Comparison of Vaginal Cuff Closure Outcomes in Patients Having Robotic-assisted Total Laparoscopic Hysterectomy: V-Loc vs. Vicryl

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Objective: To determine the hospital charges and associated trends of robotic surgery (RS) in the United States.
Methods: All endometrial cancer patients who underwent surgery were identified from the National Inpatient Sample. Demographic, clinical, and hospital charges were analyzed using Chi-squared and multivariate analyses.
Results: Of 420 hospitals, the overall median hospital charge associated with robotic surgery (RS) was $35,248, which was comparable to laparoscopic (LS) $33,302 and open surgery (OS) $33,487 ($P = 0.12$). The variations in robotic hospital charges based on west, northeast, midwest, south were $39,143, $29,688, $35,241, and $43,501, respectively ($P < 0.01$), with corresponding utilization of 23%, 26%, 26%, and 25% ($P = 0.11$).The charges for RS were $35,754, $34,816, $36,742, and $34,188, respectively, in those with low, middle, upper middle, and high income based on zip code ($P = 0.03$). Over time, Jan- Apr, May-Aug, Sept-Dec, the median charge for RS decreased from $35,173 to $34,248 to $33,955 ($P > 0.01$). In a subset analysis limited to hospitals with RS programs, we found that the median charge of RS was $35,248 compared to $35,350 for LS and $35,558 for OS. Additionally, higher-volume hospitals (>20 surgeries/year) had lower charges associated with RS at $35,002 compared to $36,754 in lower-volume hospitals.
Conclusions: In this nationwide analysis of endometrial cancer patients, the overall charges associated with robotic surgery was comparable to those for laparoscopic and open surgery. Further, robotic surgery charges decreased over this short period and was lower in higher-volume hospitals.

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Ergonomic evaluation of gynecologic oncologists performing robotic surgery

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Objective: Surgeon strain has been evaluated to some degree in gynecologic oncologists who perform laparoscopic surgery but has not been evaluated in those who perform robotic surgery. This study sought to identify ergonomic stressors associated with using the Da VinciR robotic system.
Methods: After obtaining institutional review board exemption, robotic surgeons at a tertiary care center were observed and videotaped while operating. A human factors engineer experienced with health-care ergonomics analyzed the videotapes and provided ergonomic evaluations of the surgeons. An initial ergonomic assessment was performed using the Rapid Upper Limb Assessment (RULA) tool, an ergonomic assessment and prioritization method for determining posture, force, and frequency concerns with focus on the upper limbs, neck, and trunk. A more detailed subjective and objective analysis followed using the Strain Index (SI) tool.
Results: A total of 17 hours of video were analyzed and descriptive data based on RULA/SI analysis were determined (Table). Cycle time was the length of a surgeon's uninterrupted activity on the console during each video segment. Number of exertions was defined as the number of arm extensions and changes in wrist posture while operating. Ergonomic evaluation of surgeon activity resulted in mean RULA score of 6.46 (range, 6-7), indicating an immediate need for further investigation. The mean SI grand score was 24.34 (range, 10.12-40.5), indicating that current use of the surgical robot is hazardous and should be modified.
Conclusions: The data indicated ergonomics deficits at a high-volume robotics center, which are hazardous to surgeons and require urgent intervention. A training strategy is being developed to address these ergonomic issues and ergonomic training deficiencies.

Table. Job Variables.

Average cycle time in seconds (range)	Average Number of exertions per cycle (range)	% of the cycle time when arm is not rested	Average RULA scores	Average SI Scores
1,029 (108-3,001)	452 (57-1,453)	37% (8%-74%)	6.46 (6-7)	24.34 (10.12-40.5)

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Hospital characteristics associated with the utilization of robotic surgery in endometrial cancer

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Objective: To determine the association between hospital characteristics and utilization of robotic surgery (RS) in a nationwide study.
Methods: Data were obtained from the United States National Inpatient Survey in 2010. Hospital characteristics, including division of United States, location, volume, teaching status, and ownership, were extracted. Chisquare, t-test, ANOVA, and multivariate models were used for statistical analysis.
Results: Of 420 hospitals that reported surgeries for endometrial cancer, the average number of cases per year was 16 (range, 1-274). The proportion of hospitals in the south, midwest, west, and northeast were 31%, 28%, 22% and 20%, respectively. Seventy-seven percent of hospitals were in urban locations, 77% were considered higher-volume (>20 surgeries/ year) hospitals, 44% were teaching hospitals, and 80% were reported as privately owned. The overall utilization of RS was 24% compared to 12% for laparoscopic (LS) and 63% for open surgery (OS). Utilization of RS was higher in urban vs. rural (27% vs. 5%, $P < 0.01$), teaching vs. nonteaching (28% vs. 24%, $P = 0.02$), and private vs. public hospitals (29% vs.10%, $P < 0.01$). The mean length of stay (LOS) for RS was 3.8 days in public hospitals, 2.4 days in for-profit, and 1.4 in nonprofit ($P < 0.01$). There was no difference in RS LOS among low- and high-volume hospitals ($P = 0.39$), differing hospital locations ($P = 0.25$), and teaching status ($P = 0.29$). With respect to hospital charges, RS had the highest charge in private, for-profit hospitals ($57,540) compared with private nonprofit ($41,578) and public hospitals ($38,720). RS was associated with higher charges at teaching hospitals ($45,288) than non-teaching hospitals ($32,709) ($P < 0.01$).
Conclusions: In this nationwide analysis, the utilization of robotic surgery was higher in the midwest and in urban, teaching, and private hospitals. Further, the charges for robotic surgery were higher in private and teaching centers.

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Comparison of vaginal cuff closure outcomes in patients having robot- ic-assisted total laparoscopic hysterectomy: V-Loc vs. Vicryl

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Objective: To determine if the use of V-Loc suture for vaginal cuff closure following robotic-assisted total laparoscopic hysterectomy decreased the incidence of vaginal cuff dehiscence compared to Vicryl suture.
Methods: All patients who had completed robotic-assisted laparoscopic hysterectomy from 6/1/2008 to 12/31/2011 were identified through the institution's database. Those patients who underwent vaginal closure

with 2-0 V-Loc (unidirectional barbed suture) were retrospectively compared to the cohort that underwent vaginal cuff closure with 0-Vicryl (synthetic braided suture). Exclusion criteria included use of suture material other than 0-Vicryl or 2-0 V-Loc. The primary outcome measure was vaginal cuff dehiscence. Fisher's exact test was used for data analysis.
Results: Seven hundred thirty-two patients (328 in the 2-0 V-Loc group and 404 in the 0-Vicryl group) were analyzed. The incidence rate of vaginal cuff dehiscence among those with V-Loc suture was 0% ($n = 0/328$), while it was 0.82% ($n = 6/404$) among those with Vicryl suture ($P = 0.03568$). There was no correlation identified between vaginal cuff dehiscence and type of uterine manipulator used, body mass index, smoking habits, uterine size, or estimated blood loss.
Conclusions: Dehiscence of the vaginal cuff after robotic-assisted total laparoscopic hysterectomy is a rare but important and serious complication in gynecologic surgery. The use of 2-0 V-loc unidirectional suture to close the vaginal cuff following robotic-assisted laparoscopic hysterectomy may eliminate the problem of vaginal cuff dehiscence.

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Port-site metastases after robotic surgery for gynecologic malignancy

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Objective: To evaluate the outcomes of patients diagnosed with port-site metastases after robotic surgery for gynecologic malignancies.
Methods: After institutional review board approval was obtained, a retrospective chart review was conducted evaluating all patients undergoing gynecologic robotic surgery between 6/2006 and 10/2011. Patient demographics, medical/surgical histories, histology, treatments, disease-free survival, and overall survival were collected.
Results: A total of 681 patients were identified, and 418 (61.4%) were diagnosed with a gynecologic malignancy on final pathology. Five (1.2%) patients had a recurrence in a laparoscopic port site. The mean age of patients with a port-site metastasis was 69.2 years compared to a 56.9 years for patients without a portsite metastasis ($P = 0.2$). The average body mass index for patients diagnosed with port-site metastasis was 26.2 compared to 33.3 for all other patients ($P = 0.01$). All patients with port-site metastasis had endometrioid histology. Three patients were diagnosed with stage IB cancer, 1 had stage IA, and 1 had stage IIB. One patient underwent adjuvant therapy following her primary surgery, completing 3 cycles of taxane and platinum-based chemotherapy followed by whole pelvic radiation therapy and brachytherapy. The remaining patients received no adjuvant therapy. Port-site metastases were diagnosed in the right lateral port site in 2 patients, left lateral port in 1 patient, the midline camera port in 1 patient, and the accessory port in 1 patient. The disease-free survival was 6.2 months. Four patients (80%) had isolated recurrence and were treated with surgical resection followed by 6 cycles of taxane and platinumbased chemotherapy. The patient who previously completed adjuvant therapy was diagnosed with unresectable metastatic disease and was treated with doxorubicin and cisplatin. Four patients are alive with disease; 1 patient is dead of disease. The overall survival was 24.4 months (range, 14-29 months).
Conclusions: There is a low incidence of port-site metastases in patients undergoing robotic surgery for gynecologic malignancies. In patients with an isolated port-site recurrence, treatment with surgical resection followed by taxane and platinum-based therapy is a reasonable option.

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Vaginal cuff complications decreased in total robotic vs. laparoscopic hysterectomy in cancer and noncancer patients: Bidirectional barbed vs. conventional suture

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Objective: The literature suggests that vaginal cuff dehiscence is highest with robotic procedures (1%-4%). The purpose of this study was to compare vaginal cuff complications among patients undergoing total robotic hysterectomy (TRH) vs. total laparoscopic hysterectomy (TLH) and the effect of bidirectional barbed suture used to close the vaginal cuff.
Methods: A retrospective cohort study was performed that included women undergoing TRH and TLH from 2007 to 2011. Age; weight; body mass index (BMI); surgical procedure; estimated blood loss (EBL); and vaginal cuff complications, including dehiscence, deep vein thrombosis (DVT), and pulmonary embolism (PE), were evaluated. Student t-test and chi-square test were used to determine statistical significance (P value < 0.05).
Results: A total of 437 patient charts were evaluated, with 243TRH and194 TLH. There was statistically lower EBL (128 g vs. 179 g) and higher uterine weight (333 g vs. 184 g) among TRH. Overall vaginal cuff complications were less with TRH vs. TLH (1.83% vs. 2.74%, $P = 0.65$) but not statistically significant. Vaginal cuff dehiscence was lower among TRH vs. TLH but not statistically significant (0.23% vs. 1.14%, $P = 0.42$). Vaginal cuff complications were lower in cancer vs. noncancer patients but not statistically significant (0.68% vs. 2.74%, $P = 0.723$). Bidirectional barbed sutures were used more often during TRH (46%) than TLH (0). Vaginal cuff complications among the TRH closed with bidirectional barbed sutures (0.41%) were 6 and 12 times less compared to TRH (2.47%) or TLH closed with conventional suture (6.18%), respectively.
Conclusions: In our study, vaginal cuff complications were lowest overall after robotic hysterectomy. This finding appears to be related to the use of a bidirectional barbed suture, which decreased the risk by 6 to 12 times when compared to conventional suture.

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Translational Research/Basic Science

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Circulating endothelial progenitor cells in gynecologic cancer

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Objective: Tumor growth and metastasis are closely related to abnormal angiogenesis and neovascularization. The mechanisms of tumor angiogenesis are not clear, but recent studies have shown that circulating endothelial progenitor cells (EPCs) play an important role in the tumor angiogenic reaction. The aim of this study was to compare the levels of circulating EPCs between gynecologic cancer patients and healthy subjects and to test the hypothesis that the cancer treatment such as tumor debulking surgery or computer-controlled radiation therapy (CCRT) would help in lowering the levels of EPCs.
Methods: Tumor growth and metastasis are closely related to abnormal angiogenesis and neo-vascularization. The mechanisms of tumor angiogenesis are not clear, but recent studies have shown that circulating endothelial progenitor cells (EPCs) play an important role in the tumor angiogenic reaction. The aim of this study was to compare the levels of circulating EPCs between gynecologic cancer patients and healthy subjects, and to test the hypothesis that the cancer treatment such as tumor debulking surgery or CCRT would help in lowering the levels of EPCs.