Robotic sentinel lymph node mapping with sensitive Firefly for endometrial cancer staging

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Video 1 demonstrates the novel use of robotic sentinel lymph node (SLN) mapping using sensitive Firefly for endometrial cancer staging.

Endometrial cancer staging includes lymph node assessment. Historically lymphadenectomy was performed, but it is associated with increased morbidity without a survival benefit for early-stage disease. SLN mapping and biopsy have increasingly been used to identify lymph node metastasis while minimizing the risks of lymphadenectomy. SLN mapping using indocyanine green (ICG) and near infrared imaging are the preferred methods due to improved detection rates. When a SLN is not identified, a side-specific lymphadenectomy is performed. Thus, accurate mapping may reduce harmful procedures.

Firefly is integrated into the robotic da Vinci Xi Surgical System (Intuitive Surgical) to enable SLN assessment. In standard mode, SLNs appear fluorescent green while the surrounding pelvic anatomy appears on the gray scale (Figure 1A). Standard Firefly allows for simultaneous mapping and surgical manipulation. The reported mapping failure rate was 14.3% in patients undergoing robotic staging for apparent early-stage disease; of these, 16.9% had lymph node metastasis on lymphadenectomy.

Sensitive Firefly increases the fluorescent sensitivity of the imaging system (Figure 1B). This enables visual detection of lower ICG concentrations and through deeper tissue. The auto-adjustment feature modifies signal intensity and brightness for a more consistent image as the endoscope moves. Sensitive Firefly may be helpful in detecting SLN channels in patients with more adiposity. By improving detection, sensitive Firefly may allow surgeons to identify atypical channels to pursue and find the true SLN with less dissection.

There are several issues for consideration with the use of sensitive Firefly. First, the surgeon cannot move the instruments or activate energy methods in this mode. Second, sensitive Firefly does not illuminate anatomy that does not contain ICG (Figure 1B).
Thus, the surgeon cannot see the relationship between channels and anatomic structures in real time.

In conclusion, sensitive Firefly increases the fluorescent sensitivity of the Firefly imaging system. It allows for visual detection of ICG at lower concentrations and through deeper tissue. Future directions for high sensitivity near infrared imaging use include determining whether it improves bilateral mapping rates and operative time associated with SLN biopsy due to improved recognition of lymphatic pathways.

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