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Postoperative Readmissions Following Laparoscopic and Abdominal Hysterectomy: A Comparison

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ABSTRACT

Objective: To quantify the readmission rates for total laparoscopic and total abdominal hysterectomy, as well as identify preoperative, intraoperative, and postoperative risk factors for readmission within 6 weeks of surgery.

Methods: A retrospective comparative study was performed using a departmental database to identify all readmissions following total laparoscopic and total abdominal hysterectomy and to assemble a control group. For each patient, the following data were systematically collected: surgery date, age, parity, body mass index, indications for surgery, type of procedure performed, uterine size, number of prior cesarean sections, number of prior laparoscopic abdominal surgeries, number of prior open abdominal surgeries, presence of adhesions at time of hysterectomy, diabetic status, operative time, postoperative hematocrit, intraoperative and postoperative complications, surgeon, use of postoperative antibiotics, postoperative day readmitted, reason for readmission, length of readmission, and whether the patient returned to the operating room during the readmission.

Results: From January 1, 2000 to April 1, 2007, 1,576 total abdominal and 1,198 total laparoscopic hysterectomies were performed at Ochsner Medical Center. Of these, 19 abdominal and 31 laparoscopic hysterectomy patients were readmitted within 6 weeks of surgery. Our control groups consisted of 84 laparoscopic and 53 abdominal hysterectomy patients. A statistically significant difference in readmission rates (1.2% following abdominal hysterectomy vs. 2.7% following laparoscopic hysterectomy) was identified. No correlation between readmission and operative time, adhesive disease, diabetic status, prior cesarean sections, prior open or laparoscopic procedures, postoperative antibiotic use or postoperative hematocrit could be identified. Compared to those undergoing abdominal hysterectomy, those undergoing laparoscopic hysterectomy had more readmissions due to cuff dehiscence and cuff cellulitis for ($p = 0.0146$), which is a previously recognized complication of total laparoscopic hysterectomy. We were unable to identify any significant difference in postoperative day of readmission, length of readmission, or return to operating room.

Conclusion: Further investigation would benefit from an expanded study group, which may result in identification of some significance of the studied factors that were not able to be identified in this study.

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INTRODUCTION

Over 600,000 patients in the United States undergo hysterectomy every year (1). For over 190 years, the major approaches to hysterectomy centered around various abdominal and vaginal routes, as pioneered by Langenbeck in 1813 and Burnham in 1853 (2). However, following Reich's report of the first total laparoscopic hysterectomy (TLH) in 1989 (3), gynecologists found themselves armed with a powerful new surgical tool that promised patients greater choice and minimized surgical invasion. It is now generally recognized that TLH is a viable alternative to total abdominal hysterectomy (TAH), resulting in less blood loss, lower morbidity rate, less analgesic administration, decreased hospital stay, and shortened recovery period (1,4). This shortened recovery period has also been associated with earlier resumption of daily activities (5,6) as well as lower societal costs (7). However, investigators suggest that this comes at the expense of increased operative time when compared to TAH (4,8), a greater incidence of bladder injury, and higher procedural costs (6).

While one long-term study has shown similar frequencies of vaginal vault prolapse, cysto/rectocele, and enterocele occurrence between laparoscope-assisted vaginal hysterectomy and TAH over 8 years of follow-up (9), almost no medical literature is available comparing readmissions following TLH and TAH. Quantification of the readmission rate, as well as

determination of the causal events of readmission, may give additional tools when the physician is providing informed consent and selecting the route of hysterectomy. This study examined and compared postoperative readmissions at Ochsner Medical Center. We also investigated whether a variety of preoperative, intraoperative, and postoperative factors alter the risk of readmission.

MATERIALS AND METHODS

Retrospective Study Design

The database of the Obstetrics and Gynecology Department at Ochsner Medical Center was used to identify all TAHs and TLHs performed from January 1, 2000, to April 1, 2007, including those patients who were readmitted. Study and control cases were limited to benign pathology cases and surgeries where only TAH/TLH with or without bilateral salpingoophorectomy was performed. Inclusion criteria also included a cutoff date for readmission of 6 weeks following the date of initial surgery. Our control group was selected by taking the date of initial surgery for each patient in the readmitted group and selecting the last case immediately prior to the surgery performed by that surgeon, and the first two cases immediately following the surgery performed by that surgeon. A ratio of 3:1 for control to study group was used.

For each patient in the study group, the following data were systematically entered into a spreadsheet: surgery date, age, parity, body mass index (BMI), indications for surgery, type of procedure performed, uterine size, number of prior cesarean sections, number of prior laparoscopic abdominal surgeries, number of prior open abdominal surgeries, whether adhesions were present at time of hysterectomy, diabetic status, operative time, postoperative hematocrit, intraoperative and postoperative complications, surgeon, use of postoperative antibiotics, postoperative day readmitted, reason for readmission, length of readmission, and whether return to the operating room during the readmission was necessary. The same information, excluding readmission data, was collected for the control group.

BMI for both groups was calculated as weight in kilograms divided by height in meters squared. Indications for hysterectomy included symptomatic uterine fibroids, abnormal uterine bleeding, pelvic/ovarian mass, chronic pelvic pain, postmenopausal bleeding, uterine prolapse, carcinoma in situ, BRCA ½ gene mutations, and combinations of these factors. For statistical analysis, these were condensed to Bleeding, Mass, Pain or Other. Procedure type was condensed to TAH with or without bilateral salpingoophorectomy, or TLH with or without bilateral salpingoophorectomy. Uterine size was measured in grams and determined from the pathology report. Total number of laparoscopic and open abdominal procedures included all surgeries requiring entrance into the peritoneal cavity, regardless of etiology. The presence of adhesions was determined from the operative note, and postoperative hematocrit was measured on postoperative day 1. Intraoperative complications included bleeding, bowel injury, cystotomy, and conversion. Postoperative complications included ileus, fever, anemia requiring transfusion, deep vein thrombosis, abscess or other infection, poor diabetic control, and pulmonary issues. All patients receiving postoperative antibiotics, regardless of etiology, were recorded. For the study group, reasons for readmission included ileus, cuff cellulitis or abdominal wound infections with or without dehiscence, abscess formation or fever of unknown origin, vaginal bleeding, unrecognized bowel or bladder injury, retained laparotomy sponges, or other medical problems.

A total of 12 surgeons from Ochsner Health System had cases that were eligible for inclusion in this study. All of these cases utilized a resident physician as first assistant.

Statistical Analysis

The data were analyzed using the ANOVA procedure and frequency analysis to compare the following groups: TAHs not readmitted, TAHs readmitted, TLHs not readmitted and TLHs readmitted. Correlation analyses were performed to identify associations between various factors and readmission. Finally, the chi square test, t test, and means and frequencies/percentages were used for the remaining analyses. P values of <0.05 were considered statistically significant.

RESULTS

Examination of Risk Factors

From January 1, 2000 to April 1, 2007, 1,576 TAHs and 1,198 TLHs were performed at Ochsner Medical Center. Of these, 19 TAH patients and 32 TLH patients were readmitted within 6 weeks of surgery. Information on all readmitted patients was available except for one TLH patient whose medical record was misplaced. Our control groups consisted of 96 TLH and 57 TAH patients, with medical records available for 84 and 53 patients, respectively.

The difference in the readmission rate for TAH (1.2%) and for TLH (2.7%) was statistically significant ($p = 0.0044$). In an effort to identify risk factors for readmission, the ANOVA procedure and frequency analysis were used to identify whether a statistically

significant difference existed between the following groups when compared by the following variables:

Groups	Variables
TAH readmitted	age
TAH not readmitted	parity
TLH readmitted	BMI
TLH not readmitted	indications for hysterectomy
	adhesions
	prior cesarean section
	prior open procedure
	prior laparoscopic procedure
	diabetic status
	postoperative antibiotics
	postoperative hematocrit
	uterine size
	operative time
	intraoperative complications
	postoperative complications
	initial hospital stay

Results shown in Table 1 demonstrate a statistically significant difference in age between the two groups. Patients undergoing TAH tended to be older than those who underwent TLH. When broken down into the above four categories, Table 2 shows a statistically significant 9.91-year mean age difference between the TAH readmitted category and the TLH readmitted category. However, there is no significant difference when patients readmitted were compared to the control group for their specific procedure. No significant differences were noted for parity or BMI. Similarly, no difference existed for surgical indication (Fig. 1).

The number of adhesions was statistically higher in the TAH readmitted group compared to the TLH readmitted group ($p = .0353$), indicating that more patients readmitted following TAH had adhesive disease documented at the time of surgery than did those readmitted following TLH. However, no significant difference between readmitted patients compared to their specific control group was noted, and no difference existed between TAH not readmitted and TLH not readmitted.

There was no difference between the groups for prior cesarean section or for laparoscopic procedures. A statistically significant difference ($p = 0.0007$) existed between TAH not readmitted and TLH not readmitted for open procedures, indicating that patients undergoing TAH have more prior open surgical procedures than do those undergoing TLH. Again, no difference existed when readmitted patients were compared to their specific control groups.

No significant difference was noted in diabetic status between those readmitted and the control groups. The difference in postoperative antibiotic use was statistically significant between both the TAH and TLH readmitted groups, as well as between the TAH and TLH not readmitted groups. However, the difference was not significant when the readmitted groups were compared to their respective controls. Postoperative hematocrit was shown to have no difference between the groups. Uterine size was found to be statistically different between the control groups, with no significant difference identified between control and study groups. Means for uterine size and postoperative hematocrit are found in Table 2.

Table 1. ANOVA, Frequency Analysis.

Variable	P value	Difference among groups	Test
Age	0.0008	Yes	ANOVA
Parity	NS	No	ANOVA
Body mass index	0.0233	No	ANOVA
Indication	NS	No	Frequency
Adhesions	0.0353	Yes	Frequency
Prior cesarean section	NS	No	Frequency
Prior open surgery	0.0007	Yes	Frequency
Prior laparoscopy	NS	No	Frequency
Diabetic status	NS	No	Frequency
Postoperative antibiotics	0.002	Yes	Frequency
Postoperative hematocrit	NS	No	Frequency
Uterine size	0.0019	Yes	ANOVA
Intraoperative complication	NS	No	Frequency
Postoperative complication	0.0174	Yes	Frequency

NS = not significant.

The differences in mean operative times for the groups were not statistically significant. Intraoperative and postoperative complications were condensed into the larger categories of bowel/bladder injury and bleeding for intraoperative complications, and anemia, infection, ileus, and fever for postoperative complications. No statistically significant difference existed between the groups for intraoperative complications. For postoperative complications, no statistically significant difference was identified between TAH readmissions and the TAH control group. However, differences in infection ($p = 0.0174$) and ileus ($p = 0.0034$) were statistically significant when TLH readmissions were compared with the TLH control group. No difference in length of initial hospital stay was identified between the readmitted study groups and their controls.

Correlation with Readmission

Results in Table 3 show no correlation between readmission and operative time, existence of adhe-

Table 2. Means Variable Analysis.

Group	Variable	Number	Mean	SD
TAH not readmitted	Age (y)	56	45.89	10.1
	Parity	56	1.77	1.66
	BMI	54	34.01	9.67
	Postoperative hematocrit (%)	56	31.64	4.83
	Operative time (min)	54	158.70	51.21
	Uterine size (g)	56	390.54	412.77
TAH readmitted	Age (y)	19	50.26	13.15
	Parity	19	1.74	1.33
	BMI	19	34.17	13.93
	Postoperative hematocrit (%)	19	32.83	3.85
	Operative time (min)	19	154.47	37.27
	Uterine size (g)	19	255.58	253.20
TLH not readmitted	Age (y)	89	43.95	6.74
	Parity	88	1.83	1.15
	BMI	85	30.08	7.17
	Postoperative hematocrit (%)	86	33.21	3.63
	Operative time (min)	85	151.03	38.08
	Uterine size (g)	89	214.79	167.38
TLH readmitted	Age (y)	32	40.34	7.73
	Parity	32	1.88	1.39
	BMI	31	29.52	7.97
	Postoperative hematocrit (%)	31	32.69	5.42
	Operative time (min)	31	166.45	46.85
	Uterine size (g)	32	229.34	191.78

TAH, total abdominal hysterectomy; TLH, total laparoscopic hysterectomy; BMI, body mass index.

sions, diabetic status, prior cesarean sections, prior open or laparoscopic procedures, postoperative antibiotic use, or postoperative hematocrit.

Examination of Readmissions

Mean initial hospital stay and length of readmission for each group are shown in Table 4. No significant difference was noted between TLH and TAH for length of readmission ($p = 0.2885$) or return to the operating room ($p = 0.1396$). As expected, there was a statistically significant difference in initial hospital stay between TLH and TAH ($p = 0.0001$) with TAH patients staying in the hospital twice as long as TLH patients.

Considerable variety existed for the indication for readmission: ileus, fever, vaginal bleeding, cuff cellulitis, cuff dehiscence, pelvic abscess, abdominal wound cellulitis, abdominal wound dehiscence, unrecognized bladder or small bowel injury, respiratory problems including pneumonitis/pneumonia, and oth-

Figure 1. Percent Comparison for Indication.

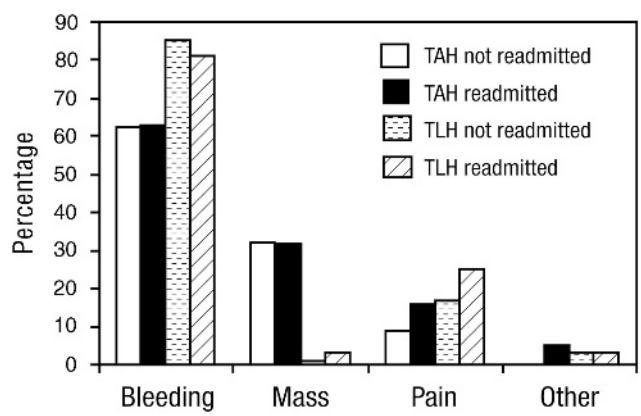


Table 3. Readmission Correlation.

Variable	P value
Operative time	0.1982
Adhesions	0.9406
Diabetic status	0.1178
Prior cesarean sections	0.2278
Prior open procedures	0.8306
Prior laparoscopic procedures	0.7525
Postoperative antibiotics	0.0655
Postoperative hematocrit	0.6884

Table 4. Mean Initial Hospital Stay and Length of Readmission.

Procedure	Time frame	Mean (days)	SD (days)
Overall	Initial hospital stay	1.97	1.47
	Length of readmission	4.30	3.07
Total abdominal hysterectomy (TAH)	Initial hospital stay	3.03	1.29
	Length of readmission	4.89	2.31
Total laparoscopic hysterectomy (TLH)	Initial hospital stay	1.31	1.16
	Length of readmission	3.94	3.44

Table 5. Infectious Versus Vaginal Cuff Problems in Readmission.

Procedure	% Infectious	% Vaginal Cuff
Total abdominal hysterectomy (TAH)	36.8	15.8
Total laparoscopic hysterectomy (TLH)	37.5	50.0
P value	0.9625	0.0146

er non-gynecologic medical problems (Fig. 2). When indications for readmission were pooled into infectious causes and vaginal cuff problems, no significant difference in infectious causes was found. However, there were statistically significantly more patients admitted for cuff problems following TLH than TAH ($p = 0.0146$) (See Table 5).

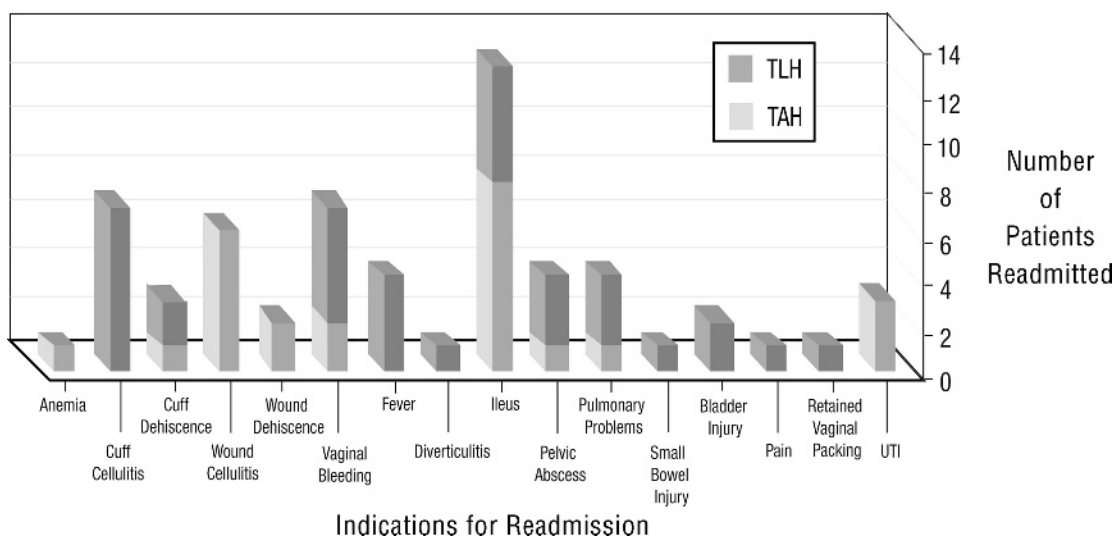
Nine of 31 TLH patients (29%) and two out of 19 (10.5%) TAH patients returned to the operating room (OR) during readmission. As previously noted, this was not statistically significant. TAH causes for return to OR were cuff dehiscence and profuse vaginal bleeding where the cuff was found to be intact. TLH causes for return to the OR were cuff dehiscence [3 patients], vaginal bleeding with intact cuff [3], vaginal cuff abscess [1], small bowel injury requiring resection [1], and unrecognized bladder injury requiring repair [1]. The mean and median day of readmission overall was postoperative day 9. The most frequent day of readmission was postoperative day 4 (range postoperative day 2 to postoperative day 34). On average, TAH patients were readmitted 10.5 days after surgery (median day 10), with TLH patients averaging 9.3 days after surgery (median day 8).

DISCUSSION

To control for surgeon-dependent variation in management we selected the control group in a 3:1 ratio based on the surgeon. Our goal was to eliminate or minimize any surgeon-related variations that would artificially alter variables such as operative time, length of initial stay, and threshold for readmission, as well as any variations in selection criteria to undergo one or the other procedure. However, in doing so, we eliminated our ability to determine whether surgeons were associated with readmission, as the percentage of cases in the readmission and control groups were identical.

The statistically significant difference between readmission rates of 1.2% for TAH and 2.7% for TLH was unexpected. One theory for this apparent increase in readmission of patients undergoing TLH is that problems or complications which may result in readmission have not yet manifested themselves by the time of discharge on postoperative day 1, and that the problems do manifest themselves prior to dis-

Figure 2. Indications for Readmission.



charge in patients undergoing TAH, resulting in earlier recognition, treatment, and, therefore, a delay in discharge. However, the results on readmission, including the average day of readmission being postoperative day 9 for patients undergoing TLH with a median readmission day of postoperative day 4, as well as no difference in length of initial hospital stay between the study and control groups, do not well support this theory. It is more likely that this discrepancy is solely due to vaginal cuff complications which dominate TLH readmissions, and a longer hospital stay would likely have no effect on detection or prevention of this postoperative complication.

The age difference of 9.9 years between TLH and TAH study groups was also unexpected. This difference is felt to be a selection bias within our study that was not initially recognized. While patients with neoplasia on pathology were excluded from the study, patients who underwent surgery by gynecologic oncologists for possible neoplasm and were subsequently found to have benign pathology, were included. This may have resulted in an artificial shift in age in relation to TAH, and indeed, examination of data from the same database utilizing only general gynecologic surgeons showed no difference in age between patients undergoing TLH and TAH in a previous study (J.P.J. et al, unpublished data, 2007).

A statistical significance for adhesive disease between the TAH readmitted and TLH readmitted categories, with no difference existing between either the control groups or the study groups in comparison to their controls, is of uncertain significance. This may represent a need to expand the control groups of the study, as some difference may surface between these two groups upon inclusion of more subjects. No specific conclusions can be drawn from this finding since the results between the categories are conflicting.

The finding of a statistically significant difference in open surgical procedures between the TLH and TAH control groups may represent a surgeon selection bias due to the patient's history, since no significant difference in adhesive disease was identified. This would be consistent with previous findings of no significant difference between TAH and TLH with respect to previous abdominal surgery (8).

We had expected to find that diabetes mellitus, as a known risk factor for postoperative infection, would be associated with an increased risk of readmission. However, this was not borne out. The finding of a difference in postoperative antibiotic use between TLH and TAH, though statistically significant, is of little clinical value, as antibiotic use did not correlate with readmission. Similarly, the finding of a difference in uterine weight between control groups is likely due to a selection bias, and no association with readmission was found.

We felt that longer operative time as a general predictor of case difficulty and/or intraoperative complications could possibly be associated with readmission. Again, this was not the case. No significant difference in operative time was noted between TLH and TAH, as in prior studies (8). Similarly, no differences in intraoperative complications were noted. The postoperative complications of ileus and infection were more common in patients readmitted following TLH than in the TLH control group. No difference was found for those readmitted following TAH compared to the TAH control group.

No correlation between readmission and operative time, existence of adhesions, diabetic status, prior cesarean sections, prior open or laparoscopic procedures, postoperative antibiotic use, or postoperative hematocrit could be identified. Examination of the indications for readmission showed more readmissions due to cuff dehiscence and cuff cellulitis for those undergoing TLH than those undergoing TAH, which is a previously recognized complication of TLH. We were unable to identify any significant difference in postoperative day of readmission, length of readmission, or return to the operating room.

CONCLUSION

We believe this to be a comprehensive review of possible risk factors for readmission following TAH and TLH. Unfortunately, no definitive conclusions can be drawn from the current results, as no significant differences relating to readmission were found. Further investigation would benefit from an expanded study group, which may result in identification of some significance of the factors that could not be identified in this study. This study was limited by the breadth of indications for readmission, some of which were nongynecologic. A larger study population would allow for improved selection criteria, eliminating postoperative readmissions that would be more likely related to pre-existing medical conditions than to previous surgery. Perhaps future reexamination of this question will lead to conclusions that will aid the gynecologist in the continual pursuit of improved patient outcomes and lead to minimization of postoperative complications and readmissions.

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