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Laparoscopic Hysterectomy Outcomes: Hospital vs Ambulatory Surgery Center

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ABSTRACT

Background and Objective: Compare operative outcomes of laparoscopic hysterectomy in an outpatient hospital setting versus freestanding ambulatory surgery center.

Methods: Retrospective cohort study of two groups in an outpatient hospital surgery department and freestanding ambulatory surgical center, both serving the Washington, DC area. Women, 18 years or older, who underwent laparoscopic hysterectomy for benign conditions in an outpatient hospital setting between 2011 and 2014 (n = 821), and at an ambulatory surgery center between 2013 and 2017 (n = 1210). Laparoscopic hysterectomy with retroperitoneal dissection and early ligation of the uterine arteries at the origin, performed by gynecologic surgical specialists from a single practice. Patient characteristics, medical history, uterine weight, pathology, operating times, estimated blood loss, and complications were analyzed.

Results: The mean uterine size between settings was not significantly different (Ambulatory Surgery Center, 349.4 g; Hospital, 329.7 g). The largest uteri removed at the surgery center was 3500 g; at the hospital it was 2489 g. The surgery center had a shorter average operating time than the hospital (53.7 and 61.3 minutes, respectively; $P < .001$). Intraoperative and postoperative complication rates were not significantly different between settings (2.7% and 3.7%, surgery center; 2.1% and 4.8%, hospital). There were two hospital transfers from the surgery center: 1 for blood transfusion, and 1 for low oxygen saturation. Same-day discharge occurred in 99.8% of surgery center patients versus 88% hospital patients.

Conclusions: Laparoscopic hysterectomy can be performed safely and effectively by skilled surgeons at a freestanding ambulatory surgery center, even in complex cases with large uteri.

Key Words: Arteries, Ligation, Regression, Retroperitoneal, Uterine.

INTRODUCTION

The first Ambulatory Surgery Center (ASC) opened in 1970. Today, there are more than 5400 ASCs in the United States, accounting for nearly 35% of all surgeries performed in the United States and approximately 10% of surgical revenue.[1,2] ASCs have demonstrated advantages over hospital-based outpatient surgery, such as improved patient accessibility, on-time scheduling, customized surgical environments, highly efficient surgical teams, shorter operative and facility times, lower costs, less potential exposure to nosocomial infections, and intensified quality control processes.[3–8] The advantages of an ASC have resulted in a migration of surgical procedures from the hospital to the ambulatory setting. The specialty categories of gastrointestinal, ophthalmology, pain management, orthopedic, and genitourinary currently constitute over 70% of all procedures performed at ASCs.[9]

Advances in technology and more emphasis on laparoscopic techniques in residency have enabled the shift in gynecological surgery from the inpatient to the outpatient setting, with 13.3% of hysterectomies performed as an outpatient procedure in 2008 vs 57.5% in 2014.[10] This shift

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Informed consent: Dr. van der Does declares that written informed consent was obtained from the patient/s for publication of this study/report and any accompanying images.

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is paralleled by a substantial increase in minimally invasive surgery, including laparoscopic hysterectomy. This changing landscape of gynecologic surgery has set the stage for further migration to the ASC setting.

Nezhat et al[11] published a retrospective review of 134 patients who underwent advanced gynecologic laparoscopic surgery at 3 freestanding ASCs over a year-long period in 2010–2011, which demonstrated that these procedures could be safely performed with a high rate of same-day discharge and low unplanned readmission rate.

Although laparoscopic hysterectomy is commonly performed as outpatient surgery, only an estimated 1% of all hysterectomies are performed at an ASC.[12] As the procedure involves the extensive vascular network inside the peritoneal cavity, the main concerns about performing hysterectomy at an ASC without hospital support are the risk of bleeding complications, visceral injury, and postoperative hospitalization.

During laparoscopic hysterectomy, the uterine vessels are typically identified and cauterized at the isthmo-cervical region of the uterus. However, pelvic pathology such as fibroids, endometriosis, adhesions from previous pelvic surgeries, or ovarian remnants can distort anatomy and pose additional technical challenges during laparoscopic hysterectomies. A retroperitoneal laparoscopic approach, with early ligation of the uterine artery at its origin at the anterior branch of the internal iliac artery, was originally described by Köhler et al[13] and Roman et al[14] as a technique to control blood loss and protect the ureter, even in cases with large uteri. The retroperitoneal dissection required for this technique may also help prevent other visceral injuries by allowing full visualization and lateralization of the ureters.[15–17] A randomized study of 400 patients showed shorter operative time and significantly less blood loss in patients who underwent uterine artery ligation at the origin versus the isthmo-cervical region.[18]

The laparoscopic retroperitoneal hysterectomy (LRH) performed in this study is a variation of a total laparoscopic hysterectomy, with the distinguishing aspect of a standard retroperitoneal dissection, lateralization of the ureters, and early ligation of the uterine artery at its origin from the anterior division of the internal iliac artery.[19–21] Our objective was to compare patient characteristics and operative outcomes of women undergoing LRH in a hospital outpatient department (Hospital) versus a freestanding ambulatory surgery center (ASC).

MATERIALS AND METHODS

A retrospective review of all outpatient LRH cases performed at a high-volume community hospital by a single private-practice gynecology group from January 1, 2011 through December 31, 2014 was compared to all LRH cases performed by the same practice at a freestanding ASC from October 1, 2013 through October 1, 2017. This practice consists of a fellowship-trained minimally invasive gynecologist and a gynecologic oncologist, who individually performed each the procedures evaluated in the study. The ASC in this review first opened on October 1, 2013, dictating the commencement date of the ASC data collection. The ASC is Medicare certified and is accredited by the Accreditation Association for Ambulatory Health Care. Distribution of patients to either ASC or Hospital was determined solely by patients' insurance. On the rare occasion, cases were scheduled at the Hospital for patients with high-risk comorbidities, including severe anemia and body mass index >60 kg/m^2. All women in this study were 18 years or older, nonpregnant, with benign indications for surgery. The type of hysterectomy performed in all cases was an LRH, performed by one of the two surgeons, as described in detail below.

LRH Technique

We provide here the most important technical principles of the LRH technique for benign gynecologic surgery as described in the operative reports. First, a uterine manipulator is inserted to allow for mobility. The hysterectomy is initiated by transecting the round ligament and entering the retroperitoneal space. The paravesical and pararectal spaces are completely developed and the vital structures are identified. The uterine artery is then ligated at its origin using the Harmonic Scalpel. A defect is made in the posterior leaf of the broad ligament, which lateralizes the ureter and aids in isolating the infundibulopelvic ligament. The anterior leaf of the broad ligaments is then opened on each side to create a bladder flap that is carried through to the midline along the vesicouterine peritoneum. The anterior vaginal fornix is delineated using a simple sponge stick, and a colpotomy is created using the Harmonic Scalpel. The uterus is then extracted vaginally, and if needed in cases of large specimen, via extraperitoneal vaginal debulking techniques using sharp dissection. No electric morcellation is used. The vaginal cuff is closed transvaginally.

Prior to surgery, postoperative instructions were reviewed in detail with the patient. After surgery, patients in the ASC were discharged home within 2–3 hours of the end of

their procedure. Pain management regimen included preoperative acetaminophen, Intravenous (IV) narcotics intraoperatively and in the post-anesthesia care unit, and patients were discharged home with oral narcotics and ibuprofen.

Patients requiring transfer from the ASC to the hospital are transported via local medical transport company, with which the ASC has an agreement, at the expense of the ASC. The emergency department is contacted before transport to alert of the incoming patient, and patients are transported directly to one of 3 local hospitals, all located within 10 miles of the ASC.

Postoperative phone calls were made by Hospital and ASC staff on the day after discharge. If the patient was not able to be reached, a follow-up phone call was made until the patient was reached or until postoperative day 7. All patients were scheduled for a 2-week postoperative visit.

Cases with concomitant procedures frequently performed during a hysterectomy were included in the study, such as adnexal surgery (salpingectomy, oophorectomy, ovarian cystectomy), adhesiolysis, cystoscopy, or other (ureterolysis, repair of incidental minor surgical injuries). Cases with major concomitant pelvic or abdominal surgery unrelated to the hysterectomy, such as appendectomy, cholecystectomy, hernia repair, and pelvic support procedures were excluded from the analysis. Patients with malignant indications for surgery were also excluded.

Clinical characteristics analyzed included age, race, weight, body mass index, prior medical/surgical history, uterine weight, and uterine pathology. The Elixhauser Comorbidity Index was used to identify and record comorbid conditions that have been shown to have a potential impact on clinical outcomes.[22]

Clinical outcomes evaluated included estimated blood loss, operative times, laparotomy conversion rate, and intraoperative and postoperative complications. Complications were categorized as intraoperative when they occurred and were recognized at the time of the procedure (intestinal injury, bladder injury, ureteral injury, vascular injury, and other operative injury). Complications that presented within 60 day of the hysterectomy were categorized as postoperative (wound complications, vaginal cuff dehiscence, pelvic abscess, venous thromboembolism, bacteremia/sepsis, blood transfusion, and emergency department visits for pain). Intraoperative complications and conversion to standard abdominal laparotomy (incision size greater than 5 cm) or minilaparotomy (incision size <5 cm) were identified from the operative notes. The medical charts were reviewed to identify postoperative complications that were reported when the patient was seen, evaluated, or admitted to the emergency department, hospital, or the office.

Statistical Analysis

Prior to inferential analyses, data were checked for potential outlier and aberrant measurements. Patient's demographic and clinical characteristics measured on a nominal or ordinal scale were summarized as counts and percentages, and compared between surgical settings using Pearson's χ^2 tests, whereas variables measured in the interval scale were summarized as means and standard deviations and compared across surgical settings using Student *t*-test.

Operative outcomes were compared between surgical settings with and without patient demographic and case complexity adjustments. We used median regression to model estimated blood loss and operative times because of concerns about non-normality of the dependent variable. Lengths of stay and the number of ports were compared using negative binomial regression. Dichotomous operative outcomes (intra-operative complications, postoperative complications, and conversions) were compared using Pearson's χ^2 tests.

The operative outcomes were also adjusted for age, race, number of previous abdominal surgeries, body mass index, number of comorbidities, weight, uterine size, and number of additional procedure. Logistic regression was used to model intra-operative, postoperative complications, and conversions. Negative binomial regression was used to model length of stay and number of ports. All statistical analyses were conducted with SPSS 21 (IBM Inc., Armonk, NY, USA). All statistical tests were 2-tailed at the $P < .001$ level.

RESULTS

A total of 1210 patients underwent LRH at the ASC and 821 patients at the Hospital. Age, weight, and body mass index were comparable between the groups. White patients were more likely to have surgery at the ASC (48.3%) than Black patients (29.5%). This difference did not exist in the Hospital group (46.4% White; 45.6% Black). No significant differences were noted in the Other group, which included Asian and Hispanic women (**Table 1**).

No statistically significant differences in mean uterine weights were noted between the surgical settings (ASC, 349.4 g; Hospital, 329.7 g). The largest uterus in the ASC

Table 1.
Patient Characteristics

	Setting		*P* Value
	Hospital	ASC	
N	821	1210	
	N (%)	N (%)	
Age group (years)			<.001
<40	150 (18.3)	280 (23.2)	
40–50	431 (52.5)	660 (54.6)	
51–60	174 (21.2)	220 (18.2)	
61–70	40 (4.9)	45 (3.7)	
>70	26 (3.2)	4 (0.3)	
Race			<.001
Black	374 (45.6)	357 (29.5)	
White	381 (46.4)	584 (48.3)	
Other	55 (6.7)	153 (12.7)	
Unknown	11 (1.3)	115 (9.5)	
No. of previous Ab surgeries			.0014
None	263 (32.0)	364 (30.1)	
1	278 (33.9)	365 (30.2)	
2	171 (20.8)	239 (19.8)	
>2	109 (13.3)	241 (19.9)	
No. of comorbidities			.120
None	205 (25.0)	278 (23.0)	
1	233 (28.4)	359 (29.7)	
2	158 (19.2)	287 (23.7)	
3	225 (27.4)	285 (23.6)	
Uterine size categories			.7817
≤250	468 (57.0)	681 (56.4)	
<250–500	176 (21.4)	260 (21.5)	
>500–750	79 (9.6)	131 (10.9)	
>750–1000	55 (6.7)	68 (5.6)	
>1000	43 (5.2)	67 (5.6)	
	Mean (SD)	Mean (SD)	
Age (years)	47.5 (9.4)	45.6 (7.7)	<.0001
Weight (kg)	79.9 (21.0)	79.8 (21.9)	.9006
BMI (m/k^2)	29.8 (7.3)	29.4 (7.8)	.3218
Uterine weight (g)	329.7 (335.9)	349.4 (364.8)	.2139

Ab, Abdominal; ASC, Ambulatory Surgery Center.

Table 2.
Pathology

Pathology	Setting	
	Hospital N (%)	ASC N (%)
N	821	1210
Leiomyoma	587 (71.5)	927 (76.6)
Adenomyosis	376 (45.8)	679 (56.1)
Endometriosis	69 (8.4)	223 (18.4)
Endometrial polyp	98 (11.9)	114 (9.4)
Ovarian cyst	114 (13.9)	172 (14.2)
Ovarian neoplasm	41 (5)	18 (1.5)
Endometrial intraepithelial neoplasia	12 (1.5)	19 (1.6)
Cervical intraepithelial neoplasia	6 (0.7)	14 (1.2)
Cervical cancer	2 (0.2)	2 (0.2)
Uterine sarcoma	0 (0)	0 (0)
Endometrial cancer	4 (0.5)	21 (1.7)
Fallopian tube cancer	1 (0.1)	0 (0)

ASC, Ambulatory Surgery Center.

setting was 3500 g, compared to 2489 g in the Hospital (**Table 1**). Uterine pathology was also similar in both groups, except for endometriosis, which was more prevalent at the ASC (**Table 2**).

There was no difference in the number of comorbidities between the ASC and Hospital settings, but the ASC group had a larger number of patients with 2 or more previous abdominal surgeries (**Table 1**). The ASC group had significantly shorter average anesthesia and surgery times (85.8 and 53.7 minutes, respectively) compared with the Hospital (97.4 and 61.3 minutes, $P < .001$) (**Table 3** and **Table 4**). The rate of intra-operative and postoperative complications between settings was not significantly different (ASC, 2.2% and 3.3%; Hospital, 2.1% and 3.4%). There was one postoperative blood transfusion in each group. There was one conversion to standard abdominal laparotomy in the ASC group, and no conversions in the Hospital. In the former case, there were extensive bowel adhesions to uterus with injury to bowel during removal of fibroids, thus a laparotomy was required for a small-bowel resection and large-bowel repair (**Table 3**). This patient was discharged home the same day, but she was seen in the emergency department 3 days later for postoperative pain, and was admitted for a pelvic abscess requiring exploratory lap-

Table 3.
Operative Outcomes (Unadjusted Analysis)

	Setting				*P* Value
	Hospital		ASC		
	N	Mean (SD)	N	Mean (SD)	
Estimated blood loss (mL)	783	128.8 (141.7)	1178	121.3 (135.2)	.99
Length of stay (days)	821	0.2 (0.8)	1090	0.0 (0.0)	<.001
Total surgery time (minutes)	818	61.3 (30.4)	1185	53.7 (23.3)	<.001
Total anesthesia time (minutes)	819	97.4 (32.7)	1175	85.8 (31.3)	<.001
Number of ports	818	2.2 (0.5)	1192	2.3 (0.5)	.29
		No. (%)		No. (%)	
Intra-operative complications	821	18 (2.19)	1209	27 (2.23)	.95
Post-operative complication	821	28 (3.41)	1209	40 (3.31)	.90
Conversion to minilaparotomy	821	10 (1.22)	1209	22 (1.82)	.16
Conversion to laparotomy	821	0 (0.0)	1209	1 (.08)	N/A

ASC, Ambulatory Surgery Center.

Table 4.
Operative Outcomes (Adjusted Analysis)

	Setting		*P* Value
	Hospital	ASC	
Estimated blood loss (mL), Adj. Medians (95% CI)	105.4 (97.8–113.1)	89.6 (83.6–95.6)	.004
Length of stay (days), Adj. Medians (95% CI)	0.2 (0.2–0.3)	0.0 (0.0–0.0)	<.001
Total surgery time (min), Adj. Medians (95% CI)	56.5 (55.0–58.0)	48.8 (47.6–50.0)	<.001
Total anesthesia time (min), Adj. Medians (95% CI)	92.7 (91.0–94.4)	80.4 (79.1–81.7)	<.001
Number of ports, Adj. counts (95% CI)	2.3 (2.2–2.4)	2.2 (2.1–2.3)	.44
Intra-operative complications, % (95% CI)	4.0 (2.1–6.0)	2.7 (2.1–3.4)	.061
Post-operative complications, % (95% CI)	4.8 (2.8–6.8)	3.7 (2.8–4.6)	.077
Conversion to minilaparotomy, % (95% CI)	1.8 (0.7–3.0)	3.2 (2.2–4.1)	.10

Adjusted for age, race, number of previous abdominal surgeries, body mass index, number of comorbidities, weight, uterine size, and number of additional procedures.

Adj, Adjusted.

arotomy to rule out bowel perforation, which was excluded. The patient recovered without further complication.

The average length of stay in the outpatient Hospital group was 0.2 days, with 88% of patients discharged the same day of surgery. Postoperative pain was the primary reason for admission, followed by case delays, and inability to void. Other reasons for postoperative admission in order of frequency were patient request, postoperative nausea/vomiting, dizziness/sleepiness, postoperative anemia, abnormal electrocardiogram (EKG), hypotension, vaginal bleeding, incisional bleeding, and low oxygen saturation. There were two transfers to the hospital from the ASC; one was for blood transfusion, and the other for observation for low oxygen saturation, secondary to a history of obstructive sleep apnea. Both cases had uncomplicated resolutions.

All other ASC patients were discharged the same day of surgery (99.8%).

In the 60-day postoperative period for the ASC group, there were 4 visits to the emergency department for pain versus 6 visits for the Hospital group. There were 2 visits to the emergency department from the ASC group for nausea/vomiting. There were 22 ASC patients who were admitted to the hospital in the 60-day postoperative period, and 16 patients who were readmitted from the Hospital group. Reasons for hospital admission were similar between settings and included vaginal cuff dehiscence, abdominal wall hematoma, ileus, infection, pelvic abscess, pulmonary embolism, deep-vein thrombosis, and ureteral obstruction.

When the operative results were adjusted for age, race, number of previous abdominal surgeries, body mass index, number of comorbidities, weight, uterine size and number of additional procedures, there was only one difference from the unadjusted results (**Table 4**). The unadjusted average estimated blood loss between the ASC and Hospital was not significantly different (128.8 mL vs 121.3 mL; $P = .99$, respectively). However, the adjusted average estimated blood loss showed a statistically significant difference (ASC, 89.6 mL vs Hospital, 105.4 mL; $P = .004$).

DISCUSSION

The patient characteristics were similar in both groups, supporting the idea that LRH can be safely performed in a freestanding ASC where subspecialty backup and immediate blood transfusion capabilities do not exist. The low average estimated blood loss and transfusion rate across settings is evidence that the techniques inherent to LRH provide hemostasis, especially in patients who require extensive adhesiolysis, multiple concomitant procedures, and who are at higher surgical risk with comorbid conditions such as diabetes, hypertension, Chronic obstructive pulmonary disease (COPD), and obesity.

LRH also allows for the safe removal of large uteri. While the average uterine weight in each setting was not significantly different, the largest uteri removed at the ASC was over 1000 g larger than at the Hospital (3500 g vs 2489 g, respectively).

Surgeon experience remains an important factor in achieving successful clinical outcomes. Many studies show an association between high-volume surgeons and lower surgical complications, which is also linked to same-day discharge.[23] Unlike past studies emphasizing the feasibility of ASCs with proper patient selection, our data support the idea that laparoscopic hysterectomy can be performed safely in the hands of skilled surgeons using advanced laparoscopic techniques, even in patients with complex cases.

In addition, there was a significant difference in average anesthesia and operating times at the ASC compared to the Hospital. Anesthesia times at the ASC were 12 minutes shorter on average, and surgeons performed LRH 7 minutes faster than at the Hospital ($P < .001$). The faster times may be attributed in part to highly efficient surgical teams and processes at the ASC. Indeed, a retrospective study by Hair et al[5] across surgical specialties found significantly shorter perioperative times at freestanding ASCs compared to hospital-based outpatient surgery centers, and concluded the difference could be attributed to efficiency and patient selection. The shorter operative times at the ASC in our study may also reflect improvement in surgical practice over time, as the commencement of the Hospital data began 2 years before the opening of the ASC, with a subsequent overlap of 2 years from the respective settings.

While these differences in operative time may not be clinically significant, faster surgical times at the ASC and faster room turnover allow surgeons to perform a higher volume of cases. Cumulatively, these efficiencies can have a significant impact on the "bottom line," which makes performing gynecological surgery at ASCs economically attractive for the provider.

Because of the lower cost structure, ASCs are also able to provide lower-priced procedures to patients. Patients typically have lower copays for procedures performed at ASCs than for the same procedures performed at hospitals. Commercial payors also benefit as they are able to negotiate more favorable rates compared to the traditional hospital setting, which lowers their overall costs.

In today's value-based healthcare environment, the migration of minimally invasive gynecologic surgery from the hospital to the ASC setting is a natural step in an effort to control costs without sacrificing quality. The Government Accountability Office compared ASC cost data from 2004 with Hospital Outpatient Department (HOPD) costs and found that costs were, on average, lower in ASCs than in HOPDs (Government Accountability Office, 2006).[24] If half of eligible hospital surgeries were moved to ASCs, the savings could amount to $2.5 billion per year.[24]

While the cost savings creates a compelling argument in favor of the freestanding ambulatory surgery model, the convenience and personalized care is advantageous to

both the patient and provider. Surgeons have greater autonomy in ASCs than in a Hospital, enabling them to design customized surgical environments and hire specialized staff. ASCs also provide more expedient and efficient patient scheduling without the interruption of emergency cases, allowing the surgeon to perform a higher volume of cases in a shorter amount of time.

Limitations

The current study has several limitations. Its retrospective nature is limited by inherent selection bias. Although tests were conducted to ensure inter- and intra-rater reliability among data abstractors, the availability and accuracy of the medical records, as well as transcription errors, also remain intrinsic limitations. All hospital data on reoperation and readmittance within 60-day were collected; however, the total number of postoperative complications may be underreported, as patients with adverse events may have been seen in their physician's office or at a different hospital.

Additionally, the surgeons involved in this study are experienced, high-volume laparoscopic gynecologic specialists, who are especially proficient in the reported technique and may not represent the general experience of the surgical community.

Another limitation with the current study is the lack of data on costs. With the increasing emphasis on the value in healthcare, future studies comparing the surgical settings should include direct cost comparisons using a microcosting approach.

Further, while much of the conversation has centered around outcomes and costs, it is imperative that discussions comparing surgical settings also consider the experience of the most central player: the patient. Future studies should incorporate measures of the patient experience, from the waiting room to the care received pre- and postoperatively.

Strengths

To our knowledge, this is one of the largest combined retrospective studies on hysterectomy. It is also the only study to compare operative outcomes of the LRH approach across ASC and Hospital settings. This study also evaluates the outcomes of only 2 surgeons, which minimizes any variations in operative technique and preop/postop management, allowing for a comparison primarily based on setting alone.

CONCLUSION

While gynecologic surgery has made a marked shift from inpatient to outpatient surgery, it is not commonly performed in the freestanding ASC setting. This study adds to the growing evidence that advanced laparoscopic gynecologic surgery can be safely performed in an ambulatory surgical center, with no significant difference in complication rates when compared to patients undergoing the same procedure by the same surgeons in an outpatient hospital setting. As more studies confirm the safety of gynecologic surgery in an ambulatory setting, ASCs are poised to become the new frontier in minimally invasive gynecology.

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