VIDEO COMMENTARY

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Fluorescence-guided nerve-sparing surgery for deep endometriosis using indocyanine green

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ABSTRACT

Background: Although the benefit of nerve-sparing surgery for deep endometriosis (DE) with postoperative voiding dysfunction has been demonstrated, it requires a high level of surgical skill to accurately remove endometriosis lesions while preserving autonomic nerves in situations of severe adhesions and fibrosis and has been performed only by expert surgeons. However, endometriosis is a common disease, and methods for intraoperative identification of endometriosis lesions, ureters, vessels, and nerves using near-infrared imaging with indocyanine green (ICG) have been explored to enable more surgeons to safely offer such procedures to their patients.

Objectives: To demonstrate the step-by-step technique of single-port robotic nerve-sparing DE surgery with ICG navigation.

Participant: The patient was a 48-year-old woman with chronic pelvic pain. Magnetic resonance imaging revealed uterine adenomyosis and a right ovarian endometrioma with DE involving the uterosacral ligament and surface of the rectum.

Intervention: An intravenous injection of 0.25 mg/kg body weight of ICG for intraoperative near-infrared fluorescence (NIR) imaging with the da Vinci SP.

Conclusions: The use of ICG with NIR during nerve-sparing DE surgery may improve the surgeon's decision-making process. ICG may be useful in highlighting pelvic autonomic nerves, identifying DE lesions, checking for pelvic organ injury, and assessing tissue perfusion and haemostasis. However, further research is needed to confirm the possible role of ICG in this setting.

What is New? This video illustrates the potential of ICG fluorescence to enhance intraoperative visualisation of autonomic nerves and DE lesions, offering educational insights into safer and more widely accessible advanced surgical techniques.

Keywords: Chronic pelvic pain, endometriosis, indocyanine green, robotic surgery, surgical techniques

Video 1. Although the benefit of nerve-sparing surgery for deep endometriosis (DE) with postoperative voiding dysfunction has been demonstrated, it requires high surgical skill to accurately remove DE lesions while preserving autonomic nerves in severe adhesions and fibrosis.[1] Since endometriosis is common, near-infrared imaging with indocyanine green (ICG) has been explored to help more surgeons identify DE lesions, ureters, vessels, and nerves intraoperatively.[2-4]

This video demonstrates step-by-step nerve-sparing surgery with ICG navigation.

The patient was a 48-year-old woman with severe dysmenorrhea and chronic pelvic pain. Magnetic resonance imaging showed adenomyosis, a right

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ovarian endometrioma with DE involving the uterosacral ligament and rectal surface, and cul-de-sac obliteration. A nerve-sparing modified radical hysterectomy, right salpingo-oophorectomy, and complete DE removal were performed using the da Vinci SP.

The surgery was conducted in seven steps: Step 1, adhesiolysis and adnexal surgery; Step 2, separation of the nerve plane; Step 3, dissection of the ureter; Step 4, reopening of the pouch of Douglas; Step 5, complete removal of DE lesions while avoiding injury to the nerve plane; Step 6, hysterectomy (if the patient desires non-fertility-sparing surgery); Step 7, checking for pelvic organ injury, assessing tissue perfusion, and hemostasis. ICG (0.25 mg/kg) was administered intravenously during Steps 2, 5, and 7.

There are no standardised recommendations for ICG dose, timing, or visualisation. Fluorescence assessment is subjective and varies by imaging system. While white light remains primary, ICG is a useful adjunct. ICG is not nerve-specific. We used low-dose intravenous injection to transiently visualise neurovascular bundles via surrounding vessel fluorescence. Nerve-specific fluorophores are in development and may become available in the future.[5] ICG serves as an adjunctive tool, enhancing anatomical recognition and intraoperative decision-making. Further research is needed to confirm its role in this setting.

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Informed consent: Informed consent was obtained from all individual participants included in the study.

Data sharing: Data are available from the authors upon reasonable request.

Transparency: The lead author affirms that this manuscript is an honest, accurate, and transparent account of the work being reported; that no important aspects have been omitted; and that any discrepancies from the work as planned have been explained.

Video 1. Fluorescence-guided nerve-sparing surgery for deep endometriosis using indocyanine green: https://youtu.be/78SokoFgHJE