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Review Article

Systematic Review of Robotic Surgery in Gynecology: Robotic Techniques Compared With Laparoscopy and Laparotomy

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ABSTRACT The Society of Gynecologic Surgeons Systematic Review Group performed a systematic review of both randomized and observational studies to compare robotic vs nonrobotic surgical approaches (laparoscopic, abdominal, and vaginal) for treatment of both benign and malignant gynecologic indications to compare surgical and patient-centered outcomes, costs, and adverse events associated with the various surgical approaches. MEDLINE and the Cochrane Central Register of Controlled Trials were searched from inception to May 15, 2012, for English-language studies with terms related to robotic surgery and gynecology. Studies of any design that included at least 30 women who had undergone robotic-assisted laparoscopic gynecologic surgery were included for review. The literature yielded 1213 citations, of which 97 full-text articles were reviewed. Forty-four studies (30 comparative and 14 noncomparative) met eligibility criteria. Study data were extracted into structured electronic forms and reconciled by a second, independent reviewer. Our analysis revealed that, compared with open surgery, robotic surgery consistently confers shorter hospital stay. The proficiency plateau seems to be lower for robotic surgery than for conventional laparoscopy. Of the various gynecologic applications, there seems to be evidence that renders robotic techniques advantageous over traditional open surgery for management of endometrial cancer. However, insofar as superiority, conflicting data are obtained when comparing robotics vs laparoscopic techniques. Therefore, the specific method of minimally invasive surgery, whether conventional laparoscopy or robotic surgery, should be tailored to patient selection, surgeon ability, and equipment availability. Journal of Minimally Invasive Gynecology (2014) 21, 353–361 © 2014 AAGL. All rights reserved.

Keywords: Gynecologic surgery; Learning curve; Robotic surgery; Systematic review

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The use of minimally invasive surgery with robotic assistance has grown exponentially since its approval in 2005 by the US Food and Drug Administration for gynecologic surgical procedures. Applications include but are not limited to hysterectomy, adnexal surgery, myomectomy, tubal reanastomosis, sacrocolpopexy, and staging and management of gynecologic malignancies. The rapid adoption of robotic

technology stems from the enhanced visualization, wristed instrumentation, and improved ergonomics inherent to such systems, enabling more surgeons to perform minimally invasive procedures previously restricted to surgeons with advanced laparoscopic skills. Such technology may also enable those with laparoscopic experience to perform more complex cases that would otherwise require open techniques. Compared with traditional laparoscopy, robotic platforms are promoted as resulting in less blood loss, less postoperative pain, shorter hospital stay, and higher lymph node retrieval, although perhaps at the expense of cost.

In 2012, the Cochrane Collaboration published a review evaluating robotic surgery for treatment of benign gynecologic disease, concluding that robotic surgery is comparable to laparoscopy insofar as intraoperative complications, quality of life, length of hospital stay, and rate of conversion to open surgery [1]. The authors further concluded that robotic gynecologic interventions seemed to be associated with more postoperative complications, longer operative time, and higher cost. However, the review included only 2 randomized controlled trials (RCTs), with a total of 158 women.

The Society of Gynecologic Surgeons (SGS) Systematic Review Group (SRG) performed a systematic review of both randomized and observational studies to compare robotic vs nonrobotic surgical approaches (laparoscopic, abdominal, and vaginal) for treatment of both benign and malignant gynecologic indications. The primary objective of the present review was to compare surgical and patient-centered outcomes, costs, and adverse events associated with the various surgical approaches.

Sources

Eleven members of the SGS SRG, which includes gynecologic surgeons and systematic review methodologists, performed a systematic search to identify studies of robotic-assisted laparoscopic gynecologic surgery. MEDLINE and the Cochrane Central Register of Controlled Trials were searched from inception to May 15, 2012, for English-language studies, using the search terms “Aesop,” “computer assisted,” “computer motion,” “da Vinci,” “gynecology,” “intuitive,” “robotics,” “surgery,” and “Zeus,” as well as various benign and malignant gynecologic conditions and surgical procedures.

Study Selection

Abstracts were independently screened in duplicate using the computerized screening program abstrackr (Tufts Medical Center, Boston, MA) [2] with the following eligibility criteria: study participants were all women who had undergone robotic-assisted laparoscopic gynecologic surgery, and the studies evaluated robotic-assisted laparoscopic surgery. We included RCTs, prospective and retrospective comparative observational studies, and case-control studies of robotic-assisted vs nonrobotic surgery. We also included noncomparative studies (i.e., preoperative and postoperative studies, and case series) for adverse outcomes. Before initiating the search, our group decided to include only studies that had at least 30 procedures in each arm, in an effort to control the quality of studies included. Potentially relevant full-text articles were retrieved and double screened for eligibility including reporting on the following a priori defined outcomes: surgical success, costs, operative time, length of hospital stay, postoperative pain, blood loss, surgical learning curve, and number of lymph nodes retrieved. A priori, we categorized adverse events as either perioperative or long-term complications, which will be reported in a separate publication. Discrepancies as to the eligibility of a study were resolved by group consensus. Data from studies were extracted using an electronic data sheet by members of the SRG, most of whom had experience from previous systematic reviews. Individual extractions were verified by a second independent extraction, and discrepancies not easily rectified were resolved by consensus of all members of the SRG involved in this review. We planned to perform meta-analysis if there were at least 3 studies that were sufficiently similar in study design, specific comparison, and outcome; however, no groups of studies met criteria for meta-analysis. We assessed the methodologic quality of each study using predefined criteria from a 3-category system modified from the Agency for Healthcare Research and Quality [3]. Quality of the studies was graded as good (A), fair (B), or poor (C) on the basis of the likelihood of bias and the completeness of reporting. Grades for different outcomes could vary within the same study. To grade the overall strength of evidence, we used the Grades for Recommendation, Assessment, Development, and Evaluation (GRADE) system, with 4 ratings: high, moderate, low, and very low [4]. As part of a public vetting process, the review and guidelines were presented for public comment at the 38th Annual Scientific Meeting of the Society of Gynecologic Surgeons (Baltimore, MD, April 13–15, 2012). These results were posted on the SGS website, and public comments were solicited for 3 months.

Results

The literature search yielded 1213 citations, of which 97 full-text articles were retrieved and rescreened. Of these, 30 comparative studies met eligibility criteria and were analyzed in the systematic review. Fourteen additional noncomparative articles were eligible for analysis of adverse events (Fig. 1).

Described are the clinical and associated outcomes from comparative studies, categorized according to the indications for surgery: surgical management of endometrial cancer (13 studies), surgical management of cervical cancer (6 studies), myomectomy (5 studies), hysterectomy to treat benign disease (3 studies), and sacrocolpopexy (3 studies). There were no studies that evaluated the surgical