



Educational video

## Uterine displacement as fertility sparing technique for pelvic malignancies: Demonstration of the surgical options on a human cadaver

Matteo Pavone<sup>a,b,c</sup>, Lise Lecointre<sup>a,d,e</sup>, Barbara Seeliger<sup>a,b,e,f</sup>, Nicolò Bizzarri<sup>c,\*</sup>, Jacques Marescaux<sup>b</sup>, Giovanni Scambia<sup>c</sup>, Cherif Akladios<sup>d</sup>, Denis Querleu<sup>a,c</sup>

<sup>a</sup> Institut Hospitalo-Universitaire (IHU) Strasbourg, Institute of Image-Guided Surgery, Strasbourg, France

<sup>b</sup> IRCAD, Research Institute against Digestive Cancer (IRCAD) France, Strasbourg, France

<sup>c</sup> UOC Ginecologia Oncologica, Dipartimento di Scienze Della Salute Della Donna, Del Bambino e di Sanità Pubblica, Fondazione Policlinico Universitario A. Gemelli, IRCCS, Rome, Italy

<sup>d</sup> Department of Gynecologic Surgery, University Hospitals of Strasbourg, Strasbourg, France

<sup>e</sup> ICube UMR 7357-Laboratoire des Sciences de l'Ingénieur, de l'Informatique et de l'Imagerie, CNRS, University of Strasbourg, 67000 Strasbourg, France

<sup>f</sup> University Hospitals of Strasbourg, Department of Digestive and Endocrine Surgery, 67000 Strasbourg, France

### ARTICLE INFO

#### Keywords:

Uterine transposition  
Uterine ventrofixation  
Uterine suspension  
Uterine displacement  
Pelvic cancer  
Radiotherapy

### ABSTRACT

Preservation of fertility without compromising oncological outcomes is a major objective in young patients at the time of cancer treatment (Azaïs et al., 2018; Bizzarri et al., 2022). Radio(chemo)therapy is often required in pelvic malignancies (anus, rectum, sarcoma). Direct irradiation results in a damage to ovarian (Bizzarri et al., 2023) and endometrial function (Lohynska et al., 2021), compromising the fertility of female patients of reproductive age. While ovarian transposition is an established method to move the ovaries away from the radiation field (Morice et al., 2022; Pavone et al., 2023), corresponding surgical procedures displacing the uterus are investigational (Pavone et al., 2023; Querleu et al., 2010; Ribeiro et al., 2017, 2024). In a human female cadaver model, the reported laparoscopic techniques of uterine displacement were carried out to demonstrate their feasibility and the step-by-step surgical techniques. The surgeries were performed in a hybrid operating room which enables to perform CT-scan and evaluate the uterine positions according to anatomical landmarks. The following procedures were performed in the same cadaveric model and were described in the video: 1. Uterine suspension of the round ligaments to the abdominal wall 2. Uterine ventrofixation of the fundus at the level of the umbilical line 3. Uterine transposition according to the technique reported by Ribeiro et al. All procedures were completed without technical complications. All of these uterine displacement procedures are technically feasible. Uterine transposition is the most technically complex procedure, and its effectiveness in protecting the endometrium should be evaluated in comparison to the simpler techniques (Table 1). Future studies incorporating radiotherapy simulations are needed to define which technique represents the best compromise between surgical complexity and positioning the uterus at a level that receives the lowest possible radiation dose.

\* Corresponding author at: Largo Agostino Gemelli, 8, 00168 Roma RM, Italy.

E-mail address: [nicolo.bizzarri@policlinicogemelli.it](mailto:nicolo.bizzarri@policlinicogemelli.it) (N. Bizzarri).

<https://doi.org/10.1016/j.gore.2024.101436>

Received 26 April 2024; Received in revised form 9 June 2024; Accepted 16 June 2024

Available online 22 June 2024

2352-5789/© 2024 Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

See Table 1.

**Table 1**

Synoptic summary of displacement techniques pro and cons (Ribeiro et al., 2024; Wallace et al., 2003).

	Uterine Round Ligament Suspension	Uterine Ventrofixation	Uterine Transposition
PRO	<ul style="list-style-type: none"> <li>– Low Surgical complexity</li> <li>– Low patient discomfort</li> <li>– No reported perioperative complications</li> </ul>	<ul style="list-style-type: none"> <li>– Intermediate surgical complexity</li> <li>– No reported perioperative complications</li> <li>– One spontaneous pregnancy reported</li> </ul>	<ul style="list-style-type: none"> <li>– Highest distance from the pelvis</li> <li>– Three spontaneous successful pregnancy reported</li> </ul>
CONS	<ul style="list-style-type: none"> <li>– No reported spontaneous pregnancy</li> <li>– Low distance from the radiation field</li> </ul>	<ul style="list-style-type: none"> <li>– Intermediate distance from the radiation field</li> </ul>	<ul style="list-style-type: none"> <li>– Highest surgical complexity</li> <li>– Reported Cervical necrosis/ischemia and same possible complications of hysterectomy</li> </ul>

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Data availability

All data generated or analyzed in this review are included in this article and/or its figures. Further enquiries can be directed to the corresponding author.

#### Acknowledgments

The authors sincerely thank those who donated their bodies to science so that anatomical research could be performed. Results from such research can potentially increase mankind's overall knowledge that can then improve patient care. Therefore, these donors and their families deserve our highest gratitude.

The authors are grateful to Catherine Cers-Meunier for illustrating the surgical procedures.

#### Funding

This work was supported by French state funds managed within the "Plan Investissements d'Avenir" and by the ANR (reference ANR-10-IAHU-02).

#### Authors' contributions

Dr. Matteo Pavone, Dr. Nicolo' Bizzarri and Pr. Denis Querleu contributed to the study design, Dr. Matteo Pavone and Pr. Barbara Seeliger wrote the first draft and edited the video. Dr. Matteo Pavone, Dr. Lise Lecointre and Pr. Denis Querleu performed the surgeries. Pr. Jacques Marescaux, Pr. Giovanni Scambia, Pr. Cherif Akladios and Pr. Denis Querleu were responsible for the critical revision of the manuscript and for important intellectual content. All Authors have read and commented on the previous version of the paper. All Authors approved the final version of the paper before submission.

#### Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.gore.2024.101436>.

#### References

- Azaïs, H., Canova, C.H., Vesale, E., Simon, J.M., Canlorbe, G., Uzan, C., 2018. Laparoscopic uterine fixation to spare fertility before pelvic radiation therapy. *Fertil. Steril.* 110 (5), 974–975.
- Bizzarri, N., Loverro, M., Angeles, M.A., Pedone Anchora, L., Fagotti, A., Fanfani, F., et al., 2022. Laparoscopic ovarian transposition with extraperitonealization of the infundibulopelvic ligament for cervical cancer in ten steps. *Ann. Surg. Oncol.* 29 (9), 5906–5907.
- Bizzarri, N., Pavone, M., Loverro, M., Querleu, D., Fagotti, A., Scambia, G., 2023. Ovarian preservation in gynecologic oncology: current indications and techniques. *Curr. Opin. Oncol.* 35 (5), 401–411.
- Lohynska, R., Jirkovska, M., Novakova-Jiresova, A., Mazana, E., Vambersky, K., Veselsky, T., et al., 2021. Radiotherapy dose limit for uterus fertility sparing in curative chemoradiotherapy for rectal cancer. *Biomed. Pap. Med. Fac. Univ. Palacky Olomouc Czech Repub.* 165 (1), 99–101.
- Morice, P., Maulard, A., Scherier, S., Sanson, C., Zarokian, J., Zaccarini, F., et al., 2022. Oncologic results of fertility sparing surgery of cervical cancer: an updated systematic review. *Gynecol. Oncol.* 165 (1), 169–183.
- Pavone, M., Goglia, M., Scambia, G., Querleu, D., Akladios, C., Lecointre, L., 2023. Laparoscopic-assisted vaginal trachelectomy with prophylactic cerclage: a safe fertility-sparing treatment for early stage cervical cancer. *Ann. Surg. Oncol.*
- Pavone, M., Autorino, R., Bizzarri, N., Chilorio, G., Valentini, V., Corrado, G., et al., 2023. Uterine transposition versus uterine ventrofixation before radiotherapy as a fertility sparing option in young women with pelvic malignancies: systematic review of the literature and dose simulation. *Eur. J. Surg. Oncol.* 50 (1), 107270.
- Querleu, D., Rives, M., Chand, M., Ferron, G., 2010. Uterine transposition before radiation therapy in young female rectal cancer patients: a novel technique aimed at preserving fertility. *J. Clin. Oncol.* 28, e19592.
- Ribeiro, R., Rebolho, J.C., Tsumanuma, F.K., Brandalize, G.G., Trippia, C.H., Saab, K.A., 2017. Uterine transposition: technique and a case report. *Fertil. Steril.* 108 (2), 320–324.e1.
- Ribeiro, R., Baiocchi, G., Obermair, A., Costa, C.N., Leitao, M., 2024. Uterine transposition for fertility preservation in pelvic cancers. *Int. J. Gynecol. Cancer* 34 (3), 403–408.
- Wallace, W.H.B., Thomson, A.B., Kelsey, T.W., 2003. The radiosensitivity of the human oocyte. *Hum. Reprod.* 18 (1), 117–121.