RESEARCH PAPER

Role of Indocyanine Green in Distorted Pelvic Anatomy - A Green Lantern for Gynec Surgeon: A Case Series

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ABSTRACT

Background and Aim: Ureteric injury remains a significant complication in gynecological surgery, particularly in patients with distorted pelvic anatomy due to prior surgeries, endometriosis, or dense adhesions. Conventional methods of ureteral identification may be unreliable in such settings. Indocyanine green (ICG) fluorescence imaging has emerged as a useful adjunct for real-time intraoperative visualization. This case series aims to evaluate the role of ICG in facilitating safe surgical dissection in complex pelvic surgeries.

Case Description: We present three cases with significantly distorted pelvic anatomy. Case 1 involved a 48-year-old woman with a large ovarian cyst and prior hysterectomy, where ICG aided ureteral identification during adhesiolysis. Case 2 was a 42-year-old multiparous woman with prior cesarean sections and severe adhesions involving the bladder, bowel, and ureter, where ICG-assisted visualization enabled safe laparoscopic hysterectomy. Case 3 was a 41-year-old nulligravida with fibroids, adenomyosis, bilateral endometriomas, and hematosalpinx, where extensive adhesions necessitated conversion to open surgery; however, ureteric identification was facilitated using ICG.

Conclusion: ICG fluorescence imaging is a safe and effective adjunct for intraoperative ureteral identification, particularly in complex pelvic surgeries with distorted anatomy.

Clinical Significance: ICG-guided ureteral visualization enhances surgical safety and precision, reducing the risk of iatrogenic ureteric injury in challenging gynecological procedures.

Keywords: Indocyanine green, ureteral identification, distorted pelvic anatomy, endometriosis, adhesions, hysterectomy.

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Introduction:

Ureteric injury is a well-recognized complication of gynecological surgery, with an incidence ranging from 0.5–2% in routine hysterectomy and higher rates in complex procedures involving distorted pelvic anatomy. Such distortion may result from prior pelvic surgeries, endometriosis, pelvic inflammatory disease, or large adnexal masses, leading to obliteration of normal anatomical planes.

Traditional ureteral identification relies on visual recognition and tactile feedback, often supplemented by ureteric stenting. However, these approaches may be insufficient when the ureter is displaced, encased in fibrosis, or adherent to surrounding structures.

Indocyanine green (ICG), a fluorescent dye visualized under near-infrared imaging, enables real-time delineation of ureteral pathways when administered through ureteric catheters. This allows continuous intraoperative visualization, thereby improving surgical orientation and precision. Increasing evidence from surgical literature supports its role as an adjunct in complex procedures.

This case series highlights the utility of ICG in facilitating ureteral identification in three patients with significantly distorted pelvic anatomy undergoing gynecological surgery.

Case Description:

Case 1:

A 48-year-old female with a history of obstetric hysterectomy performed 24 years prior presented with complaints of lower back pain.

Imaging revealed a large cystic lesion measuring 8.5 × 9.1 × 11.4 cm, probably arising from the right ovary, with benign features. Tumor markers were within normal limits.

Laparoscopic right oophorectomy with cystectomy was planned, anticipating ureteric and bowel adhesions. To aid intraoperative navigation, indocyanine green (ICG) dye was injected through bilateral ureteric catheters under cystoscopic guidance. This enabled clear visualization of the ureters during adhesiolysis and dissection. Intraoperatively, a multiloculated simple cyst was identified and punctured, yielding clear fluid. Right oophorectomy was performed.

Histopathological examination revealed a benign serous cystadenoma.

Figure 1 : ICG fluorescence guided identification of ureter during laparoscopic adhesiolysis.

Case 2:

A 42-year-old P2L2E1 with a history of two previous lower segment cesarean sections and prior diagnostic laparotomy with left salpingectomy presented with complaints of lower abdominal pain.

MRI pelvis showed a right ovarian endometriotic cyst measuring 3.2 × 5.5 × 3.8 cm (volume 33.4 cc) along with bilateral subcentimetric hemorrhagic cysts. Serum CA-125 was elevated (126.4 U/mL).

The patient was planned for total laparoscopic hysterectomy with bilateral salpingo-oophorectomy and prophylactic bilateral double-J ureteric stenting, anticipating ureteric and bowel adhesions. To aid intraoperative navigation, indocyanine green (ICG) dye was injected through bilateral ureteric catheters under cystoscopic guidance.

Dense adhesions were noted between the ureter and cervix, with the bladder adherent to the anterior abdominal wall and anterior uterine surface. The posterior uterine surface was adherent to the bowel, omentum, and peritoneum. Careful sharp adhesiolysis was performed. A 4 × 3 cm right ovarian and a 2 × 3 cm left ovarian endometriotic cyst were identified, drained, and excised. Hysterectomy was completed laparoscopically.

Histopathology revealed adenomyosis with a benign endometrial polyp, and the right ovarian cyst was reported as a benign hemorrhagic mucinous cystadenoma.

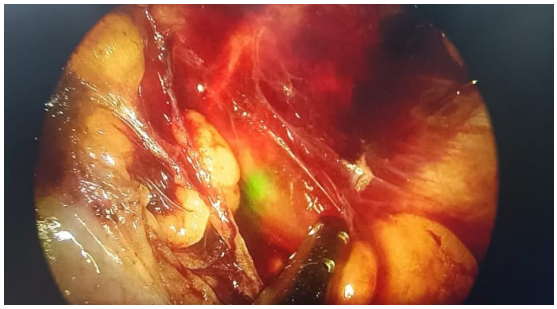

Figure 2: Intraoperative ICG fluorescence aiding safe adhesiolysis and ureter mapping in distorted pelvic anatomy

Case 3 :

A 41-year-old nulligravida with a history of prior diagnostic laparoscopy presented with lower abdominal pain and heavy menstrual bleeding.

Imaging revealed a bulky uterus with multiple fibroids and features of adenomyosis, along with bilateral hematosalpinx and chronic ovarian endometriomas. Laparoscopic hysterectomy with bilateral salpingo-oophorectomy was planned.

Intraoperatively, bilateral ureteric catheters were placed, and ICG dye was injected to facilitate ureteric visualization. A 6 × 5 cm fundal pedunculated subserosal fibroid and a 4 × 4 cm right-sided posterolateral subserosal fibroid were identified. Bilateral ovarian endometriomas measuring approximately 6 × 6 cm were noted and drained, yielding chocolate-colored fluid. Bilateral hematosalpinx was present. Dense rectosigmoid adhesions were encountered, leading to significant distortion of pelvic anatomy. Due to operative difficulty, the procedure was converted to open hysterectomy with bilateral salpingo-oophorectomy.

Histopathological examination revealed adenomyoma of the uterus. One fallopian tube showed features of endometriosis, while the other demonstrated a paratubal cyst. The other ovary revealed an endometriotic cyst.

Discussion:

Ureteric injury is an important complication of gynecological surgery, with reported rates of approximately 0.5–2% in hysterectomy, increasing significantly in the presence of distorted pelvic anatomy such as endometriosis, prior surgeries, or dense adhesions. In these situations, identification of the ureter is often difficult due to loss of normal anatomical planes.

Conventional methods rely on visual and tactile identification, with or without prophylactic ureteric stenting. However, stenting alone does not provide continuous visualization and may be insufficient when the ureter is displaced or densely adherent.

Indocyanine green (ICG) fluorescence imaging enables real-time intraoperative visualization of the ureter when administered through ureteric catheters. Under near-infrared imaging, the ureter can be continuously delineated, improving spatial orientation during dissection. Studies, including Zhang et al. (2026), have demonstrated high rates of successful ureteral visualization with minimal complications, with reported detection rates approaching 90–100% in selected series.

In the present series, all three cases involved significant distortion of pelvic anatomy. In Cases 1 and 2, ICG facilitated clear identification of the ureter during adhesiolysis, allowing safe completion of laparoscopic procedures. In Case 3, although conversion to open surgery was required due to extensive adhesions, ICG continued to aid ureteric identification and contributed to safer dissection.

ICG fluorescence thus serves as a useful adjunct to ureteric stenting, particularly in high-risk cases. While it requires additional instrumentation and expertise, its ability to provide continuous visual guidance may help reduce the risk of iatrogenic ureteric injury in complex gynecological surgeries.

Conclusion:

Indocyanine green fluorescence imaging is a safe, feasible, and effective adjunct for ureteral identification in gynecological surgeries involving distorted pelvic anatomy.

Clinical Significance:

The use of indocyanine green fluorescence imaging represents a significant advancement in gynecological surgery, particularly in cases with distorted pelvic anatomy. By enabling real-time intraoperative visualization of the ureters, ICG enhances surgical precision during adhesiolysis and dissection, where conventional anatomical landmarks are often obscured. This technique serves as an important adjunct to standard ureteric stenting, improving surgeon confidence and facilitating safer operative decision-making. Its application is especially relevant in patients with endometriosis, prior pelvic surgeries, or dense adhesions, where the risk of iatrogenic ureteric injury is significantly elevated. Incorporation of ICG into surgical practice may therefore contribute to improved patient outcomes by reducing operative complications and enhancing the safety profile of complex gynecological procedures.

List of Abbreviations:

ICG – Indocyanine Green
MRI – Magnetic Resonance Imaging
DJ – Double J stent
LSCS – Lower Segment Cesarean Section

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