

# The Essential Elements of a Robotic-Assisted Laparoscopic Hysterectomy



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## KEYWORDS

• Robotics • Laparoscopy • Hysterectomy • Minimally invasive surgery

## KEY POINTS

- A successful robotic-assisted laparoscopic hysterectomy starts with choosing the right patient and having the appropriate operating room set up with special attention paid to proper patient positioning.
- Identification and isolation of relevant anatomy, appropriate placement of the Koh colpotomy cup, and cephalad traction of the uterus are paramount in preventing organ injury.
- Maintaining meticulous hemostasis throughout the procedure with the judicious use of energy and proper pedicle formation is essential to reducing blood loss.
- Same-day discharge is safe and cost-effective following uncomplicated procedures.
- Perioperative outcomes are similar to laparoscopic hysterectomy with the exclusion of operative time, which may lead to increased costs.



Video content accompanies this article at <http://www.obgyn.theclinics.com>.

## INTRODUCTION

Robotics entered the surgical arena in a formal way in the mid-1980s with a primary goal of improving surgeon precision and accuracy. This goal led to the development of a device to assist neurosurgeons with stereotactic biopsies.<sup>1–3</sup> From there, several different models were created for specialty-specific procedures with the greatest penetration in orthopedics. It was the merging of robotics and virtual reality, however,

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that led to the precursors of modern-day systems. The National Aeronautics and Space Administration and the Stanford Research Institute were key contributors in the creation of virtual reality environments and the concept of telepresence. These concepts were rapidly extrapolated to other industries, such as medicine, with significant potential seen in the expansion of surgeon skill set. The US Department of Defense took a keen interest in this dual technology and the possibility of telesurgery or remotely performed surgery during warfare. At their charge, continued technological advancements led to the introduction of the da Vinci Surgical System (Intuitive Surgical, Inc, Sunnyvale, CA, USA) in 1997 with the performance of the first robot-assisted laparoscopic cholecystectomy. Despite earlier plans for military applications, the device became integrated into routine clinical care for cardiac and urologic surgery.

Currently, the da Vinci Surgical System is the only robotic system that is approved by the US Food and Drug Administration (FDA) for laparoscopic procedures in general surgery, cardiac, colorectal, head and neck, thoracic, urologic, and gynecologic procedures. It was initially approved in 2000 for general laparoscopic use, and as of April 2005, was given FDA clearance for use in gynecologic procedures. The system consists of a surgeon's console, a mobile patient side cart with 3 or 4 robotic arms, and a video tower. A variety of multiuse Endowrist instruments are available, including needle drivers, graspers, energized instruments, and staplers. Three models currently exist, the Si-e (2 arms), the Si, and the newest version, the Xi System, which was released in 2015. The Xi system affords the opportunity for multiquadrant surgery via a new patient-side cart orientation, a computerized docking assistant, and the ability to use the camera from all ports. Surgeon training tools have been incorporated directly into the device. Intuitive Surgical reports there are approximately 2400 units in the United States and that gynecology is the leading specialty user of the device with 263,000 hysterectomies being performed robotically in the United States in 2015.<sup>4</sup>

Hysterectomy continues to be the most common major surgical procedure performed by gynecologists in the United States. Data from 2000 to 2004 suggest that greater than 600,000 procedures were performed every year with approximately two-thirds being performed abdominally for benign indications.<sup>5</sup> Despite the introduction of laparoscopy in the late 1990s, the vast majority of hysterectomies in 2009 for benign indications were still performed via the abdominal approach (56%) as compared with minimally invasive techniques such as conventional laparoscopy (20%).<sup>6</sup> One proposed obstacle to the more widespread acceptance and application of minimally invasive surgical techniques in gynecologic surgery has been the steep learning curve for surgeons. Other obstacles are the potential technical limitations of conventional laparoscopic instruments that include counterintuitive hand movements (fulcrum effect), an unsteady 2-dimensional visual field, and limited degrees of instrument motion within the body as well as ergonomic difficulty and tremor amplification.<sup>3</sup> Robotics may offer a solution with 3-dimensional vision, wristed instrumentation mirroring open surgical technique, and tremor dampening, leading to a quicker uptake of the technology. Wright and colleagues<sup>7</sup> noted this trend toward robotics with the analysis of inpatient rates of hysterectomy between 1998 and 2010, as shown in [Fig. 1](#). Between 2002 and 2010, there was a 36.4% decrease in the overall rate of hysterectomy, which translated to decreases in abdominal and vaginal hysterectomies, a relatively stable number of laparoscopic hysterectomies, and an increase in robotic procedures.

Despite its documented advantages, robotics requires alternative laparoscopic port placement, lacks tactile feedback (haptics), and is reliant on a bedside assistant because the primary surgeon is positioned remote from the patient, necessitating

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