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Original Article

Cost-Effectiveness of Laparoscopic Hysterectomy With Morcellation Compared With Abdominal Hysterectomy for Presumed Myomas

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ABSTRACT **Study Objective:** Hysterectomy for presumed leiomyomata is 1 of the most common surgical procedures performed in nonpregnant women in the United States. Laparoscopic hysterectomy (LH) with morcellation is an appealing alternative to abdominal hysterectomy (AH) but may result in dissemination of malignant cells and worse outcomes in the setting of an occult leiomyosarcoma (LMS). We sought to evaluate the cost-effectiveness of LH versus AH.

Design: Decision-analytic model of 100 000 women in the United States assessing the incremental cost-effectiveness ratio (ICER) in dollars per quality-adjusted life-year (QALY) gained (Canadian Task Force classification III).

Setting: U.S. hospitals.

Patients: Adult premenopausal women undergoing LH or AH for presumed benign leiomyomata.

Interventions: We developed a decision-analytic model from a provider perspective across 5 years, comparing the cost-effectiveness of LH to AH in terms of dollar (2014 US dollars) per QALY gained. The model included average total direct medical costs and utilities associated with the procedures, complications, and clinical outcomes. Baseline estimates and ranges for cost and probability data were drawn from the existing literature.

Measurements and Main Results: Estimated overall deaths were lower in LH versus AH (98 vs 103). Death due to LMS was more common in LH versus AH (86 vs 71). Base-case assumptions estimated that average per person costs were lower in LH versus AH, with a savings of $2193 ($24 181 vs $26 374). Over 5 years, women in the LH group experienced 4.99 QALY versus women in the AH group with 4.91 QALY (incremental gain of .085 QALYs). LH dominated AH in base-case estimates: LH was both less expensive and yielded greater QALY gains. The ICER was sensitive to operative costs for LH and AH. Varying operative costs of AH yielded an ICER of $87 651/QALY gained (minimum) to AH being dominated (maximum). Probabilistic sensitivity analyses, in which all input parameters and costs were varied simultaneously, demonstrated a relatively robust model. The AH approach was dominated 68.9% of the time; 17.4% of simulations fell above the willingness-to-pay threshold of $50 000/QALY gained.

Conclusion: When considering total direct hospital costs, complications, and morbidity, LH was less costly and yielded more QALYs gained versus AH. Driven by the rarity of occult LMS and the reduced incidence of intra- and postoperative complications, LH with morcellation may be a more cost-effective and less invasive alternative to AH and should remain an option for women needing hysterectomy for leiomyomata. Journal of Minimally Invasive Gynecology (2015) ■, ■–■ © 2015 AAGL. All rights reserved.

Keywords: Abdominal hysterectomy; Cost-effectiveness; Laparoscopic hysterectomy; Morcellation; Uterine myomas

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Hysterectomy for presumed leiomyomata (myomas) is 1 of the most common surgical procedures performed in nonpregnant women in the United States, with over 200 000 performed annually [1]. Surgeons increasingly use less invasive laparoscopic techniques for both supracervical and total hysterectomies, shortening hospital stay and recuperation time [2,3]. In laparoscopic procedures when the uterus is too large to be removed intact vaginally, the specimen must be cut into smaller pieces for removal via the smaller abdominal incisions. This dissection of solid tissue, so-called morcellation, may result in unintentional intra-abdominal spread of tissue fragments [4,5]. In the setting of previously undiagnosed leiomyosarcoma (LMS), morcellation may result in dissemination of malignant cells. The consequences of morcellation in the context of occult malignancy has sparked a heated debate regarding the risks associated with laparoscopic hysterectomy (LH) and morcellation [6].

The prevalence of occult LMS among women undergoing hysterectomy for presumed myomas is not precisely known, but available reports indicate it is extremely rare [5,7–9] and difficult to distinguish from benign disease preoperatively [10]. For women with large myomas, the benefits of a laparoscopic approach to hysterectomy —lower overall mortality, fewer intra- and postoperative complications, improved quality of life, and lower cost —must be weighed against the uncommon risk of morcellation of an occult malignancy [3,10,11]. With governing bodies and hospital systems struggling with how to best address this clinical problem, additional insights into both the health and economic consequences of LH and abdominal hysterectomies [AHs] are critically needed.

In this study we evaluated the cost-effectiveness of LH with morcellation for removal of presumed myomas as compared with AH. We estimated the total per-person direct hospital costs associated with both procedures and the anticipated associated intraoperative and postoperative complications from existing literature. Our primary outcome was the incremental cost-effectiveness per quality-adjusted life-year (QALY) gained.

Methods

We developed a decision-tree model (Fig. 1), constructed using Excel 2010 (Microsoft Corp., Redmond, WA) and TreePlan (TreePlan Software, San Francisco, CA) to simulate costs, outcomes, and incremental cost-effectiveness ratios (ICERs) comparing LH with morcellation with AH. AH is considered the base-case scenario, with LH evaluated as the alternative. An ICER in which the alternative (LH) is less expensive and more effective (more QALYs gained) compared with AH would be interpreted as "dominant" [12]. Costs and outcomes were evaluated across a 5-year time horizon. This study was considered exempt from review by the Institutional Review Board at the University of North Carolina at Chapel Hill because it involved synthesis and analysis of existing published data.

Mortality, Complications, and Quality of Life

Assumptions regarding anticipated clinical events and associated QALYs are presented elsewhere [13]. Briefly, we simulated a hypothetical cohort of 100 000 adult premenopausal (i.e., still menstruating) women undergoing either LH or AH for presumed benign leiomyomata. This hypothetical cohort was limited to women with a uterus large enough that it would require either laparotomy or laparoscopy with morcellation. Women who could have intact removal through the vagina were not included because they were not the focus of this investigation.

We examined frequency of transfusion, wound infection, venous thromboembolism (VTE), incisional hernia, vaginal cuff dehiscence, overall mortality, and complications associated with occult LMS. All women were at risk for surgical complications associated with hysterectomy, represented as unique and independent health states in the model.

The base-case estimates and ranges for mortality, probabilities of complications, and utilities were determined by literature review (Table 1). We derived LMS estimates, weighting high-quality more recent studies with larger sample size that used pathologic diagnostic criteria. The base case estimate for LMS risk (6/5084; .0012) was derived using mean estimates of LMS rates from the 4 highest-quality studies: .0008 [9], .0007 [7], .0009 [5], and .0023 [8]. The range used in 1-way and probabilistic sensitivity analyses used the lowest and highest reported rate of occult disease among studies with a sample size greater than 1000, ranging from .0007 [7] to .0049 [14], a range inclusive of the most recent US Food and Drug Administration estimate [6].

In terms of sarcoma-related mortality, the estimates from death from sarcoma were taken from Surveillance, Epidemiology, and End Results–based 5-year mortality reporting on LMS outcomes in the United States and varied on whether a woman underwent total AH or total LH based on the presumed up-staging of disease due to dissemination during morcellation. We assumed that women with metastatic disease would be identified preoperatively and would not be included in this hypothetical cohort. Survival of women with distant metastases is likely driven by the