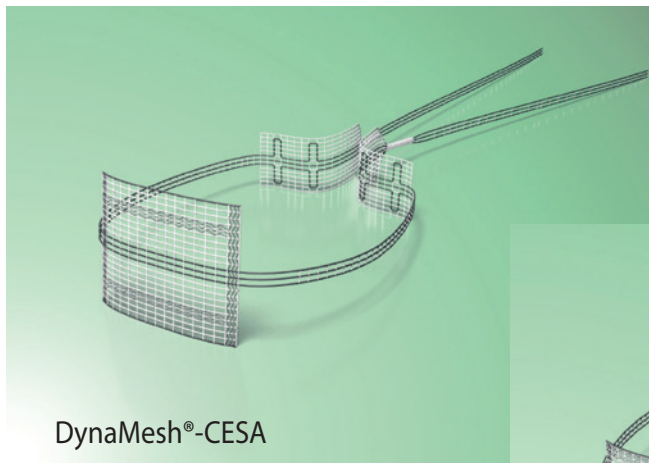


**Dr. med. Sebastian Ludwig**



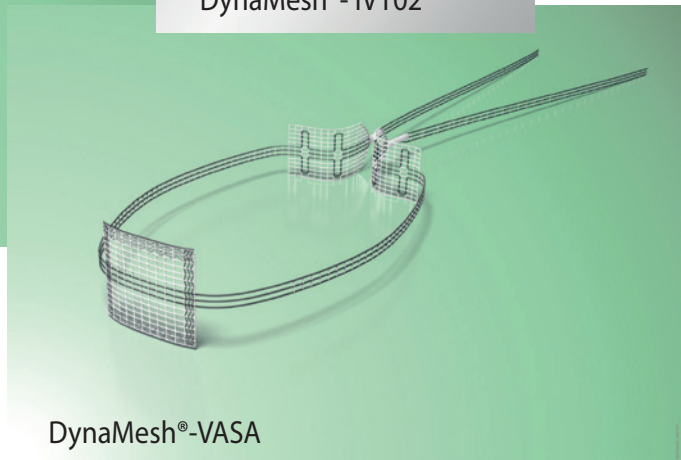
**Bilateral Apical Fixation  
Laparoscopic Surgical Procedure  
Cervico-Sacropexy (IaCESA)  
Vagino-Sacropexy (IaVASA)  
Utero-Sacropexy (IaUSA)**



DynaMesh®-CESA



DynaMesh®- IVT02



DynaMesh®-VASA

**Restoration of the apical attachment of the cervical or vaginal stump  
and of the entire uterus in cases of pelvic organ prolapse,  
with and without accompanying urinary incontinence in women**

## Introduction

A prolapse of the female pelvic organs, i.e. of the uterus or the vaginal stump (following a hysterectomy) as well as the anterior and posterior vaginal wall, becomes more prevalent with advancing age. Such a uterine or vaginal prolapse often appears accompanied by urinary incontinence and is one of the most common functional impairments of the female pelvic floor. With a prevalence of between 10% and 30%, a uterine or vaginal prolapse represents an increasingly common medical condition.

Accordingly, there is a broad spectrum of surgical therapy options, ranging from purely vaginal, to abdominal and minimally invasive interventions. What is common to many procedures, especially apical prolapse surgeries, is that aside from actual correction of the prolapse, they also have a positive effect on urinary incontinence. According to the anatomical hypotheses of Ulmsten, Petros and DeLancey, this positive effect (on urinary incontinence) is attributable to, among other things, a weakness or ultimately a prolapse of the anterior vaginal wall at the vesicoureteral junction.

Sacrocolpopexies constitute the surgical gold standard for prolapses. Until now, the effect of the particular surgical technique on urinary incontinence could only be reproduced partially or with difficulty. This is partly due to a *lack of standardisation*, which hinders surgical reproducibility of the respective surgical technique. Furthermore, many of these apical fixations using synthetic materials depend greatly on the decisions of the surgeon:

- what material will be used (polypropylene or polyvinyl fluoride)?
- what form or structure does it exhibit (mesh, tape, "multi-armed", Y-shaped structure, etc.)?
- to which anatomical structure will it be fixated (anterior or posterior vaginal wall, vaginal stump, cervix, pectineal ligament, sacrospinous ligaments, sacrum at level S1 or S3)?
- will apical fixation be unilateral or bilateral (i.e. left and/or right in the lesser pelvis)?
- to what extent will the vaginal apex be tensioned (length of the implanted meshes or tapes)?

In order to achieve better reproducibility and thus better comparability of the clinical outcomes, Jäger et al. developed a standardised surgical technique for apical reconstruction. The special aspect of this newly developed surgical technique is, first of all, the standardisation of each individual surgical step in terms of anatomical preparation, fixation points, shape and structure (i.e. length and width) of the material used. The fact that the inner osseous pelvic dimensions only differ slightly among women of different ethnicities permitted the standardisation of this surgical technique. The almost uniform, only slightly osseous pelvic dimensions are sufficiently well known from the field of obstetrics (conjugata vera or obstetrica, etc.). During the so-called cervico-sacropexy (CESA) and vagino-sacropexy (VASA), both uterosacral ligaments are reconstructed along their original course, depending on whether the cervix is present. For this purpose, a polyvinylidene difluoride (PVDF) tape measuring 8.8 cm or 9.3 cm in length (depending on whether the cervix is present) and only 0.4 cm in width is placed along the course of the right and left uterosacral ligaments, i.e. on both sides in the lesser pelvis between the vaginal apex (either cervix or vaginal stump) and sacrum (at S1 level). CESA / VASA is distinguished from previously established surgical techniques through its



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Senior Physician  
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bilateral, apical attachment with predefined “tensioning”, which is achieved through the specified length of the tapes used. Only a minimum of synthetic material is used, and no polypropylene. Polyvinylidene difluoride (PVDF) is especially well suited for use with CESA / VASA thanks to its outstanding material properties. PVDF implants exhibit good biocompatibility and significantly less granuloma formation (scar tissue). Thus, the risk of adverse foreign body reactions is minimised. The good resistance to ageing of the PVDF polymer is also important to achieving a good long-term outcome (see page 20 ff).

Originally, the CESA / VASA surgical procedure was developed as an open abdominal technique with transverse laparotomy. Our colleagues Joukhadar (University of Saarland, Homburg) and Rexhepi (Eichstätt Clinic) presented the initial concepts for laparoscopic CESA / VASA surgical procedures, back in 2015.

Thanks to standardisation, we were able to implement this technique in a minimally invasive laparoscopic procedure, and further develop it, here at the Department of Obstetrics and Gynaecology of the University of Cologne. With the so-called laCESA / laVASA, we are using for the first time a curved instrument (DynaMesh®-IVT02) that was developed by our colleague Morgenstern (Department of Obstetrics and Gynaecology at the University of Cologne). With this instrument, both uterosacral ligaments can be accurately reconstructed while preserving the peritoneum. Our colleague Bettin (Department of Obstetrics and Gynaecology, Höxter) presented a simplified tunnelling of the sigmoid colon for the laCESA / laVASA surgical procedure, at the 9th German Urogynecology Congress 2017 in Stuttgart. Thanks to these useful further developments, both uterosacral ligaments can also be safely implanted laparoscopically while protecting anatomical structures (such as the large intestine, iliac vessels and ureters). Added to this are the general advantages of laparoscopy as compared to laparotomy: reduced surgery time (possibly even under an hour), smaller wound area, shorter inpatient hospital stays, and faster convalescence.

In 2016, we presented a laparoscopic CESA in a live surgery at the 41st Annual Meeting of the International Urogynecological Association (IUGA) in Cape Town, South Africa. In 2017, the laCESA / laVASA surgical procedure was awarded the first Poster Prize at the 8th Forum Operative Gynaecology (FOG) Conference. In 2018, the “URGE 1 study” (randomised comparison of Solifenacin and CESA / VASA in the treatment of urinary urge incontinence) won the Science Prize at the 62nd Annual Conference of the German Society of Gynaecology and Obstetrics (DGGG) in Berlin.

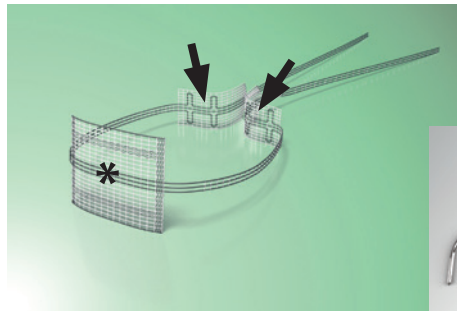
In the following, the individual, standardised surgical steps for laparoscopic cervico-sacropexy (laCESA) and vagino-sacropexy (laVASA) will be described in detail. Furthermore, a uterus-preserving laparoscopic utero-sacropexy (laUSA) will be presented.



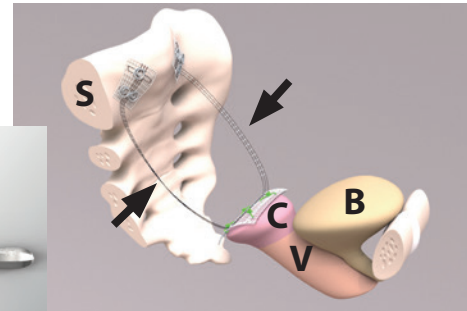
Sincerely, Dr. med. Sebastian Ludwig

## Laparoscopic cervico-sacropexy (laCESA)

– bilateral apical fixation of the cervical stump through replacement of both uterosacral ligaments



Asterisk: middle portion of the PVDF structure for anterior fixation to the cervix  
Arrows: left and right arms of the PVDF structure for posterior fixation to the predefined fixation marking



Arrows: left and right arms of the PVDF structure along the course of the original uterosacral ligaments.

S: Sacrum  
C: Cervix  
V: Vagina  
B: Bladder

### OR video:

DynaMesh®-CESA /-IVT02 - OR video:  
LaCESA - Cervicosacropexy - Bilateral Fixation - Laparoscopy  
<https://youtu.be/287rtiZc7-M>

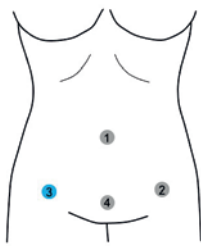


### Materials:

1. Laparoscopic instrument set with needle holder
2. PVDF ligament replacement structure (DynaMesh®-CESA)
3. Tunneller (DynaMesh®-IVT02 instrument)
4. 3 braided, non-absorbable sutures
5. 1 braided, absorbable suture
6. Bullet forceps
7. Optional for posterior fixation of the PVDF tapes: tacks (5 mm titanium helical fasteners, e.g. ProTack™ Fixation Device)

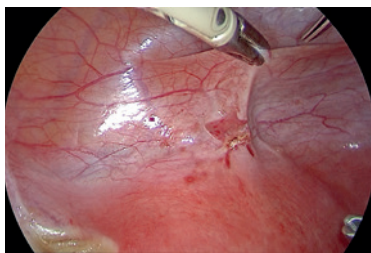
**Surgical steps:**

1. Preparation of the patient. Timely discontinuation of anticoagulants (unless instructed otherwise by a doctor). In certain cases, a bowel evacuation the day prior to surgery should be discussed with the patient. On the day of surgery, the patient should be fasting.
2. Placement of the patient in lithotomy position with shoulder supports and, if needed, on a vacuum mattress. Vaginal examination and attachment of dressing forceps at the cervix, between 9 and 3 o'clock.
3. Start of laparoscopy, creation of the pneumoperitoneum (12 mmHg) through the umbilical stab incision (as per in-house standard).
4. Placement of the 3 working trocars on the distended abdomen: two 5 mm trocars are positioned at the level of the anterior superior iliac spine, each of them 3 fingerbreadths toward medial, left and right; one 10 mm trocar is positioned in the centre, one fingerbreadth above the upper edge of the symphysis.



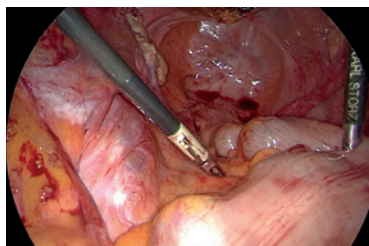
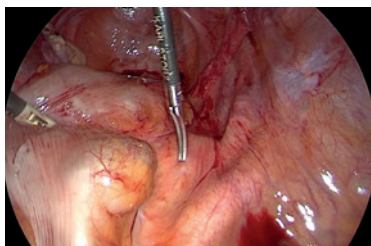
Incision for:

1. Umbilical optical trocar (10 mm)
  2. Working trocar (5 mm) left lower abdomen, with established pneumoperitoneum 3 fingerbreadths medial at the level of the anterior superior iliac spine (lateral to the epigastric vessels)
  3. Working trocar (5 mm) right lower abdomen, with established pneumoperitoneum 3 fingerbreadths medial at the level of the anterior superior iliac spine (lateral to the epigastric vessels) – after removal of the trocar, the tunneller is inserted through the skin incision.
  4. Working trocar (10 mm) 2 cm suprasymphysary, central
5. Trendelenburg position of up to 25 degrees (depending on how much movement the intestine has). Inspection of the lesser pelvis. Identification of the anterior cervix and the bladder peritoneum: at the start of the bladder peritoneum, a marking is made for easier orientation during the supracervical hysterectomy, and to ensure the correct resection margin for the corpus uteri (if present).

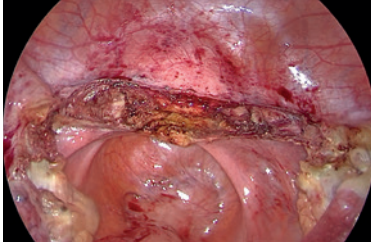


Identification of the posterior cervix and origins of both uterosacral ligaments (USL). The corpus uteri should be severed just above both origins.

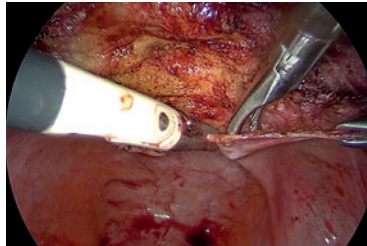
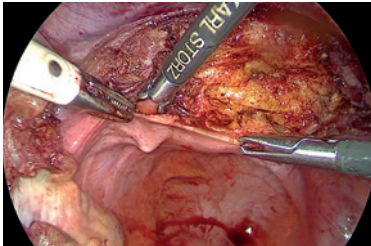
Identification of the sacral promontory, the iliac vessels and both ureters.



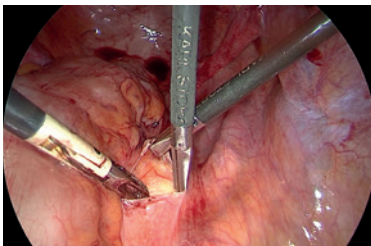
6. Anterior preparation. Supracervical hysterectomy; here, the corpus uteri is severed using monopolar hooks at the start of the bladder peritoneum (and just above the origins of both USLs), at the level of the laterally joining uterine vessels.



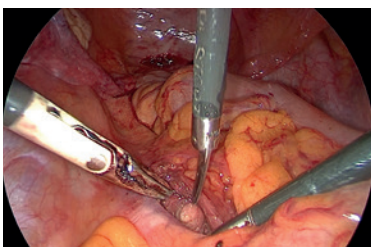
7. Blunt preparation of the peritoneal fold for both USLs paracervically left and right, for approx. 2 cm. This facilitates the tunnelling and thus the later augmentation of both USLs.



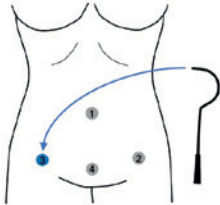
8. Posterior preparation. Lateralisation of the sigmoid colon and mesentery to the left; then opening of the peritoneum over the promontory for 3 cm. Preparation of the prevertebral fascia / right anterior longitudinal ligament at the sacrum at S1 level (on an area of just 1 cm<sup>2</sup>).



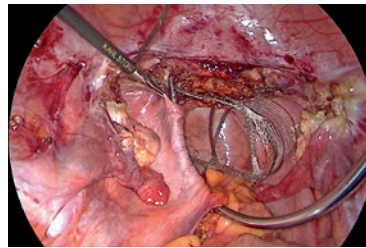
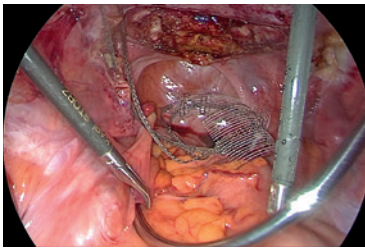
Thereafter, lateralisation of the sigmoid colon and mesentery to the right and exposure of the prevertebral fascia / left anterior longitudinal ligament at the sacrum at S1 level (on an area of just 1 cm<sup>2</sup>).



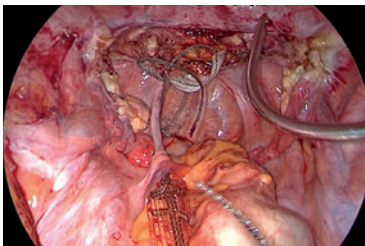
9. Insertion of the PVDF structure (DynaMesh®-CESA, 8.8 cm long, FEG Textiltechnik mbH, Aachen) into the abdominal cavity. Then, the 5 mm trocar on the right is removed and the curved hook (tunneller, DynaMesh®-IVT02 instrument, FEG Textiltechnik, Aachen) is carefully inserted through the skin incision.



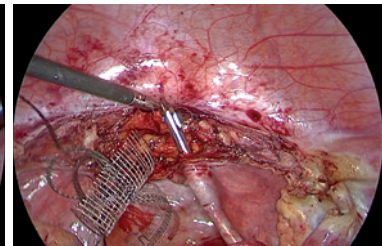
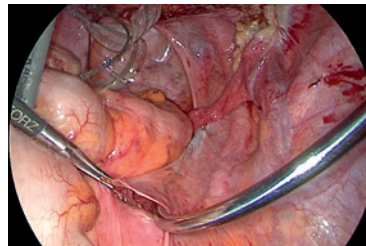
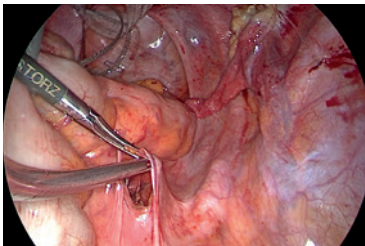
10. Tunnelling of both USLs. The blunt tip of the tunneller is carefully introduced on the left at the sacrum, below the peritoneum (along the original course of the left USL) and carefully advanced toward the cervix until the tip emerges once again paracervically on the left, below the peritoneum.



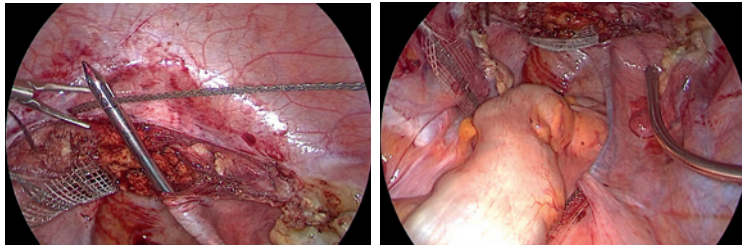
Now the left arm of the PVDF structure can be threaded into the opening at the tip of the tunneller, intended for this purpose, and then carefully retracted. In this manner, the left arm of the PVDF tape is placed along the course of the left USL.



The same procedure is conducted on the right side: the blunt tip of the tunneller is carefully advanced below the peritoneum, from the sacrum toward the cervix, until the tip emerges paracervically on the right.

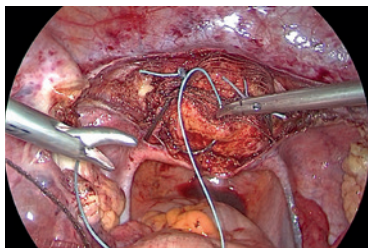


Then, the right arm of the PVDF structure is threaded into the tip, carefully retracted, and thus placed along the course of the right USL.

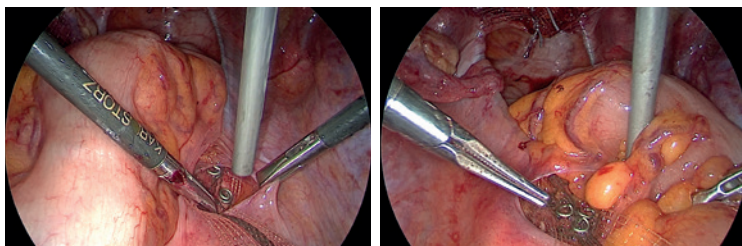


Important: before tunnelling of the two USLs, the iliac vessels and ureters were clearly identified on both sides in order to prevent injury.

11. Anterior fixation. The middle portion of the PVDF structure is now positioned over the cervical stump and is affixed with three non-absorbable, simple interrupted sutures (braided suture material) at 10, 2, and 6 o'clock. A minimum of two and a maximum of four sutures should be used for fixation so that the middle portion of the PVDF structure lies as flat as possible.



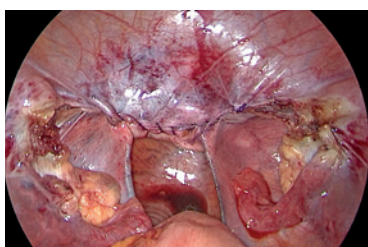
12. Posterior fixation. Both arms of the PVDF structure are affixed on the promontory, left and right, at the markings in the tape provided for this purpose. This can be done using simple interrupted sutures or three titanium helical fasteners on each side.



Next, simple covering of the promontory with peritoneum (suture).

Important: in order for a specific apical "tension" to be present, the tapes must be affixed at the markings provided for this purpose.

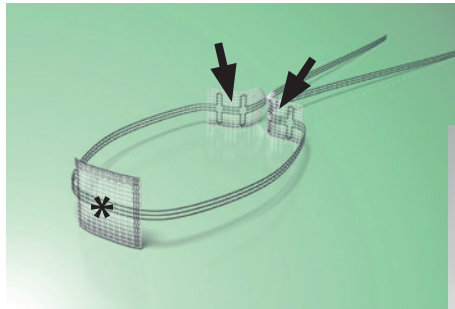
13. Closure of the peritoneum over the cervical stump with absorbable suture.



14. Removal of the corpus uteri by morcellation.
15. By pulling on the cervical stump (bullet forceps placed at the portio), it is possible to check whether parts of the rectum are possibly being constricted.
16. 100 ml of sterile irrigation solution (NaCl) is left intraabdominally for adhesion prophylaxis. Removal of the trocars, closure of incisions, and sterile wound dressing. End of operation.

## Laparoscopic vagino-sacropexy (laVASA)

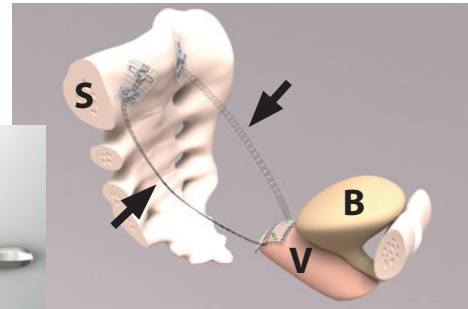
– bilateral apical fixation of the vaginal stump through replacement of both uterosacral ligaments



Asterisk: middle portion of the PVDF structure for anterior fixation to the cervix  
Arrows: left and right arms of the PVDF structure for posterior fixation to the predefined fixation marking



DynaMesh®-IVT02



Arrows: left and right arms of the PVDF structure along the course of the original uterosacral ligaments.

S: Sacrum  
V: Vagina  
B: Bladder

DynaMesh®-VASA /-IVT02 - OR-Video:  
Laparoscopic Bilateral Vaginosacropexy (laVASA) - With Use of  
DynaMesh®-VASA Implant and DynaMesh®-IVT02 Instrument  
(Tunneling Device)

[https://youtu.be/TW\\_z16o-tao](https://youtu.be/TW_z16o-tao)

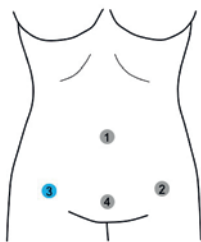


### Materials:

1. Laparoscopic instrument set with needle holder
2. PVDF ligament replacement structure (DynaMesh®-VASA)
3. Tunneller (DynaMesh®-IVT02 instrument)
4. 3 braided, non-absorbable sutures with a size 26 needle
5. 1 braided, absorbable sutures
6. Round vaginal phantom
7. Optional for posterior fixation of the PVDF tapes: tacks (5 mm titanium helical fasteners, e.g. ProTack™ Fixation Device)

**Surgical steps:**

1. Preparation of the patient. Timely discontinuation of anticoagulants (unless instructed otherwise by a doctor). In certain cases, a bowel evacuation the day prior to surgery should be discussed with the patient. On the day of surgery, the patient should be fasting.
2. Placement of the patient in lithotomy position with shoulder supports and, if needed, on a vacuum mattress. Vaginal examination and insertion of a vaginal phantom (for imaging and preparation of the vaginal stump from abdominal access).
3. Start of laparoscopy, creation of the pneumoperitoneum (12 mmHg) through the umbilical stab incision (as per in-house standard).
4. Placement of the 3 working trocars on the distended abdomen: two 5 mm trocars are positioned at the level of the anterior superior iliac spine, each of them 3 fingerbreadths toward medial, left and right; one 10 mm trocar is positioned in the centre, one fingerbreadth above the upper edge of the symphysis.



Incision for:

1. Umbilical optical trocar (10 mm)
  2. Working trocar (5 mm) left lower abdomen, with established pneumoperitoneum 3 fingerbreadths medial at the level of the anterior superior iliac spine (lateral to the epigastric vessels)
  3. Working trocar (5 mm) right lower abdomen, with established pneumoperitoneum 3 fingerbreadths medial at the level of the anterior superior iliac spine (lateral to the epigastric vessels) – after removal of the trocar, the tunneller is inserted through the skin incision.
  4. Working trocar (10 mm) 2 cm suprasymphysary, central
5. Trendelenburg position of up to 25 degrees (depending on how much movement the intestine has). Inspection of the lesser pelvis. Identification of the bridge of scar tissue of the vaginal stump and of the bladder peritoneum (depending on previous surgeries, both adnexal stumps must be followed here from lateral to medial for better identification). Identification of the sacral promontory, the iliac vessels and both ureters.
  6. Anterior preparation. Careful preparation of the bladder peritoneum above the bridge of scar tissue on the vaginal stump.
  7. Blunt preparation of the peritoneal fold of both USLs, left and right on the vaginal stump, for approx. 2 cm. This facilitates the tunnelling and thus the later augmentation of both USLs.
  8. Posterior preparation. Lateralisation of the sigmoid colon and mesentery to the left; then opening of the peritoneum over the promontory for 3 cm. Preparation of the prevertebral fascia / right anterior longitudinal ligament at the sacrum at S1 level (on an area of just 1 cm<sup>2</sup>).  
Thereafter, lateralisation of the sigmoid colon and mesentery to the right and exposure of the prevertebral fascia / left anterior longitudinal ligament at the sacrum at S1 level (on a surface of just 1 cm<sup>2</sup>).
  9. Insertion of the PVDF structure (DynaMesh®-VASA, 9.3 cm long, FEG Textiltechnik mbH, Aachen) into the abdominal cavity. Then, the 5 mm trocar on the right is removed and the curved hook (tunneller, DynaMesh®-IVT02 instrument, FEG Textiltechnik, Aachen) is carefully inserted through the skin incision.

10. Tunnelling of both USLs. The blunt tip of the tunneller is carefully introduced on the left at the sacrum, below the peritoneum (along the original course of the left USL) and carefully advanced toward the vaginal stump until the tip emerges once again to the left of the vaginal stump, below the peritoneum. Now the left arm of the PVDF structure can be threaded into the opening at the tip of the tunneller, intended for this purpose, and then carefully retracted. In this manner, the left arm of the PVDF tape is placed along the course of the left USL.

The same procedure is conducted on the right side: the blunt tip of the tunneller is carefully advanced below the peritoneum, from the sacrum toward the vaginal stump, until the tip emerges to the right of the vaginal stump. Then, the right arm of the PVDF structure is threaded into the tip and is then carefully retracted so that the right arm of the PVDF structure is also placed along the course of the right USL. Important: before tunnelling the two USLs, the iliac vessels and ureters were clearly identified on both sides in order to prevent injury.

11. Anterior fixation. With the aid of the vaginal phantom, the middle portion of the PVDF structure is manoeuvred over the cervical stump and is affixed using three non-absorbable, simple interrupted sutures (braided suture material) at 10, 2, and 6 o'clock.

Important: in order to avoid necrosis at the vaginal stump, these simple interrupted sutures should only be knotted loosely on the vaginal stump.

12. Posterior fixation. Both arms of the PVDF structure are affixed on the promontory, left and right, at the markings in the tape markings provided for this purpose This can be done using simple interrupted sutures or three titanium helical fasteners on each side. Next, simple covering of the promontory with peritoneum (suture). Important: in order for a specific apical "tension" to be present, the tapes must be affixed at the markings provided for this purpose.

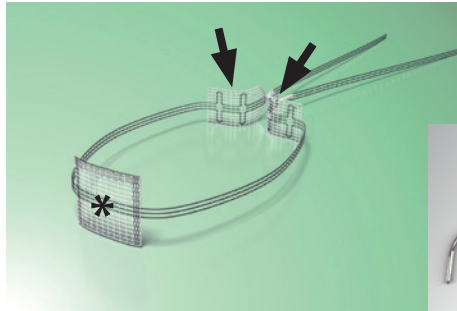
13. Closure of the peritoneum over the cervical stump using absorbable suture material.

14. By pulling on the cervical stump (pressing out the vaginal stump from abdominal), it is possible to check whether parts of the rectum are possibly being constricted.

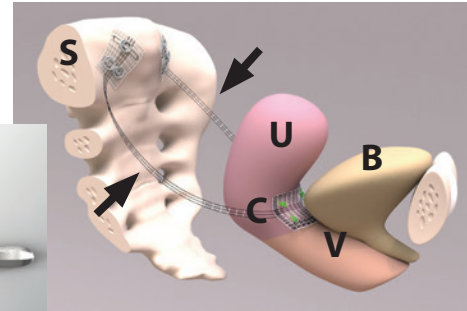
15. 100 ml of sterile irrigation solution (NaCl) is left intraabdominally for adhesion prophylaxis. Removal of the trocars, closure of incisions, and sterile wound dressing. End of operation.

## Laparoscopic utero-sacropexy (laUSA)

– bilateral apical fixation with preservation of the uterus through replacement of both uterosacral ligaments



Asterisk: middle portion of the PVDF structure for anterior fixation to the cervix  
Arrows: left and right arms of the PVDF structure for posterior fixation to the predefined fixation marking



Arrows: left and right arms of the PVDF structure along the course of the original uterosacral ligaments.

S: Sacrum  
C: Cervix  
V: Vagina  
B: Bladder

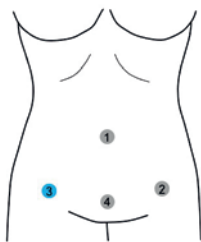
If there is no uterine pathology, the patient should be informed of the option of uterus-preserving surgery. Given the appropriate indication, this uterus-preserving operation should be discussed with the patient. **Special note:** currently, a uterus-preserving sacropexy should only be performed with CESA or VASA PVDF products under study conditions or with a special informed consent ("not intended use").

### Materials:

1. Laparoscopic instrument set with needle holder
2. PVDF ligament replacement structure (DynaMesh®-VASA)
3. Tunneller (DynaMesh®-IVT02 instrument)
4. 3 braided, non-absorbable sutures with a size 26 needle
5. 1 braided, absorbable suture
6. Uterus manipulator or bullet forceps
7. Optional for posterior fixation of the PVDF tapes: tacks (5 mm titanium helical fasteners, e.g. ProTack™ Fixation Device)

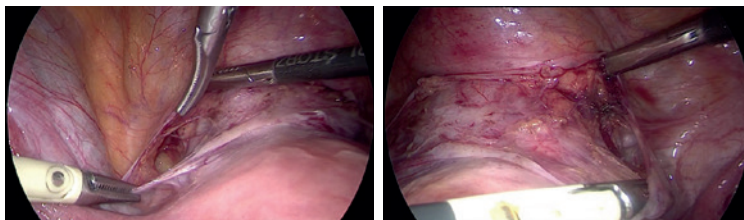
**Surgical steps:**

1. Preparation of the patient. Timely discontinuation of anticoagulants (unless instructed otherwise by a doctor). In certain cases, a bowel evacuation the day prior to surgery should be discussed with the patient. On the day of surgery, the patient should be fasting.
2. Placement of the patient in lithotomy position with shoulder supports and, if needed, on a vacuum mattress. Vaginal examination and careful attachment of the uterus manipulator.
3. Start of laparoscopy, creation of the pneumoperitoneum (12 mmHg) through the umbilical stab incision (as per in-house standard).
4. Placement of the 3 working trocars on the distended abdomen: two 5 mm trocars are positioned at the level of the anterior superior iliac spine, each of them 3 fingerbreadths toward medial, left and right; one 10 mm trocar is positioned in the centre, one fingerbreadth above the upper edge of the symphysis.



Incision for:

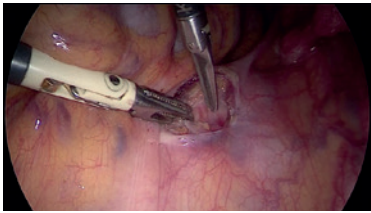
1. Umbilical optical trocar (10 mm)
  2. Working trocar (5 mm) left lower abdomen, with established pneumoperitoneum 3 fingerbreadths medial at the level of the anterior superior iliac spine (lateral to the epigastric vessels)
  3. Working trocar (5 mm) right lower abdomen, with established pneumoperitoneum 3 fingerbreadths medial at the level of the anterior superior iliac spine (lateral to the epigastric vessels) – after removal of the trocar, the tunneller is inserted through the skin incision.
  4. Working trocar (10 mm) 2 cm suprasymphysary, central
5. Trendelenburg position of up to 25 degrees (depending on how much movement the intestine has). Inspection of the lesser pelvis.  
Identification of the anterior cervix and the bladder peritoneum, identification of the posterior cervix and origins of both uterosacral ligaments (USL).  
Identification of the sacral promontory, the iliac vessels and both ureters.
  6. Anterior preparation. Sharp opening of the bladder peritoneum on the anterior cervix for approx. 4 cm. Identification of the laterally joining uterine arteries, as well as of their paracervical bilateral ascending branches.



7. Blunt preparation lateral of the ascending uterine vessels, left and right, in the broad ligament of the uterus. For better orientation, the uterus can be heavily ventralised using the manipulator. This facilitates the tunnelling and thus the later augmentation of both USLs.

8. Posterior preparation. Lateralisation of the sigmoid colon and mesentery to the left; then opening of the peritoneum over the promontory for 3 cm. Preparation of the prevertebral fascia / right anterior longitudinal ligament at the sacrum at S1 level (on an area of just 1 cm<sup>2</sup>).

Thereafter, lateralisation of the sigmoid colon and mesentery to the right and exposure of the prevertebral fascia / left anterior longitudinal ligament at the sacrum at S1 level (on an area of just 1 cm<sup>2</sup>).



9. Insertion of the PVDF structure (DynaMesh®-VASA, FEG Textiltechnik mbH, Aachen) into the abdominal cavity. Then, the 5 mm trocar on the right is removed and the curved hook (tunneller, DynaMesh®-IVT02 instrument, FEG Textiltechnik, Aachen) is carefully inserted through the skin incision.
10. Tunnelling of both USLs. The blunt tip of the tunneller is carefully introduced on the left at the sacrum, below the peritoneum (along the original course of the left USL) and carefully advanced toward the uterus until the tip emerges once again paracervically on the left, below the peritoneum. Now the left arm of the PVDF structure can be threaded into the opening at the tip of the tunneller, intended for this purpose, and then carefully retracted. In this manner, the left arm of the PVDF tape is placed along the course of the left USL.

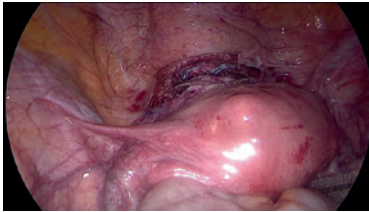


The same procedure is performed on the right side. The blunt tip of the tunneller is carefully advanced below the peritoneum, from the sacrum toward the uterus until the tip emerges paracervically on the right. Then, the right arm of the PVDF structure is threaded into the tip, carefully retracted, and thus placed along the course of the right USL.

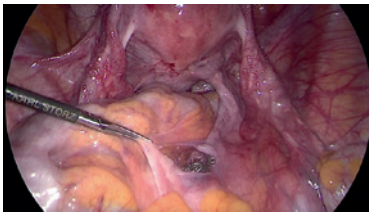
Important: before tunnelling of the two USLs, the iliac vessels and ureters were clearly identified on both sides in order to prevent injury.



11. Anterior fixation. The middle portion of the PVDF structure is now positioned over the anterior cervix and is cross-stitched with two non-absorbable, simple interrupted sutures (braided suture material).



12. Posterior fixation. Both arms of the PVDF structure are affixed on the promontory, left and right, at the markings in the tape markings provided for this purpose. This can be done using simple interrupted sutures or three titanium helical fasteners on each side. Next, simple covering of the promontory with peritoneum (suture). Important: in order for a specific apical "tension" to be present, the tapes must be affixed at the markings provided for this purpose.



13. Closure of the peritoneum over the anterior cervix using absorbable suture material.
14. By pulling on the uterus (using a manipulator), it is possible to check whether parts of the rectum are possibly being constricted.
15. 100 ml of sterile irrigation solution (NaCl) is left intraabdominally for adhesion prophylaxis. Removal of the trocars, closure of incisions, and sterile wound dressing. End of operation.

## Special features

### Periostitis

- Posterior fixation (at the sacrum). The anterior longitudinal ligament is strong, and suitable choices for fixation of the PVDF tape are simple interrupted sutures (braided, non-absorbable suture material) and fixing tacks. It is important to note here that the titanium helical fasteners used (ProTack™ Fixation Device, Covidien, Mansfield, USA) may also penetrate the periosteum and increase the risk of periostitis. To date (since 2015), no such cases have been observed with this surgical technique.
- The peritoneum above the promontory should be closed again using absorbable suture material in order to conceal the posterior fixation spots (titanium helical fasteners).

### Haemorrhaging

- Haemorrhaging during insertion of the PVDF structures along the original course of the USL. Should haemorrhaging occur during insertion of the new tape structure, this most likely originates paracervically. It can be directly verified by applying a direct paracervical clamp and observing whether the haemorrhaging persists. In this case, the peritoneum should be opened more laterally and the relevant vessel coagulated or ligated. Any haemorrhaging in the mesentery/sigmoid colon area will behave similarly.
- Haemorrhaging from the common or internal iliac veins is an improbable event. These are very large vessels that can be well visualised during an operation.
- Sometimes, bleeding occurs in the median sacral artery area. This vessel must then be coagulated, while protecting the hypogastric nerve.

### Prevention of intestinal injuries

The risk of injuries to the small intestine is the same as with surgical laparoscopy in the lesser pelvis. If the sigmoid colon is "tunnelled under" from lateral right in order to replace the left uterosacral ligament, the lumen of the sigmoid colon should always be safely delimited. This works very well if, after introducing the tunneller, you hold the blunt tip on presacral left in order to then position the sigmoid colon toward the contralateral right, such that the blunt tip of the tunneller emerges below the peritoneum. Thus, the tip of the tunneller is indirectly visible and can be carefully advanced along the course of the left uterosacral ligament toward the cervix or vaginal stump, without injuring the left iliac vessels or the left ureter.

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## Awards:

08 / 2016 **Live Surgery:**

Laparoscopic CESA procedure for vault prolapse International Urogynecological Association (IUGA),  
41st Annual Meeting, Cape Town, South Africa

10 / 2018 **Scientific Prize** of the Germany Society for Gynaecology and Obstetrics (DGGG) at the 62nd Annual  
Conference of the DGGG, Berlin.

Title: "URGE 1 Study – Randomised comparison between surgical treatment and drug-based treatment of  
urinary urge incontinence in women"

09 / 2017 **First Poster Prize** at the 8th Forum Operative Gynaecology (FOG) Conference, Berlin.

Title: "Effects of laparoscopic bilateral uterosacral ligament replacement on urinary incontinence  
in patients with POP-Q stage 1 - 4"

06 / 2015 **Science Prize** of the North Rhine-Westphalia Society of Gynaecology and Obstetrics (NWGGG), Cologne.

Title: "The surgical treatment of urinary urge incontinence using cervico-sacropexy (CESA) – A comparison  
of treatment outcomes between the Oberschwaben Clinic Wangen (OSK) and Department of Obstetrics  
and Gynaecology at the University

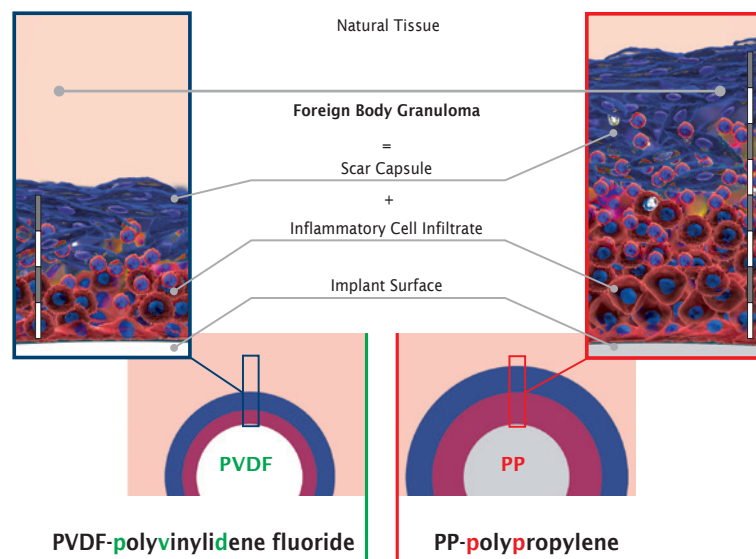
## Material information

### Biocompatibility

PVDF mesh structures have good biocompatibility (assessed according to ISO 10993) and show significantly lower granuloma formation (scar tissue). Therefore, the risk of undesirable foreign body reactions is minimised.

### Cross-Sectional View

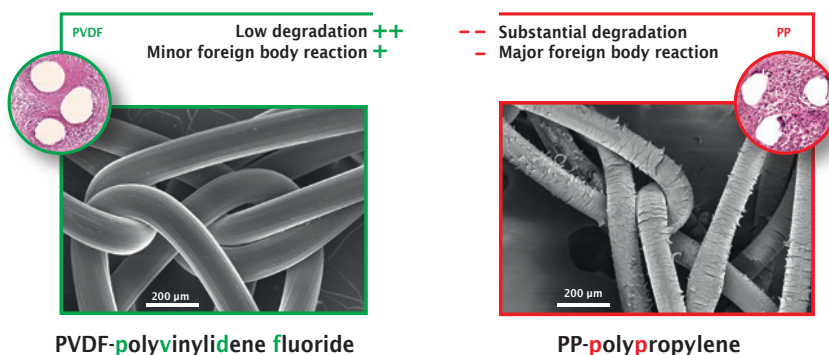
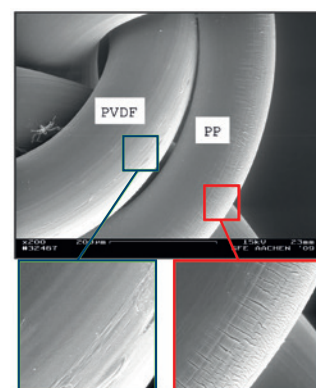
A comparison of different granuloma thicknesses



### Ageing Resistance

PVDF has been used as a surgical suture material for many decades with great success, even in the most demanding areas of application such as ophthalmology and cardiology .

A long-term study over seven years has proven this: The condition of the PVDF surface remains unchanged, filaments are still stable, nothing becomes brittle .



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