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Original Article

Effect of Robotic Surgery on Hysterectomy Trends: Implications for Resident Education

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ABSTRACT **Study Objective:** To compare the surgical approach used for hysterectomy at 2 teaching hospitals before and after introduction of the robotic surgical system.

Design: Retrospective cohort study (Canadian Task Force classification II-3).

Setting: Two gynecologic training sites at the University of Hawaii.

Patients: Women who underwent hysterectomy between January 1, 2005, and December 31, 2011.

Measurements and Main Results: ICD-9 procedural codes were used to identify hysterectomies performed between January 1, 2005, and December 31, 2011. Hysterectomies were categorized according to surgical approach: abdominal, vaginal, laparoscopic-assisted vaginal/total laparoscopic, and robotic. Each hysterectomy was also categorized according to primary preoperative diagnosis as general gynecology, gynecologic oncology, and urogynecology. The rates and numbers of hysterectomies performed during 2005–2006 (2 years before acquisition of the robot), 2007–2008 (first 2 years with the robot), and 2009–2011 (3–5 years after acquiring the robot) were compared using χ^2 tests and analysis of variance. The numbers of hysterectomies reported in resident case logs were also collected and compared. A total of 5894 hysterectomies were performed between 2005 and 2011. The total number of hysterectomies performed at Hospital A, which acquired the robotic surgical system, increased over time ($p = .04$) but remained stable at Hospital B, which did not acquire the robotic surgical system. At Hospital A, the number of robotic hysterectomies increased as the number of abdominal hysterectomies decreased ($p < .001$), a trend consistent across all diagnostic categories. The number of vaginal and laparoscopic hysterectomies remained stable. Resident case logs also reflected a decrease in the number of abdominal hysterectomies ($p = .002$) and an increase in the number of combined laparoscopic/robotic hysterectomies ($p < .001$) performed. The total number of hysterectomies performed by residents was unchanged.

Conclusion: Introduction of the robotic surgical system was associated with significant changes in the numbers and types of hysterectomies performed in both general and subspecialty gynecology. Although abdominal hysterectomies decreased as robotic hysterectomies increased, other hysterectomies did not. These trends mirror reported resident surgical experience and have implications for resident education. Journal of Minimally Invasive Gynecology (2014) 21, 399–405 © 2014 AAGL. All rights reserved.

Keyword: Hysterectomy; Resident education; Robotic; Surgical training

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Since its approval for gynecologic surgery by the US Food and Drug Administration in 2005, the robotic surgical system has become an established part of gynecologic surgery in the United States [1]. This system has been widely adopted, in particular at large metropolitan hospitals, which are often training sites for residents in Obstetrics and Gynecology [2]. In 2013, Wright et al [2] found that 3 years after a hospital acquired the robotic surgical system, 22% of hysterectomies were completed robotically. They also

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reported decreasing rates of abdominal and laparoscopic procedures [2].

By altering gynecologic surgical practice, the robotic surgical system could affect the training of residents in vaginal, abdominal, and laparoscopic techniques [3,4]. Such changes may have the greatest effect in the years after introduction of the robotic surgical system because gynecologic surgeons may elect to perform procedures robotically that they would otherwise have performed vaginally or laparoscopically, to increase their experience with this system.

The objective of the present study was to compare the rates of the types of hysterectomies performed at 2 teaching hospitals before acquisition of the robotic surgical system, at 2 years after acquiring the system, and at 3 to 5 years after acquiring the system. Also described is the percentage of hysterectomies performed because of gynecologic oncology and urogynecology indications and the number of hysterectomies reported in resident case logs.

Methods

A retrospective review was performed at the 2 major Obstetrics and Gynecology residency training sites at the University of Hawaii (Hospital A and Hospital B). These hospitals are community-based tertiary care facilities located within 2 miles of each other in Honolulu, Hawaii. Inasmuch as most teaching gynecologists (82%) have surgical privileges at both institutions, procedures can be performed by most physicians at either site. Hospital A acquired 2 robotic surgical systems in 2007. Hospital B did not have a robotic surgical system during the study.

International Classification of Diseases, ninth revision (ICD-9) procedural codes were used to identify all hysterectomies performed between January 1, 2005, and December 31, 2011. Hysterectomies performed during cesarean section delivery were excluded. Hysterectomies were grouped into one of 4 categories on the basis of surgical approach: abdominal, vaginal, laparoscopic-assisted vaginal/total laparoscopic, and robotic. Surgical procedures that began with one approach but were converted to the abdominal approach maintained their original classification. In addition, the primary ICD-9 preoperative and/or postoperative diagnosis codes were used to categorize each hysterectomy as general gynecology, gynecologic oncology (any malignant lesion), or urogynecology (pelvic organ prolapse and urinary incontinence). The numbers of hysterectomies performed by residents on completion of residency were obtained through self-reported case logs collected for the Accreditation Council for Graduate Medical Education. Institution-specific hysterectomy numbers within these case logs were unavailable, and laparoscopic and robotic hysterectomies were reported as a single category during the study. Because only deidentified information was provided to investigators from both hospital sites, the study was granted exempt status from the University of Hawaii Institutional Review Board.

The primary objective was to describe the numbers and rates of hysterectomies according to surgical approach performed at Hospital A and Hospital B 2 years before acquisition of the robotic surgical system (2005–2006), at 2 years after acquiring the system (2007–2008), and at 3 to 5 years after acquiring the system (2009–2011). We also described these rates for cases performed because of general gynecology, gynecologic oncology, and urogynecology indications. Frequency distributions based on surgical approach were compared using χ^2 tests. The numbers of hysterectomies performed at each hospital and reported by residents were compared using analysis of variance.

Results

A total of 5894 hysterectomies were identified. The rates and numbers of hysterectomies performed using each type of surgical approach are given for Hospital A (Table 1) and Hospital B (Table 2). At Hospital A, a significant change in surgical approach was noted by year ($p < .001$). In 2005–2006, 86.6% of hysterectomies were performed abdominally, compared with 62.9% in 2007–2008 and 36.9% in 2009–2011 at Hospital A. The proportion of hysterectomies performed robotically increased from 0% in 2005–2006 to 24.3% in 2007–2008 and 52.1% in 2009–2011. The proportion of cases performed vaginally remained stable. The rate of laparoscopic hysterectomies decreased, but accounted for a small percentage of hysterectomies throughout the study.

The number of hysterectomies performed during each time period differed significantly, with more cases performed in recent years ($p = .04$). The number of vaginal ($p = .003$) and robotic ($p = .03$) hysterectomies was also higher in more recent years, but the number of abdominal hysterectomies decreased ($p = .04$). The number of laparoscopic hysterectomies did not change.

At Hospital B, a significant change in surgical approach by year was also noted, with the proportions of vaginal and laparoscopic hysterectomies increasing and of abdominal hysterectomies decreasing ($p < .001$). The absolute number of hysterectomies remained unchanged, with an increase in vaginal hysterectomies ($p = .02$) while the number of other surgical approaches remained stable.

Figure 1 shows hysterectomy trends at Hospital A vs Hospital B. The number of robotic cases increased sharply at Hospital A after acquisition of the robotic surgical system. The number of abdominal hysterectomies decreased at both hospitals, and the number of vaginal hysterectomies increased at both hospitals. The number of laparoscopic hysterectomies steadily increased at Hospital B but did not change at Hospital A. More hysterectomies were performed at Hospital B before acquisition of the robotic surgical system and during the first 3 years after Hospital A acquired the robotic surgical system. However, at 4 to 5 years after acquiring the robotic surgical system, more hysterectomies were performed at Hospital A (Fig. 2).