Near-infrared and hysteroscopy-guided robotic excision of uterine isthmocele with laser fiber: a novel high-precision technique

Zachary Walker, M.D. and Antonio Gargiulo, M.D.

Division of Reproductive Endocrinology and Infertility, Department of Obstetrics, Gynecology, and Reproductive Biology, Brigham & Women's Hospital, Harvard Medical School, Boston, Massachusetts

Objective: To describe a novel high-precision technique for robotic excision of uterine isthmocele, employing a carbon dioxide laser fiber, under hysteroscopic guidance, and near-infrared guidance.
Design: Video article.
Patient(s): A 36-year-old multipara with 3 prior cesarean sections presented to our infertility clinic with secondary infertility. The patient had been trying to conceive for 6 months without success. The patient underwent a hystero-salpingo contrast sonography that identified a large cesarean scar defect with a 1.4-mm residual myometrial thickness (RMT). The patient was counseled on surgical management with robotic approach because of RMT <3 mm precluding her from hysteroscopic resection and the potential risk for a cesarean scar ectopic or abnormal placentation if she were to become pregnant in the future. She elected to undergo excision and repair and informed consent was obtained from the patient.
Intervention(s): The robot was docked for traditional gynecologic robotic surgery. The uterus was injected with 5 units of vasopressin. We used a carbon dioxide laser fiber (Lumenis FIberLase) at a power of 5 watts as the sole energy source for dissection. The bladder was dissected off the uterus to identify the general area of the isthmocele. At that point, diagnostic hysteroscopy was performed using a 30-degree 5-mm hysteroscope (Karl Storz) to identify and enter the isthmocele. Near-infrared vision (da Vinci Firefly, Intuitive USA) was activated to precisely outline the extent of the isthmocele, which was not visible with simple transillumination from the hysteroscope. We proceeded with laser excision in infrared/gray scale using the laser at a power of 20 watts removing the entire area that was highlighted by the Firefly. After full excision of the isthmocele, the hysteroscope was removed and was eventually replaced by a uterine manipulator (ConMed VCare DX). The hysterotomy was closed with a 2-layer closure: 4 mattress sutures of 2-0 Vicryl (Ethicon) followed by a running 2-0 PDS Stratafix (Ethicon). The peritoneal layer was closed over these 2 layers with 2-0 PDS Stratafix (Ethicon) in a running fashion. The uterine manipulator was removed and a 14 French Malecot catheter (Bard) was placed in the uterine cavity to allow the healing to proceed with minimal risk of cervical stenosis. The bladder was backfilled to ensure integrity of the bladder wall. Interceed adhesion barrier (Gynecare) was then placed over the area of the repair and the procedure was concluded. The patient included in this video gave consent for publication of the video and posting of the video online including social media, the journal website, scientific literature websites (such as PubMed, ScienceDirect, Scopus, etc.), and other applicable sites.
Main outcome measure(s): Completion of excision and repair of cesarean scar defect without surgical complications.
Result(s): Robotic excision and repair of a sizable uterine isthmocele with carbon dioxide laser fiber and da Vinci Firefly was completed successfully without any surgical complications. Diagnostic hysteroscopy was used to positively identify the isthmocele and provide transillumination. However, the thickness of the cervical myometrium only allows the hysteroscopic light to shine through the thinnest portion of myometrium at the apex of the isthmocele, whereas the near-infrared vision allowed by the da Vinci Firefly technology was used to precisely identify the borders of the defect. The carbon dioxide laser was used to completely remove the defect while avoiding damage to delicate reproductive tissue and over-excision. No complications were identified during the postoperative visit. Magnetic resonance imaging 3 months after the surgery revealed an RMT of 10 mm at the location of excision compared with the initial RMT of 1.4 mm.
Conclusion(s): Currently, there is no gold-standard technique for surgical management of isthmocele. This is the first description of the combined use of hysteroscopy, near-infrared vision, and laser fiber for the robotic excision of isthmocele. This specific

Received February 27, 2023; revised and accepted August 2, 2023; published online August 9, 2023.
There is no funding to report for this study.
Correspondence: Zachary Walker, M.D., Division of Reproductive Endocrinology and Infertility, Department of Obstetrics, Gynecology, and Reproductive Biology, Brigham & Women's Hospital, 75 Francis Street, Boston, Massachusetts 02115 (E-mail: zwalker1@bwh.harvard.edu).

Fertility and Sterility® Vol. 120, No. 5, November 2023 0015-0282/$36.00

https://doi.org/10.1016/j.fertnstert.2023.08.006

setup proves to be a useful technical improvement. The use of near-infrared vision combined with precise hysteroscopic targeting allows much clearer definition of he isthmocele borders, and the flexible laser fiber allows millimetric xcision in the absence of appreciable lateral thermal spread. Further investigation is warranted to identify a gold-standard surgical technique for patients with cesarean scar defect.

(Fertil Steril® 2023;120:1081-1083. ©2023 by American Society for Reproductive Medicine.)

El resumen está disponible en Español al final del artículo.

Key Words: Carbon dioxide laser, cesarean scar defect, near-infrared, robotic surgery, uterine isthmocele

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Declaration of interests: Z.W. has nothing to disclose. A.G. is a consultant for Medicaroid, Inc. and Boston Scientific, Inc., and an advisory board member at Pregmune, Inc.

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Escisión robótica del istmocele uterino con fibra láser guiada por infrarrojo cercano e histeroscopia: una nueva técnica de alta precisión

Objetivo: Describir una nueva técnica de alta precisión para la escisión robótica del istmocele uterino, empleando una fibra láser de dióxido de carbono, bajo guía histeroscópica y guía de infrarrojo cercano.

Diseño: artículo de vídeo

Paciente(s): Una multípara de 36 años con 3 cesáreas previas que se presentó en nuestra clínica de infertilidad con infertilidad secundaria. La paciente llevaba 6 meses intentando concebir sin éxito. La paciente se sometió a una ecografía histerosalpingografía con contraste que identificó un gran defecto en la cicatriz de la cesárea con un espesor miometrial residual (ERM) de 1,4 mm. Se aconsejó a la paciente sobre el manejo quirúrgico con abordaje robótico debido a que el ERM de menos de 3 mm le impedía la resección histeroscópica y el riesgo potencial de una cicatriz de cesárea ectópica o una placentación anormal si quedara embarazada en el futuro. Ella eligió someterse a la escisión y reparación y se obtuvo el consentimiento informado de la paciente.

Intervención(es): El robot se acopló para una cirugía robótica ginecológica tradicional. Se inyectaron 5 unidades de vasopresina en el útero. Utilizamos una fibra láser de dióxido de carbono (Lumenis FIberLase) a una potencia de 5 vatios como única fuente de energía para la disección. Se disecó la vejiga del útero para identificar el área general del istmocele. En ese momento, se realizó una histeroscopia diagnóstica utilizando un histeroscopio de 5 mm de 30 grados (Karl Storz) para identificar e ingresar al istmocele. Se activó la visión con infrarrojo cercano (da Vinci Firefly, Intuitive USA) para delinear con precisión la extensión del istmocele, que no era visible con una simple transiluminación del histeroscopio. Se procedió a la escisión láser en escala infrarroja/gris utilizando el láser a una potencia de 20 vatios eliminando toda el área resaltada por el Firefly. Después de la escisión completa del istmocele, se retiró el histeroscopio y finalmente se reemplazó por un manipulador uterino (ConMed VCare DX). La histerotomía se cerró con un cierre en 2 capas: 4 suturas de colchonero de Vicryl 2-0 (Ethicon) seguidas de un PDS Stratafix 2-0 continuo (Ethicon). La capa peritoneal se cerró sobre estas 2 capas con PDS Stratafix 2-0 (Ethicon) de forma continua. Se retiró el manipulador uterino y se colocó un catéter Malecot francés 14 (Bard) en la cavidad uterina para permitir que la curación prosiguiera con un riesgo mínimo de estenosis cervical. La vejiga se rellenó para asegurar la integridad de la pared de la vejiga. Luego se colocó la barrera anti-adherencias Interceed (Gynecare) sobre el área de la reparación y se concluyó el procedimiento. La paciente incluida en este video dio su consentimiento para la publicación del video y su publicación en línea, incluidas las redes sociales, el sitio web de la revista, los sitios web de literatura científica (como PubMed, ScienceDirect, Scopus, etc.) y otros sitios aplicables.

Principales medidas de resultados: finalización de la escisión y reparación del defecto de la cicatriz de la cesárea sin complicaciones quirúrgicas.

Resultados: La escisión y reparación robótica de un istmocele uterino de tamaño considerable con fibra láser de dióxido de carbono y da Vinci Firefly se completó con éxito sin complicaciones quirúrgicas. Se utilizó la histeroscopia diagnóstica para identificar positivamente el istmocele y proporcionar transiluminación. Sin embargo, el grosor del miometrio cervical sólo permite que la luz histeroscópica brille a través de la porción más delgada del miometrio en el vértice del istmocele, mientras que la visión infrarroja cercana permitida por la tecnología da Vinci Firefly se utilizó para identificar con precisión los bordes del defecto del miometrio cervical. Se utilizó láser de dióxido de carbono para eliminar completamente el defecto evitando dañar el delicado tejido reproductivo y la sobreescisión. No se identificaron complicaciones durante la visita postoperatoria. La resonancia magnética 3 meses después de la cirugía reveló un ERM de 10 mm en el lugar de la escisión en comparación con el ERM inicial de 1,4 mm.

Conclusión(es): Actualmente, no existe una técnica estándar para el tratamiento quirúrgico del istmocele. Esta es la primera descripción del uso combinado de histeroscopia, visión infrarroja cercana y fibra láser para la escisión robótica del istmocele. Esta configuración específica demuestra ser una mejora técnica útil. El uso de visión infrarroja cercana combinado con una orientación histeroscópica precisa permite una definición mucho más clara de los bordes del istmocele, y la fibra láser flexible permite la escisión milimétrica en ausencia de una dispersión térmica lateral apreciable. Se justifica realizar más investigaciones para identificar una técnica quirúrgica estándar para pacientes con CSD.