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Review Article

Robotic-Assisted Laparoscopic vs Abdominal and Laparoscopic Myomectomy: Systematic Review and Meta-Analysis

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ABSTRACT Herein is presented a systematic review and meta-analysis of evidence related to operative outcomes associated with robotic-assisted laparoscopic myomectomy (RLM) compared with abdominal myomectomy (AM) and laparoscopic myomectomy (LM). Outcome measures included estimated blood loss (EBL), blood transfusion, operating time, complications, length of hospital stay (LOHS), and costs. Meta-analysis 1 compared RLM vs AM, and meta-analysis 2 compared RLM vs LM. Studies scored moderately well on the Newcastle-Ottawa Quality Assessment Scale. No significant differences were found in age, body mass index, or number, diameter, and weight of myomas. In meta-analysis 1, EBL, blood transfusion, and LOHS were significantly lower; risk of complications was similar; and operating time and costs were significantly higher with RLM. In meta-analysis 2, no significant differences were noted in EBL, operating time, complications, and LOHS with RLM; however, blood transfusion risk and costs were higher. It was concluded that insofar as operative outcomes, RLM has significant short-term benefits compared with AM and no benefits compared with LM. Long-term benefits such as recurrence, fertility, and obstetric outcomes remain uncertain. Journal of Minimally Invasive Gynecology (2013) 20, 335–345 © 2013 AAGL. All rights reserved.

Keywords: Abdominal myomectomy; Laparoscopic myomectomy; Robotic myomectomy

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Uterine myomas are the most common benign tumors of the female genital tract, affecting 20% to 30% of women of reproductive age [1] and approximately 70% of women by age 49 years [2]. Approximately 30% of uterine myomas are associated with symptoms including menorrhagia, urinary frequency, subfertility, and recurrent pregnancy loss [3].

Available evidence suggests that fertility outcomes are poorer in women with submucosal myomas and that removal confers benefit [4]. Intramural myomas reduce fertility and are associated with adverse pregnancy outcomes [5]. Although the effect of abdominal myomectomy (AM) in improving fertility and pregnancy outcome is not clear, myomectomy is the only uterus-sparing surgical management of myomas in women desiring pregnancy [6,7]. Because of the recent trend to delay childbirth for personal and social reasons and the availability of oocyte donation programs, more women with myomas are coming to fertility clinics and requesting myomectomy to preserve reproductive potential and to optimize chances of successful pregnancy [8]. In addition, some women desire uterine conservation even after completion of childbearing because of concerns about sexual dysfunction after hysterectomy [9] or cultural belief that the uterus is symbolically associated with femininity [10].

Traditionally, myomectomy has been performed abdominally. However, since the development of advanced laparoscopic surgical techniques, laparoscopic myomectomy (LM; also known as video-assisted laparoscopic surgery) has been shown to be associated with decreased postoperative pain,

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less blood loss, quicker recovery, and comparable complication and pregnancy rates as with AM [11,12]. Despite these advantages, LM remains underused because of its inherent challenges and limitations with dissection of the myoma and multilayer closure of the myoma bed. The use of robotic assistance in laparoscopic surgery overcomes these disadvantages while maintaining the benefits of minimally invasive surgeries. With the 3-dimensional vision, improved ergonomics, wider range of movements, elimination of the fulcrum effect, improved instrument dexterity, and less surgeon fatigue, most of the limitations of traditional laparoscopy are eliminated [13]. The advantages with robotic-assisted laparoscopic myomectomy (RLM) include improved access to myomas in difficult anatomical locations and precise suturing of the myoma bed with adequate multilayering [14]. However, apart from the high cost, other limitations of RLM include reduced field of movement, limiting its effectiveness for removal of very large myomas; inability to apply hemostatic pressure to a large bleeding area; and lack of tactile feedback.

Despite a reasonable number of published studies on RLM, it is unclear whether the procedure offers any benefit over LM or AM. A systematic review of the observational studies of all robotic surgeries in gynecology compared with open or laparoscopic surgery reported limited short-term benefits [15]. That review included only 3 studies on myomectomy, with inconclusive results. With this background, the objective of the present study was to systematically review and summarize existing evidence related to the role of RLM in comparison with LM and AM.

Materials and Methods

Literature Search

We searched MEDLINE (1950 to June 2012), EMBASE (1980 to June 2012), the Cochrane Library, ISI Conference proceedings, and databases for registration of ongoing and archived randomized controlled trials (RCTs) and Register and metaRegister for RCTs for relevant studies. A combination of MeSH and text words was used to generate 2 subsets of citations: "myomectomy" ("abdominal," "laparoscopic," and "robotic") and perioperative morbidity ("morbidity" or "complications"). These subsets were combined using "AND" to generate citations relevant to our inquiry. The reference lists of all known primary and review articles were examined to identify cited articles not captured in electronic searches. No language restrictions were placed. Searches were conducted independently by 2 authors (J.P. and V.P.).

Study Selection

Studies were selected if the target population was women with uterine myomas undergoing RLM, LM, or AM. Randomized and observational controlled studies were included. Case series without historical controls were excluded. Studies were selected in a 2-stage process. Titles and abstracts from the electronic searches were independently scrutinized by 2 reviewers (J.P. and V.P.). Full manuscripts of all citations likely to meet predefined selection criteria were obtained. Final inclusion or exclusion decisions were made on examination of full manuscripts. In cases of duplicate publications, the most recent or complete version was selected. Disagreements about inclusion were resolved by consensus or arbitration by a third reviewer (S.K.).

Data Extraction and Assessment of Study Quality

Two reviewers independently undertook data extraction (J.P. and V.P.) and quality assessment (R.W. and K.O.) [16]. The Newcastle-Ottawa Quality Assessment (N-OQA) Scales for observational studies were implemented [17]. Items assessed included selection of cohorts and controls, comparability, and outcome. An arbitrary score based on assumption of equal weight of all items included in the N-OQA Scale was used to give a quantitative appraisal of overall quality of studies. Total score ranged from 0 to 9, with a score of either 0 or 1 for each item.

Outcomes

The parameters and outcomes for patient characteristics included age, body mass index, myoma characteristics (number, largest diameter, and site), and mean uterine size. Operative outcomes included estimated blood loss (EBL), decrease in hemoglobin concentration, blood transfusion, operating time, complications, fever, length of hospital stay (LOHS), and cost of the procedures.

Definition of Perioperative Morbidity

To ensure uniformity of data, we adopted definitions of perioperative morbidity as defined by Chu Jin et al [12]. Major complications were defined as one or more of the following criteria, adapted from previously published studies: life-threatening perioperative condition such as pulmonary embolism, cardiorespiratory arrest, or peritonitis; risk of major injury to bladder, ureters, or bowel; adnexectomy; upper genital tract infection; and major additional surgical procedure involving the bowel, major vessels, or urinary tract. Secondary criteria were defined as repeat operation or rehospitalization. Conversion to laparotomy was not considered a major additional procedure. Blood transfusion risk was separately analyzed. Minor complications included any complications that did not meet the above criteria, such as transient fever (temperature $>101.8^{\circ}$F [$>38.8^{\circ}$C]), urinary tract infection, wound or vault hematoma, wound infection, and hemorrhage without transfusion [18–21].

Statistical Analysis

From each study, outcome data were extracted in 2×2 tables by 2 reviewers (J.P. and VP). The meta-analysis was

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