High Level of Evidence (LOE) Publications

At Intuitive Surgical, our highest priority is and always has been to provide patient benefit – creating products that in a surgeon’s hands are safe, effective and minimally invasive.

Intuitive Surgical is pleased to highlight the attached compendium of clinical literature. With over 7,000 peer-reviewed, published studies and reports examining the use of the da Vinci® System in a wide variety of surgeries, the breadth and depth of literature regarding da Vinci Surgery is extensive. The following bibliography is based upon a PubMed and Scopus search for the following criteria:

- da Vinci robotic-assisted surgery publications
- High Level of Evidence (LOE) papers (see definitions below)
- Publications comparing da Vinci Surgery to open surgery

This list of publications will be updated and released on a quarterly basis.

High LOE Articles (Level 1, 1b and 2 a)

The following definitions are used to generate the above list of High LOE publications:

**Level 1:** Randomized Studies

1a) Systematic reviews* of Randomized Controlled Studies

1b) Randomized Controlled Trials (RCT)

**Level 2:** Higher Quality Comparison Studies

2a) Systematic reviews* of comparison studies only or independent database population studies

*includes meta-analysis studies

Definitions

Systematic Review (SR): A systematic review is a summary of the scientific literature that uses explicit methods to perform a comprehensive literature search and critical appraisal of individual studies and that uses appropriate statistical techniques to combine these valid studies.

Randomized Controlled Trial (RCT): An epidemiological experiment in which subjects in a population are randomly allocated into groups, usually called study and control groups, to receive or not receive an experimental preventive or therapeutic procedure, maneuver, or intervention. The results are assessed by rigorous comparison of rates of disease, death, recovery, or other appropriate outcome in the study.
and control groups. Generally, a very small sample sized (N < 25) or heterogeneous patient populations will result in a lower quality study.

While clinical studies support the use of the da Vinci® Surgical System as an effective tool for minimally invasive surgery for specific indications, individual results may vary. Risk specific to minimally invasive surgery may include a longer operative time, the need to convert to an open approach, or for additional or larger incision sites. We encourage patients and physicians to review all available information on surgical options and treatment in order to make an informed decision. Additional clinical studies are available through the National Library of Medicine at www.ncbi.nlm.nih.gov/pubmed.
Bibliography for high level LOE robotic publications
2008 - 4Q 2013 (includes da Vinci vs. open surgery)*

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*May include data from laparoscopic cohort (if all three surgical approaches exist in articles or MIS is not separated into laparoscopic or robotic surgery).

Cardiac ................................................................. (1)

Level 2a ................................................................. (1)

The mitral valve has been traditionally approached through a median sternotomy. However, significant advances in surgical optics, instrumentation, tissue telemanipulation, and perfusion technology have allowed for mitral valve surgery to be performed using progressively smaller incisions including the minithoracotomy and hemisternotomy. Due to reports of excellent results, minimally invasive mitral valve surgery has become a standard of care at certain specialized centers worldwide. This meta-analysis quantifies the effects of minimally invasive mitral valve surgery on morbidity and mortality compared with conventional mitral surgery and demonstrates equivalent perioperative mortality (1641 patients, odds ratio (OR) 0.46, 95% confidence interval 0.15-1.42, p = 0.18), reduced need for reoperation for bleeding (1553 patients, OR 0.56, 95% CI 0.35-0.90, p = 0.02) and a trend towards shorter hospital stays (350 patients, weighted mean difference (WMD) -0.73, 95% CI -1.52 to 0.05, p = 0.07). These benefits were evident despite longer cardiopulmonary bypass (WMD 25.81, 95% CI 13.13-38.50, p < 0.0001) and cross-clamp times (WMD 20.91, 95% CI 8.79-33.04, p = 0.0007) in the minimally invasive group. Case-control studies show consistently less pain and faster recovery compared to those having a conventional approach. Data for minimally invasive mitral valve surgery after previous cardiac surgery are limited but consistently demonstrate reduced blood loss, fewer transfusions and faster recovery compared to reoperative sternotomy. Long-term follow-up data from multiple cohort studies are also examined revealing equivalent survival and freedom from reoperation. Thus, current clinical data suggest that minimally invasive mitral valve surgery...
is a safe and a durable alternative to a conventional approach and is associated with less morbidity. © 2008.

**General Surgery**  (6)

**Level 2a**  (6)


OBJECTIVE: To perform a meta-analysis of eligible studies from multiple medical centers to assess the safety, feasibility, and efficacy of robotic-assisted pancreatectomy (RP). METHODS: We searched the electronic databases PubMed and EMBASE for studies comparing RP with laparoscopic pancreatectomy (LP) and open pancreatectomy (OP) for patients with pancreatic disease from June 2009 to June 2012. Continuous variables were pooled using the standardized mean difference (SMD) and odds ratio (OR), and dichotomous variables were pooled using the risk difference (RD) method. For all analyses, the 95% confidence interval (CI) was calculated. Three studies comparing RP and LP, and 4 studies comparing RP and OP were suitable for meta-analysis. RESULTS: Six published studies met the inclusion criteria. Our results showed that RP can reduce estimated blood loss and duration of hospitalization more than OP. For pancreatic fistula, there were no statistical differences between RP, OP, and LP, and no significant differences in intraoperative conversion rates between RP and LP. Robotic-assisted pancreatectomy may be able to increase microscopic negative margins of resection (R0) and spleen preserving rates. CONCLUSION: Robotic-assisted pancreatectomy was associated with increased R0 resection rates and spleen preserving rates than LP and OP. Moreover, RP can reduce estimated blood loss and duration of hospitalization more than OP. A robotic approach to pancreatectomy may be suited to patients with pancreatic disease.


OBJECTIVE: The aim of this systematic review is to determine the potential advantages of robotic distal pancreatectomy (RDP). STUDY SELECTION: Both randomized and non-randomized studies. DATA EXTRACTION: Two investigators independently selected studies for inclusion by article abstraction and full text reviewing. DATA SYNTHESIS: Five non-RCTs were included in the review. The feasibility of RDP (95.4%) and spleen-preserving rate is between 50% and 100%. Mean OT varied between 298 min and 398 min with only completely robotic procedures, whereas mean OT was 293 in "laparoscopic/robotic" technique. Postoperative length of hospital stay ranged from 7 days to 13.7 days. The 30-day postoperative overall morbidity resulted between 0 and 18% of patients. CONCLUSIONS: RDP is an emergent technology for which there are not yet sufficient data to draw definitive conclusions with respect to conventional or laparoscopic surgery. The mean duration of RDP is longer with Da Vinci robot, but hospital stay is shorter even if it is influenced by hospital protocols. We cannot make any conclusions comparing the outcomes to laparoscopic or open procedures here, since none of these studies are randomized, and we all know that most of these surgeons selected the easier cases for robotic procedures. For these reasons randomized controlled trials are recommended to better evaluate RDP cost-effectiveness.

Background Robot-assisted gastrectomy (RAG) has been developed in the hope of improving surgical quality and overcoming the limitations of conventional laparoscopically assisted gastrectomy (LAG) and open gastrectomy (OG) for gastric cancer. The aim of this study was to determine the extent of evidence in support of these ideals. Methods A systematic review of the three operation types (RAG, LAG and OG) was carried out to evaluate short-term outcomes including duration of operation, retrieved lymph nodes, estimated blood loss, resection margin status, technical postoperative complications and hospital stay. Results Nine non-randomized observational clinical studies involving 7200 patients satisfied the eligibility criteria. RAG was associated with longer operating times than LAG and OG (weighted mean difference 61.99 and 65.73 min respectively; P â 0A;circ·001). The number of retrieved lymph nodes and the resection margin length in RAG were comparable with those of LAG and OG. Estimated blood loss was significantly less in RAG than in OG (P = 0·002), but not LAG. Mean hospital stay for RAG was similar to that for LAG (P = 0·14). In contrast, hospital stay was significantly shorter, by a mean of 2-18 days, for RAG compared with OG (P < 0·001). Postoperative complications were similar for all three operative approaches. Conclusion Short-term oncological outcomes of RAG were comparable with those of the other approaches. LAG was a shorter procedure and less expensive than RAG. Future studies involving RAG should focus on minimizing duration of operation and reducing cost. Expensive, but no great advantage for robotics © 2013 British Journal of Surgery Society Ltd. Published by John Wiley & Sons Ltd.


PURPOSE: To define the role of robotic gastrectomy for the treatment of gastric cancer, the present systematic review with meta-analysis was performed. MATERIALS AND METHODS: A comprehensive search up to July 2012 was conducted on PubMed, EMBASE, and the Cochrane Library. All eligible studies comparing robotic gastrectomy versus laparoscopic gastrectomy or open gastrectomy were included. RESULTS: Included in our meta-analysis were seven studies of 1,967 patients that compared robotic (n=404) with open (n=718) or laparoscopic (n=845) gastrectomy. In the complete analysis, a shorter hospital stay was noted with robotic gastrectomy than with open gastrectomy (weighted mean difference: -2.92, 95% confidence interval: -4.94 to -0.89, P=0.005). Additionally, there was a significant reduction in intraoperative blood loss with robotic gastrectomy compared with laparoscopic gastrectomy (weighted mean difference: -35.53, 95% confidence interval: -66.98 to -4.09, P=0.03). These advantages were at the price of a significantly prolonged operative time for both robotic gastrectomy versus laparoscopic gastrectomy (weighted mean difference: 44.22 to 83.17, P<0.00001) and robotic gastrectomy versus open gastrectomy (weighted mean difference: 95.83, 95% confidence interval: 54.48 to 137.18, P<0.00001). Analysis of the number of lymph nodes retrieved and overall complication rates revealed that these outcomes did not differ significantly between the groups. CONCLUSIONS: Robotic gastrectomy for gastric cancer reduces intraoperative blood loss and the postoperative hospital length of stay compared with laparoscopic gastrectomy and open gastrectomy at a cost of a longer operating time. Robotic gastrectomy also provides an oncologically adequate lymphadenectomy. Additional high-quality prospective studies are recommended to better evaluate both short and long-term outcomes.

Since its introduction in 1997, robotic surgery has overcome many limitations, including setup costs and surgeon training. The use of robotics in general surgery remains unknown. This study evaluates robotic-assisted procedures in general surgery by comparing characteristics with its nonrobotic (laparoscopic and open) counterparts. Weighted Healthcare Cost and Utilization Project Nationwide Inpatient Sample data (2008, 2009) were used to identify the top 12 procedures for robotic general surgery. Robotic cases were identified by Current Procedural Terminology codes 17.41 and 17.42. Procedures were grouped: esophagogastric, colorectal, adrenalectomy, lysis of adhesion, and cholecystectomy. Analyses were descriptive, t tests, chi(2)s, and logistic regression. Charges and length of stay were adjusted for gender, age, race, payer, hospital bed size, hospital location, hospital region, median household income, Charlson score, and procedure type. There were 1,389,235 (97.4%) nonrobotic and 37,270 (2.6%) robotic cases. Robotic cases increased from 0.8 per cent (2008) to 4.3 per cent (2009, P < 0.001). In all subgroups, robotic surgery had significantly shorter lengths of stay (4.9 days) than open surgery (6.1 days) and lower charges (median $30,540) than laparoscopic ($34,537) and open ($46,704) surgery. Fewer complications were seen in robotic-assisted colorectal, adrenalectomy and lysis of adhesion; however, robotic cholecystectomy and esophagogastric procedures had higher complications than nonrobotic surgery (P < 0.05). Overall robotic surgery had a lower mortality rate (0.097%) than nonrobotic surgeries per 10,000 procedures (laparoscopic 0.48%, open 0.92%; P < 0.001). The cost of robotic surgery is generally considered a prohibitive factor. In the present study, when overall cost was considered, including length of stay, robotic surgery appeared to be cost-effective and as safe as nonrobotic surgery except in cholecystectomy and esophagogastric procedures. Further study is needed to fully understand the long-term implications of this new technology.


BACKGROUND: Robotic surgery is gaining momentum with advantages for minimally invasive management of pancreatic diseases. The objective of this meta-analysis is to compare the clinical and oncologic safety and efficacy of robotic versus open pancreatectomy. METHODS: A systematic review of the literature was performed to identify studies comparing robotic pancreatectomy and open pancreatectomy. Postoperative outcomes, intraoperative outcomes, and oncologic safety were evaluated. Meta-analysis was performed using a random-effect model. RESULTS: Seven studies matched the selection criteria, including 137 (40 %) cases of robotic pancreatectomy and 203 (60 %) cases of open pancreatectomy. None of the included studies were randomized. Overall complication rate was significantly lower in robotic group [risk difference (RD) = -0.12, 95 % confidence interval (CI) -0.22 to -0.01, P = 0.03], as well as reoperation rate (RD = -0.12; CI -0.2 to -0.03, P = 0.006) and margin positivity (RD = -0.18; 95 % CI -0.3 to -0.06, P = 0.003). There was no significant difference in postoperative pancreatic fistula (POPF) incidence and mortality. The median (range) conversion rate was 10 % (0-12 %). CONCLUSIONS: The results of this meta-analysis suggest that robotic pancreatectomy is as safe and efficient as, if not superior to, open surgery for patients with benign or malignant pancreatic diseases. However, the evidence is limited and more randomized controlled trials are needed to further clearly define this role.

**INTRODUCTION AND HYPOTHESIS:** The aim was to review the safety and efficacy of pelvic organ prolapse surgery for vaginal apical prolapse. METHODS: Every 4 years and as part of the Fifth International Collaboration on Incontinence we reviewed the English-language scientific literature after searching PubMed, Medline, Cochrane library and Cochrane database of systematic reviews, published up to January 2012. Publications were classified as level 1 evidence (randomised controlled trials [RCT] or systematic reviews), level 2 (poor quality RCT, prospective cohort studies), level 3 (case series or retrospective studies) and level 4 case reports. The highest level of evidence was utilised by the committee to make evidence-based recommendations based upon the Oxford grading system. Grade A recommendation usually depends on consistent level 1 evidence. Grade B recommendation usually depends on consistent level 2 and or 3 studies, or "majority evidence" from RCTs. Grade C recommendation usually depends on level 4 studies or "majority evidence from level 2/3 studies or Delphi processed expert opinion. Grade D "no recommendation possible" would be used where the evidence is inadequate or conflicting and when expert opinion is delivered without a formal analytical process, such as by Delphi. RESULTS: Abdominal sacral colpopexy (ASC) has a higher success rate than sacrospinous colpopexy with less SUI and postoperative dyspareunia for vault prolapse. ASC had greater morbidity including operating time, inpatient stay, slower return to activities of daily living and higher cost (grade A). ASC has the lowest inpatient costs compared with laparoscopic sacral colpopexy (LSC) and robotic sacral colpopexy (RSC). LSC has lower inpatient costs than RSC (grade B). In single RCTs the RSC had longer operating time than both ASC and LSC (grade B). In small trials objective outcomes appear similar although postoperative pain was greater in RSC. LSC is as effective as ASC with reduced blood loss and admission time (grade C). The data relating to operating time are conflicting. ASC performed with polypropylene mesh has superior outcomes to fascia lata (level I), porcine dermis and small intestine submucosa (level 3; grade B). In a single RCT, LSC had a superior objective and subjective success rate and lower reoperation rate compared with polypropylene transvaginal mesh for vault prolapse (grade B). Level 3 evidence suggests that vaginal uterosacral ligament suspension, McCall culdoplasty, iliococcygeus fixation and colpocleisis are relatively safe and effective interventions (grade C). CONCLUSION: Sacral colpopexy is an effective procedure for vault prolapse and further data are required on the route of performance and efficacy of this surgery for uterine prolapse. Polypropylene mesh is the preferred graft at ASC. Vaginal procedures for vault prolapse are well described and are suitable alternatives for those not suitable for sacral colpopexy.


**INTRODUCTION AND HYPOTHESIS:** The aim was to review the economic costs associated with pelvic organ prolapse surgery. METHODS: Every 4 years and as part of the Fifth International Collaboration on Incontinence we reviewed the English-language scientific literature after searching PubMed, Medline, Cochrane library and Cochrane database of systematic reviews, published up to January 2012. Publications were classified as level 1 evidence (randomised controlled trials [RCT] or systematic reviews), level 2 (poor quality RCT, prospective cohort studies), level 3 (case series or retrospective studies) and level 4 (case reports). The highest level of evidence was utilised by the committee to make evidence based recommendations based upon the Oxford grading system. Grade A recommendation usually depends on consistent level 1 evidence. Grade B recommendation usually depends on consistent level 2 and or 3 studies, or "majority evidence" from RCTs. Grade C recommendation usually depends on level 4 studies or "majority evidence" from level 2/3 studies or Delphi processed expert opinion. Grade D "no recommendation possible" would be used where the evidence is inadequate or conflicting and when expert opinion is delivered without a formal analytical process, such as by Delphi. RESULTS: The annual economic costs of pelvic organ prolapse surgeries are
significant and over the next decades will grow at twice the rate of population growth because of our aging population. In a single institution study vaginal reconstructive surgery and pessary use were more cost-effective than expectant management, traditional abdominal sacral colpopexy (ASC) or robot-assisted sacral colpopexy (RSC; grade C). Two studies have demonstrated that ASC incurs lower inpatient costs than LSC or RSC (grade C). Data from a single RCT demonstrated the LSC to incur lower inpatient costs than RSC specifically relating to shorter operating times in the LSC group (grade B). Data from a single RCT demonstrated LSC to be a more effective cost-minimising surgery than total vaginal mesh for vaginal vault prolapse (grade B). Data from a meta-analysis of anterior vaginal compartment prolapse operations demonstrated that commercial mesh kits for anterior repair are less cost-effective than non-kit mesh and anterior colporrhaphy (grade B). CONCLUSIONS: There is a paucity of good economic data relating to pelvic organ prolapse surgery. Transvaginal mesh surgeries have not been proven to be cost-effective. It is recommended that all randomised controlled trials relating to prolapse surgery include a formal cost analysis.


OBJECTIVE:: To summarize comparative studies describing clinical outcomes of robotic-assisted surgeries compared with traditional laparoscopic or laparotomy techniques for the treatment of endometrial cancer. DATA SOURCES:: Using search words "robotic hysterectomy" and "endometrial cancer," 22 citations were identified from Medline and PubMed (2005 to February 2010). METHODS OF STUDY SELECTION:: We selected English language studies reporting at least 25 robotic cases compared with laparoscopic or laparotomy cases that also addressed surgical technique, complications, and perioperative outcomes. Patients underwent total hysterectomy, bilateral salpingo-oophorectomy, and lymphadenectomy. TABULATION, INTEGRATION, AND RESULTS:: Eight eligible comparative studies were identified that included 1,591 patients (robotic=589, laparoscopic=396, and laparotomy=606). Pooled means of the resected aortic lymph nodes for robotic hysterectomy and laparoscopy were 10.3 and 7.8 (P=.15), and robotic hysterectomy and laparotomy were 9.4 and 5.7 (P=.28). Pooled means of pelvic lymph nodes for robotic and laparoscopic hysterectomy were 18.5 and 17.8 (P=.95) and 18.0 compared with 14.5 (P=.11) for robotic hysterectomy compared with laparotomy. Estimated blood loss was reduced in robotic hysterectomy compared with laparotomy (P<.005) and laparoscopy (P=.001). Length of stay was shorter for both robotic and laparoscopic cases compared with laparotomy (P<.01). Operative time for robotic hysterectomy was similar to laparoscopic cases but was greater than laparotomy (P<.005). Conversion to laparotomy for laparoscopic hysterectomy was 9.9% compared with 4.9% for robotic cases (P=.06). Vascular, bowel, and bladder injuries; cuff dehiscence; and thromboembolic complications were similar for each surgical method. Transfusions for robotic hysterectomy compared with laparotomy was 1.7% and 7.2% (P=.06) and robotic hysterectomy compared were laparoscopy was 2.6% and 5.0% (P=.22). CONCLUSION:: Perioperative clinical outcomes for robotic and laparoscopic hysterectomy appear similar with the exception of less blood loss for robotic cases and longer operative times for robotic and laparoscopy cases.

Gaia, R. B., et al. (2013). "A Systematic Review Of Robotic Surgery In Gynecology - Robotic Techniques Compared With Laparoscopy And Laparotomy." Journal of Minimally Invasive Gynecology. The Society of Gynecologic Surgeons (SGS) Systematic Review Group (SRG) performed a systematic review of both randomized and observational studies to compare robotic against non-robotic surgical approaches (laparoscopic, abdominal, and vaginal) for both benign and malignant gynecologic indications to compare surgical and patient-centered outcomes, costs, and adverse events associated with the different surgical approaches. MEDLINE and the Cochrane Central Register of Controlled Trials
were searched from inception to May 15, 2012 for English language studies with terms related to robotic surgery and gynecology. Studies of any design including at least 30 women undergoing robotic-assisted laparoscopic gynecologic surgery were included for review. The literature search yielded 1213 citations of which 97 full text articles were reviewed and 44 met eligibility criteria (30 comparative studies and 14 non-comparative studies). Study data were extracted into structured electronic forms and reconciled by a second independent reviewer. Our analysis revealed that robotic surgery consistently confers reduced length of hospital stay when compared to open surgery. Finally, the proficiency plateau appears to be lower for robotic surgery than for conventional laparoscopy. Among the different gynecologic applications, there appears to be evidence that renders robotic techniques advantageous over traditional open surgery for the management of endometrial cancer. Unfortunately, the data regarding superiority are conflicted when comparing robotics to traditional laparoscopic techniques. Therefore the specific modality of minimally invasive surgery (whether conventional laparoscopy or robotic surgery) should be tailored to patient selection, surgeon ability, and equipment availability.


Background: Over the last two decades, numerous studies have indicated the feasibility of minimally invasive surgery for early cervical cancer without compromising the oncological outcome. Objective: Systematic literature review and meta analysis aimed at evaluating the outcome of laparoscopic and robotic radical hysterectomy (LRH and RRH) and comparing the results with abdominal radical hysterectomy (ARH). Search Strategy: Medline, PubMed, Embase, Cochrane library and Reference lists were searched for articles published until January 31st 2011, using the terms radical hysterectomy, laparoscopic radical hysterectomy, robotic radical hysterectomy, surgical treatment of cervical cancer and complications of radical hysterectomy. Selection Criteria: Studies that reported outcome measures of radical hysterectomy by open method, laparoscopic and robotic methods were selected. Data collection and analysis: Two independent reviewers selected studies, abstracted and tabulated the data and pooled estimates were obtained on the surgical and oncological outcomes. Results: Mean sample size, age and body mass index across the three types of RH studies were similar. Mean operation time across the three types of RH studies was comparable. Mean blood loss and transfusion rate are significantly higher in ARH compared to both LRH and RRH. Duration of stay in hospital for RRH was significantly less than the other two methods. The mean number of lymph nodes obtained, nodal metastasis and positive margins across the three types of RH studies were similar. Post operative infectious morbidity was significantly higher among patients who underwent ARH compared to the other two methods and a higher rate of cystotomy in LRH. Conclusions: Minimally invasive surgery especially robotic radical hysterectomy may be a better and safe option for surgical treatment of cervical cancer. The laparoscopic method is not free from complications. However, experience of surgeon may reduce the complications rate.


Purpose: To review the safety and effectiveness of robot-assisted hysterectomy compared to traditional open and conventional laparoscopic surgery, differentiating radical, simple total with node staging, and simple total hysterectomy. Methods: Medline, Embase, the Cochrane library, and the Journal of Robotic Surgery were searched for controlled trials and observational studies with historic or concurrent controls. Data were pooled using random effects meta-analysis. Results: Compared to open surgery, robot-assisted radical hysterectomy is associated with reduced hospital stay and blood
transfusions. For simple total hysterectomy with node staging, robot-assisted surgery is associated with reduced hospital stay, complications, and blood transfusions compared to open surgery. Compared to conventional laparoscopic surgery, robot-assisted simple total hysterectomy with node staging is associated with complications and conversions. Conclusions: Compared to open surgery, robot-assisted hysterectomy offers benefits for reduced length of hospital stay and blood transfusions. The best evidence of improved outcomes is for simple total hysterectomy with node staging. Study quality was poor. © 2013 Springer-Verlag Berlin Heidelberg.


Herein is presented a systematic review and meta-analysis of evidence related to operative outcomes associated with robotic-assisted laparoscopic myomectomy (RLM) compared with abdominal myomectomy (AM) and laparoscopic myomectomy (LM). Outcome measures included estimated blood loss (EBL), blood transfusion, operating time, complications, length of hospital stay (LOHS), and costs. Meta-analysis 1 compared RLM vs AM, and meta-analysis 2 compared RLM vs LM. Studies scored moderately well on the Newcastle-Ottawa Quality Assessment Scale. No significant differences were found in age, body mass index, or number, diameter, and weight of myomas. In meta-analysis 1, EBL, blood transfusion, and LOHS were significantly lower; risk of complications was similar; and operating time and costs were significantly higher with RLM. In meta-analysis 2, no significant differences were noted in EBL, operating time, complications, and LOHS with RLM; however, blood transfusion risk and costs were higher. It was concluded that insofar as operative outcomes, RLM has significant short-term benefits compared with AM and no benefits compared with LM. Long-term benefits such as recurrence, fertility, and obstetric outcomes remain uncertain.


BACKGROUND:: The safety and effectiveness of robotic, open and conventional laparoscopic surgery in gynaecological surgery was assessed in a systematic review of the literature. This will enable the general surgical community to understand where robotic surgery stands in gynaecology. METHODS:: A search was made for previous systematic reviews in the Abstracts of Reviews of Effects, Health Technology Assessment, Cochrane Collaboration and Hayes Inc. databases. In addition, the MEDLINE,
Embase and CINAHL databases were searched for primary studies. The quality of studies was assessed and meta-analyses were performed. RESULTS: Twenty-two studies were included in the review. All were controlled but none was randomized. The majority were retrospective with historical controls. The settings in which robotic surgery was used included hysterectomy for malignant and benign disease, myomectomy, sacrocolpopexy, fallopian tube reanastomosis and adnexectomy. Robotic surgery achieved a shorter hospital stay and less blood loss than open surgery. Compared with conventional laparoscopic surgery, robotic surgery achieved reduced blood loss and fewer conversions during the staging of endometrial cancer. No clinically significant differences were recorded for the other indications tested. CONCLUSION: The available evidence shows that robotic surgery offers limited advantages with respect to short-term outcomes. However, the clinical outcomes should be interpreted with caution owing to the methodological quality of the studies. Copyright (c) 2010 British Journal of Surgery Society Ltd. Published by John Wiley & Sons, Ltd.


OBJECTIVE: We analyzed the uptake, morbidity, and cost of laparoscopic and robotic radical hysterectomy for cervical cancer. METHODS: We identified women recorded in the Perspective database with cervical cancer who underwent radical hysterectomy (abdominal, laparoscopic, robotic) from 2006-2010.. The associations between patient, surgeon, and hospital characteristic and use of minimally invasive hysterectomy as well as complications and cost were estimated using multivariable logistic regression models. RESULTS: We identified 1894 patients including 1610 (85.0%) who underwent abdominal, 217 (11.5%) who underwent laparoscopic, and 67 (3.5%) who underwent robotic radical hysterectomy were analyzed. In 2006, 98% of the procedures were abdominal and 2% laparoscopic; by 2010 abdominal radical hysterectomy decreased to 67%, while laparoscopic increased to 23% and robotic radical hysterectomy was performed in 10% of women (p<0.0001). Patients treated at large hospitals were more likely to undergo a minimally invasive procedure (OR=4.80; 95% CI, 1.28-18.01) while those with more medical comorbidities (OR=0.60; 95% CI, 0.41-0.87) were less likely to undergo a minimally invasive surgery. Perioperative complications were noted in 15.8% of patients who underwent abdominal surgery, 9.2% who underwent laparoscopy, and 13.4% who had a robotic procedure (p=0.04). Both laparoscopic and robotic radical hysterectomy were associated with lower transfusion requirements and shorter hospital stays than abdominal hysterectomy (p<0.05). Median costs were $9618 for abdominal, $11,774 for laparoscopic, and $10,176 for robotic radical hysterectomy (p<0.0001). CONCLUSION: Uptake of minimally invasive radical hysterectomy for cervical cancer has been slow. Both laparoscopic and robotic radical hysterectomy are associated with favorable morbidity profiles.

Head & Neck (2)

Level 2a (2)


BACKGROUND: This study compared the efficacy of robotic thyroidectomy via a gasless, axillary approach with conventional cervical and endoscopic techniques by meta-analysis. METHODS: Articles were identified from the following keyword searches: robotic/robot-assisted thyroidectomy/thyroid surgery. Outcomes included operative time, hospital stay, complications, and cosmetic satisfaction after surgery. Between-group outcome differences were calculated
using random-effects models. RESULTS: In all, 87 publications were identified and 9 studies met inclusion criteria, totaling 2881 patients, 1122 of whom underwent robotic thyroidectomy. Those who underwent robotic surgery reported greater cosmetic satisfaction, with a pooled net mean difference of -1.35 (95% confidence interval [CI]: -1.69, -1.09). Robotic approach operative time was longer than that of the conventional approach (95% CI: 29.23, 54.87), with a trend to be shorter than the endoscopic approaches. Robotic surgery had similar risks to open and endoscopic approaches. CONCLUSIONS: Our meta-analysis suggests that robotic thyroidectomy is as safe, feasible, and efficacious as conventional cervical and endoscopic thyroidectomy, showing superior cosmetic satisfaction than that of conventional thyroidectomy. (c) 2012 Wiley Periodicals, Inc. Head Neck, 2012.


Background: Despite gaining popularity, robotic-assisted thyroidectomy (RT) remains controversial. This systematic review and meta-analysis is aimed at comparing surgically-related complications between RT and conventional open thyroidectomy (OT). Methods: A systematic review of the literature was performed to identify studies comparing surgically-related outcomes between RT and OT. Studies that compared ≥1 surgically-related outcomes between RT and OT were included. Outcomes included operating time, blood loss, complications, and hospital stay. Meta-analysis was performed using a fixed-effects model. Results: Eleven studies were eligible but none were randomized controlled trials. Of the 2,375 patients, 839 (35.3%) underwent RT, while 1,536 (64.7%) underwent OT. RT was significantly associated with longer operating time (p < 0.001), hospital stay (p = 0.023) and higher temporary recurrent laryngeal nerve (RLN) injury (p = 0.016). Although there was no correlation between the number of RTs reported in the study and the rate of temporary RLN injury (p = 0.486, p = 0.328, respectively), routine perioperative laryngoscopy was performed in only 2 of 11 studies. Blood loss (p = 0.485), temporary (p = 0.333) and permanent (p = 0.599) hypocalcemia, hematoma (p = 0.602), and overall morbidity (p = 0.880) appeared comparable. Two (0.2%) brachial plexus injuries in RT were reported in one study. Conclusions: Relative to OT, RT was associated with significantly longer operating time, longer hospital stay, and higher temporary RLN injury rate but comparable permanent complications and overall morbidity. Given some of the limitations with the literature and the potential added surgical risks and morbidity in RT, application of the robot in thyroid surgery should be carefully and thoroughly discussed before one decides on the procedure. © 2013 Society of Surgical Oncology.

Thoracic (1)

Level 2a (1)

BACKGROUND: To date, reports on outcomes after robotic-assisted pulmonary resection have been confined to small, single-institution case series. Furthermore, no comparison has been made between robotic, open, and video-assisted thoracic surgery (VATS) procedures. We sought to compare the outcomes between these approaches using the State Inpatient Databases (SID). METHODS: Using the 2008 to 2010 SID, we identified patients who underwent an open, VATS, or robotic lobectomy from 8 states. Patients who underwent segmentectomy were also included. A comparison of outcomes was performed using a propensity-matched analysis. RESULTS: We identified a total of 33,095 patients
Case volumes for robotic resections increased over the study period from 0.2% in 2008 to 3.4% in 2010. Robotic resections were performed in all 8 states, and 38% were conducted in a community hospital. In propensity-matched analysis, robotic resections were associated with significant reductions in mortality (0.2% vs 2.0%, p = 0.016), length of stay (5.9 vs 8.2 days, p < 0.0001), and overall complication rates (43.8% vs 54.1%, p = 0.003) when compared with open thoracotomy. Robotic resection was also associated with reductions in mortality (0.2% vs 1.1%, p = 0.12), length of stay (5.9 days vs 6.3 days, p = 0.45), and overall complication rates (43.8% vs 45.3%, p = 0.68) when compared with VATS; however, none of these differences were statistically significant.

CONCLUSIONS: Case volume for robotic pulmonary resections has increased significantly during the study period, and thoracic surgeons have been able to adopt the robotic approach safely. Robotic resection appears to be an appropriate alternative to VATS and is associated with improved outcomes compared with open thoracotomy.

Urology (35)

Level 1b (1)

BACKGROUND: In recent years, surgeons have begun to report case series of minimally invasive approaches to radical cystectomy, including robotic-assisted techniques demonstrating the surgical feasibility of this procedure with the potential of lower blood loss and more rapid return of bowel function and hospital discharge. Despite these experiences and observations, at this point high levels of clinical evidence with regard to the benefits of robotic cystectomy are absent, and the current experiences represent case series with limited comparisons to historical controls at best. OBJECTIVE: We report our results on a prospective randomized trial of open versus robotic-assisted laparoscopic radical cystectomy with regard to perioperative outcomes, complications, and short-term narcotic usage. DESIGN, SETTING, AND PARTICIPANTS: A prospective randomized single-center noninferiority study comparing open versus robotic approaches to cystectomy in patients who are candidates for radical cystectomy for urothelial carcinoma of the bladder. Of the 41 patients who underwent surgery, 21 were randomized to the robotic approach and 20 to the open technique. INTERVENTION: Radical cystectomy, bilateral pelvic lymphadenectomy, and urinary diversion by either an open approach or by a robotic-assisted laparoscopic technique. MEASUREMENTS: The primary end point was lymph node (LN) yield with a noninferiority margin of four LNs. Secondary end points included demographic characteristics, perioperative outcomes, pathologic results, and short-term narcotic use. RESULTS AND LIMITATIONS: On univariate analysis, no significant differences were found between the two groups with regard to age, sex, body mass index, American Society of Anesthesiologists classification, anticoagulation regimen of aspirin, clinical stage, or diversion type. Significant differences were noted in operating room time, estimated blood loss, time to flatus, time to bowel movement, and use of inpatient morphine sulfate equivalents. There was no significant difference in regard to overall complication rate or hospital stay. On surgical pathology, in the robotic group 14 patients had pT2 disease or higher; 3 patients had pT3/T4 disease; and 4 patients had node-positive disease. In the open group, eight patients had pT2 disease or higher; five patients had pT3/T4 disease; and seven patients had node-positive disease. The mean number of LNs removed was 19 in the robotic group versus 18 in the open.
group. Potential study limitations include the limited clinical and oncologic follow-up and the relatively small and single-institution nature of the study. CONCLUSIONS: We present the results of a prospective randomized controlled noninferiority study with a primary end point of LN yield, demonstrating the robotic approach to be noninferior to the open approach. The robotic approach also compares favorably with the open approach in several perioperative parameters.

Level 2a (34)

Study Type - Therapy (systematic review) Level of Evidence 1a What’s known on the subject? and What does the study add? Research on the subject has shown that robotic surgery is more costly than both laparoscopic and open approaches due to the initial cost of purchase, annual maintenance and disposable instruments. However, both robotic and laparoscopic approaches have reduced blood loss and hospital stay and robotic procedures have better short term post-operative outcomes such as continence and sexual function. Some studies indicate that the robotic approach may have a shorter learning curve. However, factors such as reduced learning curve, shorter hospital stay and reduced length of surgery are currently unable to compensate for the excess costs of robotic surgery. This review concludes that robotic surgery should be targeted for cost efficiency in order to fully reap the benefits of this advanced technology. The excess cost of robotic surgery may be compensated by improved training of surgeons and therefore a shorter learning curve; and minimising costs of initial purchase and maintenance. The review finds that only a few studies gave an itemised breakdown of costs for each procedure, making accurate comparison of costs difficult. Furthermore, there is a lack of long term follow up of clinical outcomes, making it difficult to accurately assess long term post-operative outcomes. A breakdown of costs and studies of long term outcomes are needed to accurately assess the effectiveness of robotic surgery in urology. OBJECTIVES: * Although robotic technology is becoming increasingly popular for urological procedures, barriers to its widespread dissemination include cost and the lack of long term outcomes. This systematic review analyzed studies comparing the use of robotic with laparoscopic and open urological surgery. * These three procedures were assessed for cost efficiency in the form of direct as well as indirect costs that could arise from length of surgery, hospital stay, complications, learning curve and postoperative outcomes. METHODS: * A systematic review was performed searching Medline, Embase and Web of Science databases. Two reviewers identified abstracts using online databases and independently reviewed full length papers suitable for inclusion in the study. RESULTS: * Laparoscopic and robot assisted radical prostatectomy are superior with respect to reduced hospital stay (range 1-1.76 days and 1-5.5 days, respectively) and blood loss (range 482-780 mL and 227-234 mL, respectively) when compared with the open approach (range 2-8 days and 1015 mL). Robot assisted radical prostatectomy remains more expensive (total cost ranging from US $2000-$39 215) than both laparoscopic (range US $740-$29 771) and open radical prostatectomy (range US $1870-$31 518). * This difference is due to the cost of robot purchase, maintenance and instruments. The reduced length of stay in hospital (range 1-1.5 days) and length of surgery (range 102-360 min) are unable to compensate for the excess costs. * Robotic surgery may require a smaller learning curve (20-40 cases) although the evidence is inconclusive. CONCLUSIONS: * Robotic surgery provides similar postoperative outcomes to laparoscopic surgery but a reduced learning curve. * Although costs are currently high, increased competition from manufacturers and wider dissemination of the technology could drive down costs. * Further trials are needed to evaluate long term outcomes in order to evaluate fully the value of all three procedures in urological surgery.

There are scant national outcomes data for robot-assisted laparoscopic surgery. We assessed costs and length of stay (LOS) related to robot-assisted radical and partial nephrectomy in a nationally representative population database. We performed a cohort analysis of the US Nationwide Inpatient Sample database. Using ICD-9 procedure codes, we identified patients who underwent radical or partial nephrectomy for kidney cancer from October 2008 to December 2008. We excluded patients with non-robot-assisted laparoscopic procedures and those under age 18 years. We performed multivariate analyses of LOS and total hospital charges, adjusting for age, race, gender, Charlson comorbidity index, and teaching hospital status. Records of 2,242 patients were analyzed. On adjusted multivariate analysis, robot-assisted partial nephrectomy was associated with shorter LOS compared with open surgery (-2.0 days, P = 0.032). Robot-assisted radical nephrectomy was associated with shorter LOS compared with open surgery (-1.8 days, P = 0.077). There were no significant differences in total charges for robot-assisted compared with open surgery for either radical (P = 0.631) or partial (P = 0.713) nephrectomy. In this large, population-based analysis, robot-assisted radical and partial nephrectomy were associated with shorter LOS and equivalent hospital charges compared with their open surgery counterparts. These data suggest that, for renal surgery, diminished LOS offsets other hospital costs associated with robot-assisted procedures. © 2011 Springer-Verlag London Ltd.


CONTEXT: Over the last two decades, minimally invasive treatment options for ureteropelvic junction obstruction (UPJO) have been developed and popularized. OBJECTIVE: To critically analyze the current status of laparoscopic and robotic repair of UPJO. EVIDENCE ACQUISITION: A systematic literature review was performed in November 2012 using PubMed. Article selection proceeded according to the search strategy based on Preferred Reporting Items for Systematic Reviews and Meta-analyses criteria. EVIDENCE SYNTHESIS: Multiple series of laparoscopic pyeloplasty have demonstrated high success rates and low perioperative morbidity in pediatric and adult populations, with both the transperitoneal and retroperitoneal approaches. Data on pediatric robot-assisted pyeloplasty are increasingly becoming available. A larger number of cases have also been reported for adult patients, confirming that robotic pyeloplasty represents a viable option for either primary or secondary repair. Robot-assisted redo pyeloplasty has been mostly described in the pediatric population. Different technical variations have been implemented with the aim of tailoring the procedure to each specific case. The type of stenting, retrograde versus antegrade, continues to be debated. Internal-external stenting as well as a stentless approach have been used, especially in the pediatric population. Comparative studies demonstrate similar success and complication rates between minimally invasive and open pyeloplasty in both the adult and pediatric setting. A clear advantage in terms of hospital stay for minimally invasive over open pyeloplasty was observed only in the adult population. CONCLUSIONS: Laparoscopy represents an efficient and effective less invasive alternative to open pyeloplasty. Robotic pyeloplasty is likely to emerge as the new minimally invasive standard of care whenever robotic technology is available because its precise suturing and shorter learning curve represent unique attractive features. For both laparoscopy and robotics, the technique can be tailored to the specific case according to intraoperative findings and personal surgical experience.

Context: Robot-assisted laparoscopic radical prostatectomy (RALP) has been rapidly adopted as a new approach for radical prostatectomy (RP) in patients with prostate cancer (PCa). The use of new technology may increase costs for RP. Objective: To summarize data on direct costs of various approaches to RP and to discuss the consequences of cost differences. Evidence acquisition: A systematic literature search was performed in March 2012 using the PubMed, Web of Science, and Cochrane Library databases. A complex search strategy was applied. Articles were selected according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses criteria. Articles reporting on direct costs of RP (open retropubic [RRP], radical perineal [RPP], laparoscopic [LRP], RALP) in men with clinically localized PCa were eligible for study inclusion. Evidence synthesis: Of 1218 articles initially screened by title, the multistep, systematic search identified 11 studies presenting direct costs of different approaches to RP. Of the 11 studies, 7 compared the costs of different RP approaches. Minimally invasive RP (MIRP) (ie, LRP or RALP) was more expensive than RRP in most studies, mainly due to increased surgical instrumentation costs. In the comparative studies, costs ranged from (in US dollars) $5058 to $11 806 for MIRP and from $4075 to $6296 for RRP, with RALP having the highest direct costs. In one study applying standardized, health economic-evaluation criteria, RALP was not found to be cost effective. Limitations of this review include significant differences in observational study designs and an absence of prospective comparative studies. Moreover, there are limited post-RP data on the costs of adjuvant treatments and other health care-related expenses after PCa surgery. Conclusions: Few studies compared direct costs of different approaches to RP. The use of new technology, particularly RALP, results in added costs for the procedure. Cost effectiveness of new technologies should be assessed before widespread adoption. To date, in the lone study to evaluate this, RALP was not found to be cost effective from a health care, economic standpoint. However, longer follow-up of patients is required to better evaluate its impact on overall costs and quality of PCa care. © 2012 European Association of Urology.


WHAT'S KNOWN ON THE SUBJECT? AND WHAT DOES THE STUDY ADD?: Multiple treatment alternatives exist for localised prostate cancer, with few high-quality studies directly comparing their comparative effectiveness and costs. The present study is the most comprehensive cost-effectiveness analysis to date for localised prostate cancer, conducted with a lifetime horizon and accounting for survival, health-related quality-of-life, and cost impact of secondary treatments and other downstream events, as well as primary treatment choices. The analysis found minor differences, generally slightly favouring surgical methods, in quality-adjusted life years across treatment options. However, radiation therapy (RT) was consistently more expensive than surgery, and some alternatives, e.g. intensity-modulated RT for low-risk disease, were dominated - that is, both more expensive and less effective than competing alternatives. OBJECTIVE: To characterise the costs and outcomes associated with radical prostatectomy (open, laparoscopic, or robot-assisted) and radiation therapy (RT: dose-escalated three-dimensional conformal RT, intensity-modulated RT, brachytherapy, or combination), using a comprehensive, lifetime decision analytical model. PATIENTS AND METHODS: A Markov model was constructed to follow hypothetical men with low-, intermediate-, and high-risk prostate cancer over their lifetimes after primary treatment; probabilities of outcomes were based on an exhaustive literature search yielding 232 unique publications. In each Markov cycle, patients could have remission, recurrence, salvage treatment, metastasis, death from prostate cancer, and death from other causes. Utilities for each health state were determined, and disutilities were applied for complications and toxicities of treatment. Costs were determined from the USA payer perspective, with incorporation of patient costs in a sensitivity analysis. RESULTS: Differences across treatments in quality-adjusted life
years across methods were modest, ranging from 10.3 to 11.3 for low-risk patients, 9.6-10.5 for intermediate-risk patients and 7.8-9.3 for high-risk patients. There were no statistically significant differences among surgical methods, which tended to be more effective than RT methods, with the exception of combined external beam + brachytherapy for high-risk disease. RT methods were consistently more expensive than surgical methods; costs ranged from $19,901 (robot-assisted prostatectomy for low-risk disease) to $50,276 (combined RT for high-risk disease). These findings were robust to an extensive set of sensitivity analyses. CONCLUSIONS: Our analysis found small differences in outcomes and substantial differences in payer and patient costs across treatment alternatives. These findings may inform future policy discussions about strategies to improve efficiency of treatment selection for localized prostate cancer.


Introduction: The primary aims of this study were to assess the learning curve effect of robot-assisted radical prostatectomy (RARP) in a large administrative database consisting of multiple U.S. hospitals and surgeons, and to compare the results of RARP to open radical prostatectomy (ORP) from the same settings. Materials and Methods: The patient population of study was from the Premier Perspective Database (Premier, Inc., Charlotte, NC) and consisted of 71,312 radical prostatectomies performed at more than 300 U.S. hospitals by up to 3,739 surgeons by open or robotic techniques from 2004-2010. The key endpoints were surgery time, inpatient length of stay, overall complications. We compared open versus robotic, results by year of procedures, results by case volume of specific surgeons, and results of open surgery in hospitals with and without a robotic system Results: The mean surgery time was longer for RARP (4.4 hours, SD 1.7) compared to ORP (3.4 hours, SD 1.5) in the same hospitals, p<0.0001. Inpatient stay was shorter for RARP (2.2 days, SD 1.9) compared to ORP (3.2 days, SD 2.7) in the same hospitals, p< 0.0001. The overall complications were less for RARP (10.6%) compared to ORP (15.8%) in the same hospitals, as were transfusion rates. ORP results in hospitals without a robot were not better than ORP with a robot, and pre-treatment co-morbidity profiles were similar in all cohorts. Trending of results by year of procedure showed no differences in the 3 cohorts, but trending of RARP results by surgeon experience showed improvements in surgery time, hospital stay, conversion rates, and complication rates. Conclusions: During the initial seven years of RARP development, outcomes showed decreased hospital stay, complications, and transfusion rates. Learning curve trends for RARP were evident for these endpoints when grouped by surgeon experience, but not by year of surgery.


Context: Despite the wide diffusion of laparoscopic radical prostatectomy (LRP) and robot-assisted laparoscopic radical prostatectomy (RALP), only few studies comparing the results of these techniques with the retropubic radical prostatectomy (RRP) are currently available. Objective: To evaluate the perioperative, functional, and oncologic results in the comparative studies evaluating RRP, LRP, and RALP. Evidence acquisition: A systematic review of the literature was performed in January 2008, searching Medline, Embase, and Web of Science databases. A "free-text" protocol using the term radical prostatectomy was applied. Some 4000 records were retrieved from the Medline database; 2265 records were retrieved from the Embase database; and 4219 records were retrieved from the Web of Science database. Three of the authors reviewed the records to identify comparative studies. A cumulative analysis was conducted using Review Manager software v.4.2 (Cochrane Collaboration,
Evidence synthesis: Thirty-seven comparative studies were identified in the literature search, including a single, randomised, controlled trial. With regard to the perioperative outcome, LRP and RALP were more time consuming than RRP, especially in the initial steps of the learning curve, but blood loss, transfusion rates, catheterisation time, hospitalisation duration, and complication rates all favoured LRP. With regard to the functional results, LRP and RRP showed similar continence and potency rates. Similarly, no significant differences were identified between LRP and RALP, while a single, nonrandomised, prospective study suggested advantages in terms of both continence and potency recovery after RALP, compared with RRP. With regard to the oncologic outcome, LRP and RALP were associated with positive surgical margin rates similar to those of RRP. Conclusions: The quality of the available comparative studies was not excellent. LRP and RALP are followed by significantly lower blood loss and transfusion rates, but the available data were not sufficient to prove the superiority of any surgical approach in terms of functional and oncologic outcomes. Further high-quality, prospective, multicentre, comparative studies are needed. © 2009 European Association of Urology.


Background: Although the initial robot-assisted radical prostatectomy (RARP) series showed 12-mo potency rates ranging from 70% to 80%, the few available comparative studies did not permit any definitive conclusion about the superiority of this technique when compared with retropubic radical prostatectomy (RRP) and laparoscopic radical prostatectomy (LRP). Objectives: The aims of this systematic review were (1) to evaluate the current prevalence and the potential risk factors of erectile dysfunction after RARP, (2) to identify surgical techniques able to improve the rate of potency recovery after RARP, and (3) to perform a cumulative analysis of all available studies comparing RARP versus RRP or LRP. Evidence acquisition: A literature search was performed in August 2011 using the Medline, Embase, and Web of Science databases. Only comparative studies or clinical series including >100 cases reporting potency recovery outcomes were included in this review. Cumulative analysis was conducted using Review Manager v.4.2 software designed for composing Cochrane Reviews (Cochrane Collaboration, Oxford, UK). Evidence synthesis: We analyzed 15 case series, 6 studies comparing different techniques in the context of RARP, 6 studies comparing RARP with RRP, and 4 studies comparing RARP with LRP. The 12- and 24-mo potency rates ranged from 54% to 90% and from 63% to 94%, respectively. Age, baseline potency status, comorbidities index, and extension of the nerve-sparing procedure represent the most relevant preoperative and intraoperative predictors of potency recovery after RARP. Available data seem to support the use of cautery-free dissection or the use of pinpointed low-energy cauterization. Cumulative analyses showed better 12-mo potency rates after RARP in comparison with RRP (odds ratio [OR]: 2.84; 95% confidence interval [CI]: 1.46-5.43; p = 0.002). Only a nonstatistically significant trend in favor of RARP was reported after comparison with LRP (OR: 1.89; p = 0.21). Conclusions: The incidence of potency recovery after RARP is influenced by numerous factors. Data coming from the present systematic review support the use of a cautery-free technique. This update of previous systematic reviews of the literature showed, for the first time, a significant advantage in favor of RARP in comparison with RRP in terms of 12-mo potency rates. © 2012.

Context: Robot-assisted radical prostatectomy (RARP) was proposed to improve functional outcomes in comparison with retropubic radical prostatectomy (RRP) or laparoscopic radical prostatectomy (LRP). In the initial RARP series, 12-mo urinary continence recovery rates ranged from 84% to 97%. However, the few available studies comparing RARP with RRP or LRP published before 2008 did not permit any definitive conclusions about the superiority of any one of these techniques in terms of urinary continence recovery. Objective: The aims of this systematic review were (1) to evaluate the prevalence and risk factors for urinary incontinence after RARP, (2) to identify surgical techniques able to improve urinary continence recovery after RARP, and (3) to perform a cumulative analysis of all available studies comparing RARP versus RRP or LRP in terms of the urinary continence recovery rate. Evidence acquisition: A literature search was performed in August 2011 using the Medline, Embase, and Web of Science databases. The Medline search included only a free-text protocol using the term radical prostatectomy across the title and abstract fields of the records. The following limits were used: humans; gender (male); and publication date from January 1, 2008. Searches of the Embase and Web of Science databases used the same free-text protocol, keywords, and search period. Only comparative studies or clinical series including >100 cases reporting urinary continence outcomes were included in this review. Cumulative analysis was conducted using the Review Manager v.4.2 software designed for composing Cochrane Reviews (Cochrane Collaboration, Oxford, UK). Evidence synthesis: We analyzed 51 articles reporting urinary continence rates after RARP: 17 case series, 17 studies comparing different techniques in the context of RARP, 9 studies comparing RARP with RRP, and 8 studies comparing RARP with LRP. The 12-mo urinary incontinence rates ranged from 4% to 31%, with a mean value of 16% using a no pad definition. Considering a no pad or safety pad definition, the incidence ranged from 8% to 11%, with a mean value of 9%. Age, body mass index, comorbidity index, lower urinary tract symptoms, and prostate volume were the most relevant preoperative predictors of urinary incontinence after RARP. Only a few comparative studies evaluated the impact of different surgical techniques on urinary continence recovery after RARP. Posterior musculofascial reconstruction with or without anterior reconstruction was associated with a small advantage in urinary continence recovery 1 mo after RARP. Only complete reconstruction was associated with a significant advantage in urinary continence 3 mo after RARP (odds ratio [OR]: 0.76; p = 0.04). Cumulative analyses showed a better 12-mo urinary continence recovery after RARP in comparison with RRP (OR: 1.53; p = 0.03) or LRP (OR: 2.39; p = 0.006). Conclusions: The prevalence of urinary incontinence after RARP is influenced by preoperative patient characteristics, surgeon experience, surgical technique, and methods used to collect and report data. Posterior musculofascial reconstruction seems to offer a slight advantage in terms of 1-mo urinary continence recovery. Update of a previous systematic review of literature shows, for the first time, a statistically significant advantage in favor of RARP in comparison with both RRP and LRP in terms of 12-mo urinary continence recovery. © 2012.
increased for RRP ($18k in 2002, $32k in 2008). After 2005, overall CR of MIP was lower than for RRP. High-volume centers reported lower CR for both procedures. MIP was associated with fewer transfusions and wound complications. Men living in ZIP codes with the top quartile of yearly mean household income were more likely to undergo MIP than RRP (p<0.001). Although there were more white patients receiving MIP and black or Hispanic patients more frequently underwent RRP there was no statistically significant difference. Increasing use of MIP led to decreased hospital stay for all patients, increase charges for RRP and decreased complication rates for both MIP and RRP. In recent years, MIP was associated with fewer complications. Charges for RRP have increased over time to approach those for MIP and patients with increased socio-economic status were more likely to receive MIP.


Background and Purpose: Our present understanding of the effect of robotic surgery and surgical volume on the cost of radical prostatectomy (RP) is limited. Given the increasing pressures placed on healthcare resource utilization, such determinations of healthcare value are becoming increasingly important. Therefore, we performed a study to define the effect of robotic technology and surgical volume on the cost of RP. Methods: The state of Maryland mandates that all acute-care hospitals report encounter-level and hospital discharge data to the Health Service Cost Review Commission (HSCRC). The HSCRC was queried for men undergoing RP between 2008 and 2011 (the period during which robot-assisted laparoscopic radical prostatectomy [RALRP] was coded separately). High-volume hospitals were defined as >60 cases per year, and high-volume surgeons were defined as >40 cases per year. Multivariate regression analysis was performed to evaluate whether robotic technique and high surgical volume impacted the cost of RP. Results: There were 1499 patients who underwent RALRP and 2565 who underwent radical retropubic prostatectomy (RRP) during the study period. The total cost for RALRP was higher than for RRP ($14,000 vs 10,100; P<0.001) based primarily on operating room charges and supply charges. Multivariate regression demonstrated that RALRP was associated with a significantly higher cost (β coeff 4.1; P<0.001), even within high-volume hospitals (β coeff 3.3; P<0.001). High-volume surgeons and high-volume hospitals, however, were associated with a significantly lower cost for RP overall. High surgeon volume was associated with lower cost for RALRP and RRP, while high institutional volume was associated with lower cost for RALRP only. Conclusions: High surgical volume was associated with lower cost of RP. Even at high surgical volume, however, the cost of RALRP still exceeded that of RRP. As robotic surgery has come to dominate the healthcare marketplace, strategies to increase the role of high-volume providers may be needed to improve the cost-effectiveness of prostate cancer surgical therapy. © Copyright 2013, Mary Ann Liebert, Inc. 2013.

radical prostatectomy at hospital adopters from 55.8% in 2006 and 70.7% in 2007 to 76.1% in 2008 (p <0.001 for trend). After adjusting for patient and hospital features, lower odds of undergoing radical prostatectomy at hospitals with robotic surgery were seen in black patients (OR 0.81, p <0.001) and Hispanic patients (OR 0.77, p <0.001) vs white patients. Compared to having private health insurance, being primarily insured with Medicaid (OR 0.70, p <0.001) was also associated with lower odds of being treated at hospitals with robotic surgery. Conclusions: Although there was a rapid shift of patients who underwent radical prostatectomy to hospitals with robotic surgery from 2006 to 2008, black and Hispanic patients or those primarily insured by Medicaid were less likely to undergo radical prostatectomy at such hospitals. © 2013 American Urological Association Education and Research, Inc.


Background: With health technology innovation responsible for higher health care costs, it is essential to have accurate estimates regarding the differential costs between robot-assisted radical prostatectomy (RARP) and open radical prostatectomy (ORP). Objective: To describe the total hospitalization costs attributable to robotic and open surgery for radical prostatectomy (RP). Design, setting, and participants: Using a population-based cohort by merging the Nationwide Inpatient Sample (NIS) and the American Hospital Association (AHA) survey from 2006 to 2008, we identified 29 837 prostate cancer patients who underwent RP. Interventions: ORP and RARP. Outcome measurements and statistical analysis: The primary outcome was total hospitalization costs adjusted to year 2008 US dollars. Generalized estimating equations were used to identify patient and hospital characteristics associated with total hospitalization costs and to estimate costs of ORP and RARP adjusted for case mix and hospital teaching status, location, and annual case volume. Results and limitations: Overall, 20 424 (68.5%) patients were surgically treated with RARP, and 9413 (31.5%) patients underwent ORP. Compared to ORP, patients undergoing RARP had shorter median length of stay (1 d vs 2 d; p < 0.001) and were less likely to experience any postoperative complications (8.2% vs 11.3%; p < 0.001). However, patients undergoing RARP had higher median hospitalization costs ($10 409 vs $8862; p < 0.001). After adjusting for patient and hospital features, RARP was associated with higher total hospitalization costs compared to ORP ($11 932 vs $9390; p < 0.001). Our results are limited by a study design using retrospective population-based data. Conclusions: Despite RARP having lower complications and shorter length of stay than ORP, total hospitalization costs are higher for patients treated with RARP compared with those treated with ORP. © 2012 European Association of Urology.


Background: Robot-assisted radical cystectomy (RARC) is increasingly being used in the management of bladder cancer. Studies comparing RARC and open radical cystectomy (ORC) have reported conflicting results. We conducted a systematic review and meta-analysis of the literature on the efficacy and advantages of RARC compared with ORC. Methods: An electronic database search of PubMed, Scopus, and the Cochrane Library was performed up to July 8, 2012. This systematic review and meta-analysis was performed based on all randomized controlled trials (RCTs) and observational comparative studies assessing the two techniques. Results: One RCT, eight studies with prospectively collected data, and four retrospective studies were identified, including 962 cases. Although RARC was associated with longer operative time (p<0.001), patients in this group might benefit from less overall perioperative complications (p=0.04), more lymph node yield (p=0.009), less estimated blood loss (p<0.001), a lower need for perioperative transfusion (p<0.001), and shorter length of hospital stay.
(p<0.001). Positive surgical margins did not differ significantly between techniques. Sensitivity analysis with prospective studies showed similar results to the original analysis, but no significant difference of lymph node yield and length of stay between two techniques. Conclusions: RARC is a mini-invasive alternative to ORC with less overall perioperative complications, more lymph node yields, less estimated blood loss, less need for a perioperative transfusion, and shorter length of stay.


The aim was to review the current status and evaluate the outcomes of robot-assisted laparoscopic radical prostatectomy in comparison with open radical prostatectomy and laparoscopic radical prostatectomy. Between January 2008 and June 2012, published English language comparative studies comparing robot-assisted laparoscopic radical prostatectomy with either open radical prostatectomy and/or laparoscopic radical prostatectomy were reviewed. End-points for this review include oncological, functional and perioperative outcomes, and complications. Compared with laparoscopic radical prostatectomy and/or open radical prostatectomy, robot-assisted laparoscopic radical prostatectomy offered at least equivalent oncological control. Current evidence seems to suggest a superiority of robot-assisted laparoscopic radical prostatectomy over open radical prostatectomy and laparoscopic radical prostatectomy in terms of functional outcomes, such as urinary continence and potency. Risks of perioperative complications were also low after robot-assisted laparoscopic radical prostatectomy. Robot-assisted laparoscopic radical prostatectomy offers at least equivalent oncological and functional outcomes with low risks of complications when compared with open radical prostatectomy and laparoscopic radical prostatectomy. However, there is a paucity of high-level evidence available in current literature.


Context: For the treatment of localised renal cell carcinoma (RCC), uncertainties remain over the perioperative and quality-of-life (QoL) outcomes for the many different surgical techniques and approaches of nephrectomy. Controversy also remains on whether newer minimally invasive nephron-sparing interventions offer better QoL and perioperative outcomes, and whether adrenalectomy and lymphadenectomy should be performed simultaneously with nephrectomy. These non-oncological outcomes are important because they may have a considerable impact on localised RCC treatment decision making. Objective: To review systematically all the relevant published literature comparing perioperative and QoL outcomes of surgical management of localised RCC (T1-2N0M0). Evidence acquisition: Relevant databases including Medline, Embase, and the Cochrane Library were searched up to January 2012. Randomised controlled trials (RCTs) or quasi-randomised controlled trials, prospective observational studies with controls, retrospective matched-pair studies, and comparative studies from well-defined registries/databases were included. The outcome measures were QoL, analgesic requirement, length of hospital stay, time to normal activity level, surgical morbidity and complications, ischaemia time, renal function, blood loss, length of operation, need for blood transfusion, and perioperative mortality. The Cochrane risk of bias tool was used to assess RCTs, and an extended version was used to assess non-randomised studies (NRSs). The quality of evidence was assessed using Grading of Recommendations, Assessment, Development, and Evaluation. Evidence synthesis: A total of 4580 abstracts and 380 full-text articles were assessed, and 29 studies met the inclusion criteria (7 RCTs and 22 NRSs). There were high risks of bias and low-quality evidence for studies meeting the inclusion criteria. There is good evidence indicating that partial nephrectomy results in better preservation of
renal function and better QoL outcomes than radical nephrectomy regardless of technique or approach. Regarding radical nephrectomy, the laparoscopic approach has better perioperative outcomes than the open approach, and there is no evidence of a difference between the transperitoneal and retroperitoneal approaches. Alternatives to standard laparoscopic radical nephrectomy (LRN) such as hand-assisted, robot-assisted, or single-port techniques appear to have similar perioperative outcomes. There is no good evidence to suggest that minimally invasive procedures such as cryotherapy or radiofrequency ablation have superior perioperative or QoL outcomes to nephrectomy. Regarding concomitant lymphadenectomy during nephrectomy, there were low event rates for complications, and no definitive difference was observed. There was no evidence to base statements about concomitant ipsilateral adrenalectomy during nephrectomy. Conclusions: Partial nephrectomy results in significantly better preservation of renal function over radical nephrectomy. For tumours where partial nephrectomy is not technically feasible, there is no evidence that alternative procedures or techniques are better than LRN in terms of perioperative or QoL outcomes. In making treatment decisions, perioperative and QoL outcomes should be considered in conjunction with oncological outcomes. Overall, there was a paucity of data regarding QoL outcomes, and when reported, both QoL and perioperative outcomes were inconsistently defined, measured, or reported. The current evidence base has major limitations due to studies of low methodological quality marked by high risks of bias. © 2012 European Association of Urology.


Abstract Purpose: To compare direct costs associated with open partial nephrectomy (OPN), laparoscopic partial nephrectomy (LPN), and robot-assisted LPN (RALPN). Methods: A meta-analysis of nonoverlapping studies was performed to determine operating room (OR) time, equipment use, and length of stay (LOS) for OPN, LPN, and RALPN. Cost models using cost data obtained from our institution were created, and robotic cost and maintenance were amortized over 7 years. One- and two-way sensitivity analyses were performed to evaluate the effect of changing variables on the cost effectiveness of each approach. Results: Seven RALPN, 18 LPN, and 8 OPN data series were identified, comprising a total of 477, 2220, and 2745 procedures, respectively. Weighted mean OR time was 188, 200, 193 minutes; weighted mean LOS was 2.6, 3.2, and 5.9 days for RALPN, LPN, and OPN, respectively. LPN was the most cost-effective approach at a mean direct cost of $10,311, with a cost advantage of $1116 and $1652 over OPN ($11,427) and RALPN ($11,962), respectively. Sensitivity analyses demonstrate that significant decreases in robotic costs are required for RALPN to be cost effective. Conclusion: Despite similar OR times, LPN is more cost effective than OPN because of shorter LOS. Because of lower instrumentation costs, LPN is the most cost effective despite a longer LOS than RALPN. RALPN has high cost of maintenance and instrumentation, which is partially compensated by the shorter LOS. Evidence of oncological and functional equivalence to OPN is warranted to determine the future role of RALPN.


PURPOSE: We evaluated trends and associated characteristics in the use of robotics for pyeloplasty as treatment for ureteropelvic junction obstruction. MATERIALS AND METHODS: Data from the Nationwide Inpatient Sample were used to evaluate pyeloplasty trends from 2005 to 2010. Patients treated with pyeloplasty and procedure method (robotic, laparoscopic or open) were identified by ICD-9-CM codes. Coding for robotics was initiated in the fourth quarter of 2008. Multivariable analysis was performed to examine characteristics affecting the odds of undergoing robotic pyeloplasty vs other approaches to pyeloplasty. RESULTS: We identified 3,947 pyeloplasties performed between 2005 and
2010, including 1,642 since the fourth quarter of 2008. There was a statistically significant increase in the number of robotic pyeloplasties ($p < 0.001$). Mean total charges for robotic vs nonrobotic procedures were $40,200 vs $37,817 ($p = 0.106$). Characteristics related to undergoing a robotic procedure included surgery at a teaching hospital (OR 1.29, 95% CI 1.04-1.59, $p = 0.021$) and in the Northeast (OR 1.54, 95% CI 1.17-2.04, $p = 0.002$) or Midwest (OR 1.62, 95% CI 1.23-2.12, $p < 0.001$) compared with the South. When the primary payer was Medicaid vs private insurance, patients were 46% less likely to undergo the procedure robotically ($p < 0.001$). There was no significant difference in charges between robotic and open pyeloplasty. CONCLUSIONS: The number of robotic pyeloplasties performed quarterly in the United States is increasing, although there are disparities in the adoption of the robotic approach among geographic regions and hospital types.


Context: Radical retropubic prostatectomy (RRP) has long been the most common surgical technique used to treat clinically localized prostate cancer (PCa). More recently, robot-assisted radical prostatectomy (RARP) has been gaining increasing acceptance among patients and urologists, and it has become the dominant technique in the United States despite a paucity of prospective studies or randomized trials supporting its superiority over RRP. Objective: A 2-d consensus conference of 17 world leaders in prostate cancer and radical prostatectomy was organized in Pasadena, California, and at the City of Hope Cancer Center, Duarte, California, under the auspices of the European Association of Urology Robotic Urology Section to systematically review the currently available data on RARP, to critically assess current surgical techniques, and to generate best practice recommendations to guide clinicians and related medical personnel. No commercial support was obtained for the conference. Evidence acquisition: A systematic review of the literature was performed in agreement with the Preferred Reporting Items for Systematic Reviews and Meta-analysis statement. Evidence synthesis: The results of the systematic literature review were reviewed, discussed, and refined over the 2-d conference. Key recommendations were generated using a Delphi consensus approach. RARP is associated with less blood loss and transfusion rates compared with RRP, and there appear to be minimal differences between the two approaches in terms of overall postoperative complications. Positive surgical margin rates are at least equivalent with RARP, but firm conclusions about biochemical recurrence and other oncologic end points are difficult to draw because the follow-up in existing studies is relatively short and the overall experience with RARP in locally advanced PCa is still limited. RARP may offer advantages in postoperative recovery of urinary continence and erectile function, although there are methodological limitations in most studies to date and a need for well-controlled comparative outcomes studies of radical prostatectomy surgery following best practice guidelines. Surgeon experience and institutional volume of procedures strongly predict better outcomes in all relevant domains. Conclusions: Available evidence suggests that RARP is a valuable therapeutic option for clinically localized PCa. Further research is needed to clarify the actual role of RARP in patients with locally advanced disease. © 2012.


Medline and Embase were searched for studies comparing robot-assisted radical prostatectomy with open prostatectomy and conventional laparoscopic prostatectomy. Random effects meta-analysis was used to calculate a pooled estimate of effect. The 95% prediction intervals are also reported. One
randomized study and 50 observational studies were identified. The results show that compared with open surgery, robot-assisted surgery is associated with fewer positive surgical margins for pT2 tumors (relative risk 0.63, 95% confidence interval 0.49-0.81, P < 0.001) and improved outcomes for sexual function at 12 months (relative risk 1.60, 95% confidence interval 1.33-1.93, P < 0.001), and, to a lesser extent, urinary function at 12 months (relative risk 1.06, 95% confidence interval 1.02-1.11, P < 0.01). Compared with conventional laparoscopic prostatectomy, robot-assisted surgery is associated with a slight increase in urinary function at 12 months (relative risk 1.09, 95% confidence interval 1.02 to 1.17, P = 0.013). The overall methodological quality of the included studies was low, with high levels of heterogeneity. The use of prediction intervals as an aid to decision making in regard to the introduction of this technology is examined. Clinically significant improvements in positive surgical margins rates for pT2 tumors and sexual function at 12 months associated with robot-assisted surgery in comparison with open surgery should be interpreted with caution given the limitations of the evidence. Differences between robot-assisted and conventional laparoscopic surgery are minimal.


Context: Perioperative complications are a major surgical outcome for radical prostatectomy (RP). Objective: Evaluate complication rates following robot-assisted RP (RARP), risk factors for complications after RARP, and surgical techniques to improve complication rates after RARP. We also performed a cumulative analysis of all studies comparing RARP with retropubic RP (RRP) or laparoscopic RP (LRP) in terms of perioperative complications. Evidence acquisition: A systematic review of the literature was performed in August 2011, searching Medline, Embase, and Web of Science databases. A free-text protocol using the term radical prostatectomy was applied. The following limits were used: humans; gender (male); and publications dating from January 1, 2008. A cumulative analysis was conducted using Review Manager software v.4.2 (Cochrane Collaboration, Oxford, UK). Evidence synthesis: We retrieved 110 papers evaluating oncologic outcomes following RARP. Overall mean operative time is 152 min; mean blood loss is 166 ml; mean transfusion rate is 2%; mean catheterization time is 6.3 d; and mean in-hospital stay is 1.9 d. The mean complication rate was 9%, with most of the complications being of low grade. Lymphocele/lymphorrea (3.1%), urine leak (1.8%), and reoperation (1.6%) are the most prevalent surgical complications. Blood loss (weighted mean difference: 582.77; p < 0.00001) and transfusion rate (odds ratio [OR]: 7.55; p < 0.00001) were lower in RARP than in RRP, whereas only transfusion rate (OR: 2.56; p = 0.005) was lower in RARP than in LRP. All the other analyzed parameters were similar, regardless of the surgical approach. Conclusions: RARP can be performed routinely with a relatively small risk of complications. Surgical experience, clinical patient characteristics, and cancer characteristics may affect the risk of complications. Cumulative analyses demonstrated that blood loss and transfusion rates were significantly lower with RARP than with RRP, and transfusion rates were lower with RARP than with LRP, although all other features were similar regardless of the surgical approach. © 2012.


Context: Despite the large diffusion of robot-assisted radical prostatectomy (RARP), literature and data on the oncologic outcome of RARP are limited. Objective: Evaluate lymph node yield, positive surgical margins (PSMs), use of adjuvant therapy, and biochemical recurrence (BCR)-free survival
following RARP and perform a cumulative analysis of all studies comparing the oncologic outcomes of RARP and retropubic radical prostatectomy (RRP) or laparoscopic radical prostatectomy (LRP). Evidence acquisition: A systematic review of the literature was performed in August 2011, searching Medline, Embase, and Web of Science databases. A free-text protocol using the term radical prostatectomy was applied. The following limits were used: humans; gender (male); and publications dating from January 1, 2008. A cumulative analysis was conducted using Review Manager software v.4.2 (Cochrane Collaboration, Oxford, UK) and Stata 11.0 SE software (StataCorp, College Station, TX, USA). Evidence synthesis: We retrieved 79 papers evaluating oncologic outcomes following RARP. The mean PSM rate was 15% in all comers and 9% in pathologically localized cancers, with some tumor characteristics being the most relevant predictors of PSMs. Several surgeon-related characteristics or procedure-related issues may play a major role in PSM rates. With regard to BCR, the very few papers with a follow-up duration >5 yr demonstrated 7-yr BCR-free survival estimates of approximately 80%. Finally, all the cumulative analyses comparing RARP with RRP and comparing RARP with LRP demonstrated similar overall PSM rates (RARP vs RRP: odds ratio [OR]: 1.21; p = 0.19; RARP vs LRP: OR: 1.12; p = 0.47), pT2 PSM rates (RARP vs RRP: OR: 1.25; p = 0.31; RARP vs LRP: OR: 0.99; p = 0.97), and BCR-free survival estimates (RARP vs RRP: hazard ratio [HR]: 0.9; p = 0.526; RARP vs LRP: HR: 0.5; p = 0.141), regardless of the surgical approach. Conclusions: PSM rates are similar following RARP, RRP, and LRP. The few data available on BCR from high-volume centers are promising, but definitive comparisons with RRP or LRP are not currently possible. Finally, significant data on cancer-specific mortality are not currently available. © 2012.


Introduction and Objective: Open radical prostatectomy (RRP) is the gold standard and most widespread treatment for clinically localized prostate cancer. However, in recent years robot-assisted laparoscopic prostatectomy (RARP) is rapidly gaining acceptance among urologists worldwide. We sought to outline our surgical technique of robotic radical prostatectomy and provide practical recommendations based on available reports and personal experience. We also critically review the current experience on RARP worldwide and compare the available data with the gold standard open RRP series. Material and Methods: A systematic review of the literature was performed for all published manuscripts between 1997 and 2008 using the keywords - 'robotic radical prostatectomy,' 'robot-assisted radical prostatectomy,' 'laparoscopic radical prostatectomy' and 'robotic' using the Medline database. Results: A total of 226 original manuscripts on RARP were identified. Manuscripts were selected according to their relevance to the current topic (i.e. original articles, number of patients in the series, prospective data collection) and incorporated into this review. Conclusions: Eight years after the first RARP, multiple series are mature enough to demonstrate safety, efficiency and reproducibility of the procedure, as well as oncologic and functional outcomes comparable to its open counterpart. Further prospective, randomized studies comparing both surgical techniques are necessary in order to draw more definitive conclusions.


Objectives: To compare outcomes of radical retropubic, laparoscopic, and robotic-assisted prostatectomy using evidence-based analysis. Methods: We performed meta-analysis of observational studies directly comparing radical retropubic, laparoscopic, and robotic-assisted prostatectomy for the treatment of localized prostate cancer. The primary outcomes were operative blood loss, perioperative transfusion, surgical margin status, postoperative urinary incontinence, and postoperative erectile dysfunction. Based on established similarities in surgical principles, we combined laparoscopic and
robotic-assisted data into a single group. We estimated standardized mean differences (SMD), risk ratios (RR), and risk differences (RD) using random effects models. Results: Nineteen studies (n = 3893 patients) met inclusion criteria for this analysis. Compared with those undergoing retropubic prostatectomy, patients undergoing laparoscopic or robotic-assisted prostatectomy experienced less operative blood loss (SMD -1.74, 95% confidence interval [CI] -1.74 to -1.49, P <0.001) and were 77% less likely to receive a perioperative transfusion (RR 0.23, 95% CI 0.11 to 0.49, P <0.001). There was no significant difference in overall risk of positive surgical margin (RR 0.88, 95% CI 0.74 to 1.06, P = 0.17). There were also no significant differences in 1-year urinary continence (P = 0.49) and 1-year erectile function (P = 0.09); however, these outcomes were measured using nonvalidated instruments.

Conclusions: Our results suggest that, compared with retropubic prostatectomy, laparoscopic and robotic-assisted prostatectomy are associated with decreased operative blood loss, decreased risk of transfusion, and similar risk of positive surgical margin. Further comparative studies—using consistent, validated outcomes measures—are needed to further assess postoperative urinary continence and potency. © 2008 Elsevier Inc. All rights reserved.


Background: Many American hospitals will soon face readmissions penalties deducted from Medicare reimbursements, which will place further scrutiny on techniques which may offer reduced post-operative morbidity. We aimed to perform the first multi-institutional study using the National Surgical Quality Improvement Program (NSQIP) database, to compare predictors of readmission within cohorts of open Radical Retropubic Prostatectomy (RRP) and Robotic Assisted Laparoscopic Radical Prostatectomy (RALRP) in a contemporary nationwide series of radical prostatectomy. Methods: All patients undergoing radical prostatectomy in 2011 were identified in the National NSQIP database using procedural codes. As no patients in the analysis underwent laparoscopic radical prostatectomy (LRP) patients were grouped as RRP or RALRP for analysis. Peri-operative variables were analyzed using Chi-squared and Student's T-test as appropriate. Multiple logistic regression was used to identify readmission risk factors. Results: Of 5,471 patient cases analyzed, 4374 (79.9%) and 1097 (20.1%) underwent RALRP and RRP, respectively. RRP and RALRP cohorts experienced different re-admission rates (5.47% vs. 3.48%, respectively; p =0.002). In addition, RRP experienced a higher rate of overall complications than RALRP (23.25% vs. 5.62%, respectively; p<0.001), but not higher rates of reoperation (1.09% vs. 0.96%, respectively; p=0.689). Overall predictors of re-admission included operative time, dyspnea, and RRP or RALRP procedure type. Current smoking and patient age were predictive of readmission for RRP only, while dyspnea was predictive of readmission following RALRP only. Conclusion: This is the first multi-institutional retrospective study examining readmission rates and procedural intracohort predictors of readmission for RRP in the contemporary United States. We report a significant difference in post-operative complication and readmission rates in RRP compared to RALRP. Further prospective analysis is warranted.


OBJECTIVE: To compare the effectiveness of robot-assisted and standard laparoscopic prostatectomy. METHODS: A care pathway was described. We performed a systematic literature review based on a search of Medline, Medline in Process, Embase, Biosis, Science Citation Index, Cochrane Controlled Trials Register, Current Controlled Trials, Clinical Trials, WHO International Clinical Trials Registry and NIH Reporter, the Health Technology Assessment databases, the Database of Abstracts of
Reviews of Effects, and relevant conference abstracts up to 31st October 2010). Additionally, reference lists were scanned, an expert panel consulted, and websites of manufacturers, professional organisations, and regulatory bodies were checked. We selected randomised controlled trials (RCTs) and non-randomised comparative studies, published after 1st January 1995, including men with localised prostate cancer undergoing robot-assisted or laparoscopic prostatectomy compared with the other procedure or with open prostatectomy. Studies where at least 90% of included men had clinical tumour stages T1 to T2 and which reported at least one of our specified outcomes were eligible for inclusion. A mixed-treatment comparison meta-analysis was performed to generate comparative statistics on specified outcomes. RESULTS: We included data from 19,064 men across one RCT and 57 non-randomised comparative reports. Robotic prostatectomy had a lower risk of major intra-operative harms such as organ injury [0.4% robotic vs 2.9% laparoscopic], odds ratio ([OR] [95% credible interval [CrI]] 0.16 [0.03 to 0.76]), and a lower rate of surgical margins positive for cancer [17.6% robotic vs 23.6% laparoscopic], OR [95% CrI] 0.69 [0.51 to 0.96]). There was no evidence of a difference in the proportion of men with urinary incontinence at 12 months (OR [95% CrI] 0.55 [0.09 to 2.84]). There were insufficient data on sexual dysfunction. Surgeon learning rates for the procedures did not differ, although data were limited. CONCLUSIONS: Men undergoing robotic prostatectomy appear to have reduced surgical morbidity, and a lower risk of a positive surgical margin, which may reduce rates of cancer recurrence and the need for further treatment, but considerable uncertainty surrounds these results. We found no evidence that men undergoing robotic prostatectomy are disadvantaged in terms of early outcomes. We were unable to determine longer-term relative effectiveness.


OBJECTIVE: To assess erectile dysfunction in patients with prostate cancer undergoing surgery by radical prostatectomy, laparoscopic prostatectomy or robotic prostatectomy. MATERIAL AND METHODS: Systematic Review of literature based on a search strategy (2000-10) in MedLine, Embase, Cochrane Library, CRD, ECRI, and Hayes. Mesh terms used were Prostatectomy, "Prostatic Neoplasm, Transuretral Resection Prostate, Impotence and as free terms erectile dysfunction and prostatectomy. Studies included patients with prostate cancer underwent by prostatectomy radical with open surgery (retropubic), laparoscopic or robotic surgery. RESULTS: Ten observational studies with moderate quality and 29 case series with low quality were selected. Observational studies showed lower percentages of erectile dysfunction after intervention in the patients underwent robotic surgery (3-51%). Radical surgery (36-91%) and laparoscopic surgery showed higher values of impotence. In the studies that compared surgery versus radiotherapy, the results were better for radiotherapy (3-72% erectile dysfunction). In the case series, lower percentages of erectile dysfunction were shown in patients underwent to robotic surgery (22%), the following was for laparoscopic surgery (40%) and open radical prostatectomy (41.4%). CONCLUSIONS: This result should be considered with caution because of the low methodological quality of the studies included. However, the different surgical techniques assessed showed similar effects in the two types of studies included and we found that robotic surgery presented lower percentages of sexual impotence.


BACKGROUND: Utilization of robot-assisted radical prostatectomy (RARP) has increased rapidly, despite the absence of randomized controlled trials demonstrating the superiority of this approach.
While recent studies suggest an advantage in perioperative complication rates, they fail to account for the volume-outcome relationship. We sought to compare perioperative outcomes after RARP vs. ORP, whilst fully considering the impact of this established relationship. METHODS: Using the Nationwide Inpatient Sample, patients undergoing RP in 2009 were abstracted. Univariable and multivariable logistic regression analyses compared rates of blood transfusions, intraoperative and postoperative complications, prolonged length of stay (pLOS), elevated hospital charges (EHC), and mortality between RARP and ORP, overall and across volume quartiles. RESULTS: An estimated 77616 men underwent RP (RARP: 63.9%, ORP: 36.1%). Low-volume centers averaged 26.2 (RARP) and 5.2 (ORP) cases, very high-volume centers averaged 578.8 (RARP) and 150.2 (ORP) cases. Overall, RARP-treated patients experienced lower rates of adverse outcomes than ORP patients, in all measured categories. Across equivalent volume quartiles, RARP outcomes were generally favorable; however ORP at very high-volume centers produced lower rates of postoperative complications (OR: 0.59 (95%CI: 0.46-0.75)), EHC (0.75 (0.64-0.87)) and comparable rates of blood transfusions (1.38 (0.93-2.02)) relative to RARP at low-volume centers. CONCLUSION: Regionalization has occurred to a greater extent for RARP than ORP, with an associated benefit in overall outcomes. Nonetheless, low volume institutions experienced inferior outcomes relative to the highest volume centers irrespective of approach. These findings demonstrate the importance of accounting for hospital volume when examining the benefit of a surgical technique.


Purpose: The use of robot-assisted radical prostatectomy has increased rapidly despite the absence of randomized, controlled trials showing the superiority of this approach. While recent studies suggest an advantage for perioperative complication rates, they fail to account for the volume-outcome relationship. We compared perioperative outcomes after robot-assisted and open radical prostatectomy, while considering the impact of this established relationship. Materials and Methods: Using the NIS (Nationwide Inpatient Sample), we abstracted data on patients treated with radical prostatectomy in 2009. Univariable and multivariable logistic regression analyses were done to compare the rates of blood transfusion, intraoperative and postoperative complications, prolonged length of stay, increased hospital charges and mortality between robot-assisted and open radical prostatectomy overall and across volume quartiles. Results: An estimated 77,616 men underwent radical prostatectomy, including a robot-assisted and an open procedure in 63.9% and 36.1%, respectively. Low volume centers averaged 26.2 robot-assisted and 5.2 open cases, while very high volume centers averaged 578.8 robot-assisted and 150.2 open cases. Overall, patients treated with the robot-assisted procedure experienced a lower rate of adverse outcomes than those treated with the open procedure for all measured categories. Across equivalent volume quartiles robot-assisted radical prostatectomy outcomes were generally favorable. However, the open procedure at high volume centers resulted in a lower postoperative complication rate (OR 0.59, 95% CI 0.46-0.75), elevated hospital charges (OR 0.75, 95% CI 0.64-0.87) and a comparable blood transfusion rate (OR 1.38, 95% CI 0.93-2.02) relative to the robot-assisted procedure at low volume centers. Conclusions: Regionalization has occurred to a greater extent for robot-assisted than for open radical prostatectomy with an associated benefit in overall outcomes. Nonetheless, low volume institutions experienced inferior outcomes relative to the highest volume centers irrespective of approach. These findings demonstrate the importance of accounting for hospital volume when examining the benefit of a surgical technique. © 2013 American Urological Association Education and Research, Inc.

Background: Costs and benefits of emerging prostate cancer treatments for young men (age < 65 years) in the United States are not well understood. We compared utilization, clinical outcomes, and costs between two types of radical prostatectomy (RP) - minimally invasive prostatectomy (MIRP) and retropubic prostatectomy (RRP) - among young patients. Methods: We extracted from LifeLink Health Plan Claims Database, a commercial claims database, information on 10,669 patients receiving either MIRP or RRP between 2003 and 2007. In unadjusted analyses, we used chi-square tests to compare clinical outcomes and nonparametric bootstrapping method to compare costs between the MIRP and RRP groups. We applied logistic, Cox proportional hazard, and extended estimation equation methods to examine the association between surgical modality and perioperative complications, anastomotic stricture, and costs while controlling for age, comorbidity, and health plan characteristics. Results: The percentage of prostatectomies performed as MIRP increased from 5.7% in 2003 to 50.3% in 2007. Patients with more comorbidity were more likely to undergo RRP than MIRP. Compared with the RRP group, the MIRP group had a significantly lower rate of perioperative complications (23.0% vs. 30.4%; P < 0.001) and a lesser tendency for anastomotic strictures (hazard ratio 0.42; 95% CI 0.35-0.50) within the first postoperative year but had higher hospitalization costs ($19,998 vs. $18,424; P < 0.001) despite shorter hospitalizations (1.7 days vs. 3.1 days; P < 0.001). Similar findings were reported in the subgroup analysis of patients with comorbidity score 0. Conclusion: MIRP among nonelderly patients increased substantially over time. MIRP was found to have fewer complications. Lower costs of complications appeared to have offset higher hospitalization costs of MIRP. Copyright © 2012, International Society for Pharmacoeconomics and Outcomes Research (ISPOR). Published by Elsevier Inc.


BACKGROUND: Positive surgical margins (PSMs) are a known risk factor for biochemical recurrence in patients with prostate cancer (PCa) and are potentially affected by surgical technique and volume. OBJECTIVE: To investigate whether radical prostatectomy (RP) modality and volume affect PSM rates. DESIGN, SETTING, AND PARTICIPANTS: Fourteen institutions in Europe, the United States, and Australia were invited to participate in this study, all of which retrospectively provided margins data on 9778 open RP, 4918 laparoscopic RP, and 7697 robotic RP patients operated on between January 2000 and October 2011. OUTCOME MEASUREMENTS AND STATISTICAL ANALYSES: The outcome measure was PSM rate. Multivariable logistic regression analyses and propensity score methods identified odds ratios for risk of a PSM for one modality compared with another, after adjustment for age, preoperative prostate-specific antigen, postoperative Gleason score, pathologic stage, and year of surgery. Classic adjustment using standard covariates was also implemented to compare PSM rates based on center volume for each minimally invasive surgical cohort. RESULTS AND LIMITATIONS: Open RP patients had higher-risk PCa at time of surgery on average and were operated on earlier in the study time period on average, compared with minimally invasive cohorts. Crude margin rates were lowest for robotic RP (13.8%), intermediate for laparoscopic RP (16.3%), and highest for open RP (22.8%); significant differences persisted, although were ameliorated, after statistical adjustments. Lower-volume centers had increased risks of PSM compared with the highest-volume center for both laparoscopic RP and robotic RP. The study is limited by its nonrandomized nature; missing data across covariates, especially year of surgery in many of the open cohort cases; lack of standardized histologic processing and central pathology review; and lack of information regarding potential confounders such as patient comorbidity, nerve-sparing status, lymph node status, tumor volume, and individual surgeon caseload.
CONCLUSIONS: This multinational, multi-institutional study of 22,393 patients after RP suggests that PSM rates might be lower after minimally invasive techniques than after open RP and that PSM rates are affected by center volume in laparoscopic and robotic cases. PATIENT SUMMARY: In this study, we compared the effectiveness of different types of surgery for prostate cancer by looking at the rates of cancer cells left at the margins of what was removed in the operations. We compared open, keyhole, and robotic surgery from many centers across the globe and found that robotic and keyhole operations appeared to have lower margin rates than open surgeries. How many cases a center and surgeon do seems to affect this rate for both robotic and keyhole procedures.


Purpose: Minimally invasive pyeloplasty might have several advantages compared to open pyeloplasty in the management of ureteropelvic junction obstruction. Nonetheless, minimally invasive pyeloplasty appears to be underused in North America. We examined specific patient and hospital characteristics that may be associated with these disparities. Materials and Methods: The Nationwide Inpatient Sample was used to identify a national estimate of 29,456 patients with ureteropelvic junction obstruction treated with minimally invasive pyeloplasty (laparoscopic or robotic) and open pyeloplasty between 1998 and 2009. The rates of use of minimally invasive and open pyeloplasty were assessed according to year of surgery, and patient and hospital characteristics. The determinants of minimally invasive pyeloplasty were evaluated using logistic regression models adjusted for clustering. Results: Overall 15.3% of patients underwent minimally invasive pyeloplasty between 1998 and 2009. The use of minimally invasive pyeloplasty increased remarkably during the study period from 2.4% to 55.3%, a 23-fold increase. On multivariable logistic regression analysis African-American race (OR 0.584, p = 0.015) and other insurance status (including uninsured patients, OR 0.613, p = 0.013) were associated with a lower rate of minimally invasive pyeloplasty. Patients treated at teaching (OR 1.788, p = 0.003) and/or urban (OR 4.819, p <0.001) institutions were significantly more likely to undergo minimally invasive pyeloplasty. Conclusions: In the last decade there has been a dramatic increase in the use of minimally invasive pyeloplasty in the United States and in 2009 a slight majority underwent minimally invasive pyeloplasty. Nonetheless, treatment disparities exist. African-American patients with other insurance status (including those uninsured) treated at nonteaching, rural hospitals were less likely to undergo minimally invasive pyeloplasty. Efforts should be made to understand these treatment disparities and broaden the availability of minimally invasive pyeloplasty. © 2012 American Urological Association Education and Research, Inc.


Context: Radical prostatectomy (RP) approaches have rarely been compared adequately with regard to margin and perioperative complication rates. Objective: Review the literature from 2002 to 2010 and compare margin and perioperative complication rates for open retropubic RP (ORP), laparoscopic RP (LRP), and robot-assisted LRP (RALP). Evidence acquisition: Summary data were abstracted from 400 original research articles representing 167,184 ORP, 57,303 LRP, and 62,389 RALP patients (total: 286,876). Articles were found through PubMed and Scopus searches and met a priori inclusion criteria (eg, surgery after 1990, reporting margin rates and/or perioperative complications, study size >25 cases). The primary outcomes were positive surgical margin (PSM) rates, as well as total
intra- and perioperative complication rates. Secondary outcomes included blood loss, transfusions, conversions, length of hospital stay, and rates for specific individual complications. Weighted averages were compared for each outcome using propensity adjustment. Evidence synthesis: After propensity adjustment, the LRP group had higher positive surgical margin rates than the RALP group but similar rates to the ORP group. LRP and RALP showed significantly lower blood loss and transfusions, and a shorter length of hospital stay than the ORP group. Total perioperative complication rates were higher for ORP and LRP than for RALP. Total intraoperative complication rates were low for all modalities but lowest for RALP. Rates for readmission, reoperation, nerve, ureteral, and rectal injury, deep vein thrombosis, pneumonia, hematoma, lymphocele, anastomotic leak, fistula, and wound infection showed significant differences between groups, generally favoring RALP. The lack of randomized controlled trials, use of margin status as an indicator of oncologic control, and inability to perform cost comparisons are limitations of this study. Conclusions: This meta-analysis demonstrates that RALP is at least equivalent to ORP in terms of margin rates and suggests that RALP provides certain advantages, especially regarding decreased adverse events. © 2012 European Association of Urology.


Prostate cancer is the most frequent in men: 71000 new cases were diagnosed in France in 2011. Early diagnosis allows treatments with curative intent. Risk groups by D'Amico classification system were validated to estimate progression risk after radical prostatectomy, external beam radiotherapy and brachytherapy. Radical prostatectomy is one of the reference treatments for localized prostate cancer. There are many surgical approaches: open retropubic approach, perineal, trans peritoneal or extra peritoneal laparoscopic approach, robotic assisted or not. Main surgical steps are the same between retropubic or laparoscopic approaches. Regarding oncologic (positive surgical margins rate, progression free survival) and functional results (continence and erections), no difference was reported between different surgical approaches.


CONTEXT: The clinical significance of positive surgical margins (PSMs) in radical prostatectomy (RP) specimens and the management of affected patients remain unclear. OBJECTIVE: To address pitfalls in the pathologic interpretation of margin status; provide an update on the incidence, predictors, and long-term oncologic implications of PSMs in the era of robot-assisted laparoscopic RP (RALRP); and suggest a practical evidence-based approach to patient management. EVIDENCE ACQUISITION: A systematic review of the literature was performed in April 2013 using Medline/PubMed, Web of Science, and Scopus databases and the Cochrane Database of Systematic Reviews. Studies focusing on PSMs in RP pertinent to the objectives of this review were included. Particular attention was paid to publications within the last 5 yr and those concerning RALRP. EVIDENCE SYNTHESIS: A total of 74 publications were retrieved. Standardized measures to overcome variability in the pathologic interpretation of surgical margins have recently been established by the International Society of Urological Pathology. The average rate of PSMs in contemporary RALRP series is 15% (range: 6.5-32%), which is higher in men with a more advanced pathologic stage and equivalent to the rate reported in prior open and laparoscopic prostatectomy series. The likelihood of PSMs is strongly influenced by the surgeon's experience irrespective of the surgical approach. Technical modifications using the robotic platform and the role of frozen-section analysis to reduce the margin positivity rate continue to evolve. Positive margins are associated with a twofold increased hazard of biochemical relapse, but their association with more robust clinical end points is controversial. Level 1 evidence suggests that adjuvant radiation therapy (RT)
may favorably affect prostate-specific antigen recurrence rates, but whether the therapy also affects systemic progression, prostate cancer-specific mortality, and overall survival remains debatable.

CONCLUSIONS: Although positive margins in prostate cancer are considered an adverse oncologic outcome, their long-term impact on survival is highly variable and largely influenced by other risk modifiers. Adjuvant RT appears to be effective, but further study is required to determine whether early salvage RT is an equivalent alternative.

General Robotic (9)

Level 2a (9)
(2009). "HTA_AUS_Asernip_RPT_2009-12-09_Robotic-assisted_Surgery."

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KCE reports 104C (D/2009/10.273/09)


This health technology assessment (HTA) examined the evidence of the effectiveness, safety, costs and budget impact of robot-assisted surgery for a number of procedures. The HTA focussed on the procedures where there is sufficient evidence around the effectiveness of robot-assisted surgery. The organisational and other issues that would need to be considered in order to implement the technology as effectively and efficiently as possible have also been taken into account. The key findings of this HTA which precede and inform the Authority’s advice below were: 1) Although robot-assistance is reported for a range of surgeries, prostatectomy and hysterectomy are the two surgical procedures where there is sufficient evidence, albeit of low quality, to inform decision making. Evidence continues to emerge of its use in a broad range of other procedures; 2) Robot-assisted prostatectomy is superior to open prostatectomy across a range of outcomes evaluated in this HTA. Improved outcomes include urinary continence, sexual function and surgical margins. Peri-operative improved outcomes include lower risk of transfusion and shorter hospital stays. The benefits of robot-assisted prostatectomy over conventional laparoscopic approaches are minor; 3) Robot-assisted hysterectomy, when compared with open surgery, is associated with improved peri-operative outcomes. These include lower risk of transfusion, and shorter hospital stays. Compared to conventional laparoscopic hysterectomy, the benefits of robot-assistance are less pronounced; 4) Robot-assisted surgery is more ergonomic than conventional laparoscopic surgery for the operating surgeon, thereby allowing the surgeon to operate more easily; 5) The current capital cost of a new surgical robot is €1.45 million, and an annual maintenance fee of €150,000 applies from year 2. This maintenance fee and the amortised capital costs of the robot over its lifetime have been included in the economic models; 6) The incremental costs of robot-assisted surgery per procedure range from €2,487 to €3,019 for prostatectomy and hysterectomy respectively.
based on volumes per robot of 200 prostatectomies or 300 hysterectomies per annum. National demand for robot-assisted prostatectomy could be approximately 300 cases per annum and national demand for robot-assisted hysterectomy would be significantly higher. A single robot may not meet demand in either programme. 

7) A cost utility analysis of the prostatectomy-only model (based on 200 procedures annually) predicted an incremental cost effectiveness ratio (ICER) of €26,647/quality-adjusted life years (QALY) (95% CI: €14,241 - €61,220/QALY). Based on ‘willingness to pay’ thresholds, the probability of robot-assisted surgery being cost-effective is 0.20 at a threshold of €20,000 per QALY, 0.63 at €30,000 per QALY and 0.85 at €40,000 per QALY.


Background: There are few population-based data describing outcomes of robotic-assisted surgery. We compared outcomes of robotic-assisted, laparoscopic, and open surgery in a nationally representative population database. Study Design: A retrospective analysis of the Nationwide Inpatient Sample database from October 2008 to December 2009 was performed. We identified the most common robotic procedures by ICD-9 procedure codes and grouped them into categories by procedure type. Multivariate analyses examined mortality, length of stay (LOS), and total hospital charges, adjusting for age, race, sex, Charlson comorbidity index, and teaching hospital status. Results: A total of 368,239 patients were identified. On adjusted analysis, compared with open, robotic-assisted laparoscopic surgery was associated with decreased odds of mortality (odds ratio = 0.1; 95% CI, 0.0-0.2; p < 0.001), decreased mean LOS (-2.4 days; 95% CI, -2.5 to 2.3; p < 0.001), and increased mean total charges in all procedures (range $3,852 to $15,329) except coronary artery bypass grafting (-$17,318; 95% CI, -34,492 to -143; p = 0.048) and valvuloplasty (not statistically significant). Compared with laparoscopic, robotic-assisted laparoscopic surgery was associated with decreased odds of mortality (odds ratio = 0.1; 95% CI, 0.0-0.6; p = 0.008), decreased LOS overall (-0.6 days; 95% CI, -0.7 to -0.5; p < 0.001), but increased LOS in prostatectomy and other kidney/bladder procedures (0.3 days; 95% CI, 0.1-0.4; p = 0.006; 0.8 days; 95% CI, 0.0-1.6; p = 0.049), and increased total charges ($1,309; 95% CI, 519-2,099; p = 0.001). Conclusions: Data suggest that, compared with open surgery, robotic-assisted surgery results in decreased LOS and diminished likelihood of death. However, these benefits are not as apparent when comparing robotic-assisted laparoscopic with nonrobotic laparoscopic procedures. © 2012 American College of Surgeons.


OBJECTIVE: An application was received to review the evidence on the 'The Da Vinci Surgical System' for the treatment of gynecologic malignancies (e.g. endometrial and cervical cancers). Limitations to the current standard of care include the lack of trained physicians on minimally invasive surgery and limited access to minimally invasive surgery for patients. The potential benefits of 'The Da Vinci Surgical System' include improved technical manipulation and physician uptake leading to increased surgeries, and treatment and management of these cancers. The
demand for robotic surgery for the treatment and management of prostate cancer has been increasing due to its alleged benefits of recovery of erectile function and urinary continence, two important factors of men's health. The potential technical benefits of robotic surgery leading to improved patient functional outcomes are surgical precision and vision. CLINICAL NEED: Uterine and cervical cancers represent 5.4% (4,400 of 81,700) and 1.6% (1,300 of 81,700), respectively, of incident cases of cancer among female cancers in Canada. Uterine cancer, otherwise referred to as endometrial cancer is cancer of the lining of the uterus. The most common treatment option for endometrial cancer is removing the cancer through surgery. A surgical option is the removal of the uterus and cervix through a small incision in the abdomen using a laparoscope which is referred to as total laparoscopic hysterectomy. Risk factors that increase the risk of endometrial cancer include taking estrogen replacement therapy after menopause, being obese, early age at menarche, late age at menopause, being nulliparous, having had high-dose radiation to the pelvis, and use of tamoxifen. Cervical cancer occurs at the lower narrow end of the uterus. There are more treatment options for cervical cancer compared to endometrial cancer, however total laparoscopic hysterectomy is also a treatment option. Risk factors that increase the risk for cervical cancer are multiple sexual partners, early sexual activity, infection with the human papillomavirus, and cigarette smoking, whereas barrier-type of contraception as a risk factor decreases the risk of cervical cancer. Prostate cancer is ranked first in men in Canada in terms of the number of new cases among all male cancers (25,500 of 89,300 or 28.6%). The impact on men who develop prostate cancer is substantial given the potential for erectile dysfunction and urinary incontinence. Prostate cancer arises within the prostate gland, which resides in the male reproductive system and near the bladder. Radical retropubic prostatectomy is the gold standard treatment for localized prostate cancer. Prostate cancer affects men above 60 years of age. Other risk factors include a family history of prostate cancer, being of African descent, being obese, consuming a diet high in fat, physical inactivity, and working with cadmium. THE DA VINCI SURGICAL SYSTEM: The Da Vinci Surgical System is a robotic device. There are four main components to the system: 1) the surgeon's console, where the surgeon sits and views a magnified three-dimensional image of the surgical field; 2) patient side-cart, which sits beside the patient and consists of three instrument arms and one endoscope arm; 3) detachable instruments (endowrist instruments and intuitive masters), which simulate fine motor human movements. The hand movements of the surgeon's hands at the surgeon's console are translated into smaller ones by the robotic device and are acted out by the attached instruments; 4) three-dimensional vision system: the camera unit or endoscope arm. The main advantages of use of the robotic device are: 1) the precision of the instrument and improved dexterity due to the use of "wristed" instruments; 2) three-dimensional imaging, with improved ability to locate blood vessels, nerves and tissues; 3) the surgeon's console, which reduces fatigue accompanied with conventional laparoscopy surgery and allows for tremor-free manipulation. The main disadvantages of use of the robotic device are the costs including instrument costs ($2.6 million in US dollars), cost per use ($200 per use), the costs associated with training surgeons and operating room personnel, and the lack of tactile feedback, with the trade-off being increased visual feedback. RESEARCH QUESTIONS: For endometrial and cervical cancers, 1. What is the effectiveness of the Da Vinci Surgical System vs. laparoscopy and laparotomy for women undergoing any hysterectomy for the surgical treatment and management of their endometrial and cervical cancers? 2. What are the incremental costs of the Da Vinci Surgical System vs. laparoscopy and laparotomy for women undergoing any hysterectomy for the surgical treatment and management of their endometrial and cervical cancers? For prostate cancer, 3. What is the effectiveness of robotically-assisted radical prostatectomy using the Da Vinci Surgical System vs. laparoscopic radical prostatectomy and
retropubic radical prostatectomy for the surgical treatment and management of prostate cancer. What are the incremental costs of robotically-assisted radical prostatectomy using the Da Vinci Surgical System vs. laparoscopic radical prostatectomy and retropubic radical prostatectomy for the surgical treatment and management of prostate cancer? RESEARCH METHODS: LITERATURE SEARCH: SEARCH STRATEGY: A literature search was performed on May 12, 2010 using OVID MEDLINE, MEDLINE In-Process and Other Non-Indexed Citations, OVID EMBASE, Wiley Cochrane, CINAHL, Centre for Reviews and Dissemination/International Agency for Health Technology Assessment for studies published from January 1, 2000 until May 12, 2010. Abstracts were reviewed by a single reviewer and, for those studies meeting the eligibility criteria, full-text articles were obtained. Reference lists were also examined for any additional relevant studies not identified through the search. Articles with unknown eligibility were reviewed with a second clinical epidemiologist, then a group of epidemiologists until consensus was established. The quality of evidence was assessed as high, moderate, low or very low according to GRADE methodology. INCLUSION CRITERIA: English language articles (January 1, 2000-May 12, 2010)Journal articles that report on the effectiveness or cost-effectiveness for the comparisons of interest using a primary data source (e.g. obtained in a clinical setting)Journal articles that report on the effectiveness or cost-effectiveness for the comparisons of interest using a secondary data source (e.g. hospital- or population-based registries)Study design and methods must be clearly describedHealth technology assessments, systematic reviews, randomized controlled trials, non-randomized controlled trials and/or cohort studies, case-case studies, regardless of sample size, cost-effectiveness studies EXCLUSION CRITERIA: Duplicate publications (with the more recent publication on the same study population included)Non-English papersAnimal or in-vitro studiesCase reports or case series without a referent or comparison groupStudies on long-term survival which may be affected by treatmentStudies that do not examine the cancers (e.g. advanced disease) or outcomes of interest OUTCOMES OF INTEREST: For endometrial and cervical cancers, Primary outcomes: Morbidity factors- Length of hospitalization Number of complicationsPeri-operative factors- Operation time- Amount of blood loss- Number of conversions to laparotomyNumber of lymph nodes recoveredFor prostate cancer, Primary outcomes: Morbidity factors- Length of hospitalization- Amount of morphine use/painPeri-operative factors- Operation time- Amount of blood loss- Number of transfusions- Duration of catheterization- Number of complications- Number of anastomotic stricturesNumber of lymph nodes recoveredOncoologic factors- Proportion of positive surgical marginsLong-term outcomes- Urinary continence- Erectile function SUMMARY OF FINDINGS: Robotic use for gynecologic oncology compared to:LAPAROTOMY: benefits of robotic surgery in terms of shorter length of hospitalization and less blood loss. These results indicate clinical effectiveness in terms of reduced morbidity and safety, respectively, in the context of study design limitations. The beneficial effect of robotic surgery was shown in pooled analysis for complications, owing to increased sample size. More work is needed to clarify the role of complications in terms of safety, including improved study designs, analysis and measurement. LAPAROSCOPY: benefits of robotic surgery in terms of shorter length of hospitalization, less blood loss and fewer conversions to laparotomy likely owing to the technical difficulty of conventional laparoscopy, in the context of study design limitations. Clinical significance of significant findings for length of hospitalizations and blood loss is low. Fewer conversions to laparotomy indicate clinical effectiveness in terms of reduced morbidity. Robotic use for urologic oncology, specifically prostate cancer, compared to: RETROPUBIC SURGERY: benefits of robotic surgery in terms of shorter length of hospitalization and less blood loss/fewer individuals requiring transfusions. These results indicate clinical effectiveness in terms of reduced morbidity and safety, respectively, in the
context of study design limitations. There was a beneficial effect in terms of decreased positive surgical margins and erectile dysfunction. These results indicate clinical effectiveness in terms of improved cancer control and functional outcomes, respectively, in the context of study design limitations. Surgeon skill had an impact on cancer control and functional outcomes. The results for complications were inconsistent when measured as either total number of complications, pain management or anastomosis. (ABSTRACT TRUNCATED)


Background: Health technology assessment (HTA) is frequently used when a new and expensive technology is being introduced into clinical practice. This certainly is the case with the da Vinci surgical robot, with costs ranging from $1 to $2.5 million for each unit. This systematic review documents major variability in the reported cost evaluation studies of da Vinci robot-assisted operations compared with those performed by the direct manual laparoscopic approach.

Methods: Published studies in the English language related to the period 2000-2010 were searched using economic and clinical electronic databases. Results: All 11 reports included some form of cost analysis, which made it possible for the authors to extract information on certain specific economic outcomes: operating room time, hospital stay, and total costs. With the exception of two studies, the reported operating room time was higher with the robotic approach than with manual laparoscopic surgery, and the hospital stay was the same for the two techniques. Robotic surgery is significantly more expensive if the purchase and maintenance costs of the robot system are included in the total costs. Only 3 of the 11 publications included these costs. Conclusions: The disadvantage of robotic surgery is its higher costs related to purchase and maintenance of technology and its longer operating room time. However, emerging evidence shows that operating room time decreases with experience using the robot. From the HTA viewpoint, the result of this review is that the jury still is out on the HTA of da Vinci-assisted robotic surgery. © 2011 Springer Science+Business Media, LLC.

MIS vs Open (19)

Level 2a (19)

Purpose: The number of radical prostatectomies has increased. Many urologists have shifted from the open surgical approach to minimally invasive techniques. It is not clear whether the risk of post-prostatectomy incisional hernia varies by surgical approach. Materials and Methods: In the linked Surveillance, Epidemiology and End Results (SEER)-Medicare data set we identified men 66 years old or older who were treated with minimally invasive or open radical prostatectomy for prostate cancer diagnosed from 2003 to 2007. The main study outcome was incisional hernia repair, as identified in Medicare claims after prostatectomy. We also examined the frequency of umbilical, inguinal and other hernia repairs. Results: We identified 3,199 and 6,795 patients who underwent minimally invasive and
open radical prostatectomy, respectively. The frequency of incisional hernia repair was 5.3% at a median 3.1-year followup in the minimally invasive group and 1.9% at a 4.4-year median followup in the open group, corresponding to an incidence rate of 16.1 and 4.5/1,000 person-years, respectively. Compared to the open technique, the minimally invasive procedure was associated with more than a threefold increased risk of incisional hernia repair when controlling for patient and disease characteristics (adjusted HR 3.39, 95% CI 2.63-4.38, p <0.0001). Minimally invasive radical prostatectomy was associated with an attenuated but increased risk of any hernia repair compared with open radical prostatectomy (adjusted HR 1.48, 95% CI 1.29-1.70, p <0.0001). Conclusions: Minimally invasive radical prostatectomy was associated with a significantly increased risk of incisional hernia compared with open radical prostatectomy. This is a potentially remediable complication of prostate cancer surgery that warrants increased vigilance with respect to surgical technique. © 2013 by AMERICAN UROLOGICAL ASSOCIATION EDUCATION AND RESEARCH, INC.


Objective: To determine the effect of minimally invasive radical prostatectomy (MIRP) surgeon volume on outcomes, and correlate with those of open radical prostatectomy retropubic (ORP).

Methods and materials: Observational population-based study of 8,831 men undergoing MIRP and ORP by 1,457 low, medium, and high volume surgeons from SEER-Medicare linked data from 2003 to 2007. After stratifying by surgeon ORP and MIRP volume, the following outcomes were studied: length of stay, transfusions, post-operative 30-day and anastomotic stricture complications, and use of additional cancer therapies. Results: Men undergoing MIRP with high and medium vs. low volume surgeons were less likely to require additional cancer therapies (4.5% and 4.7% vs. 7%, P = 0.020). Similarly, men undergoing ORP with high vs. medium and low volume surgeons were less likely to require additional cancer therapies (5.7% vs. 6.8% and 7.1%, P = 0.044). Men undergoing ORP with high vs. medium and low volume surgeons experienced shorter lengths of stay (2.9 vs. 3.3 and 3.6 days, P < 0.001), and fewer transfusions (15.4% vs. 21.3% and 22.7%, P = 0.017), 30-day complications (18.4% vs. 25.6% and 25.7%, P < 0.001), and anastomotic strictures (10.1% vs. 15.6% and 16.3%, P = 0.003). However, MIRP surgeon volume did not affect these outcomes. Conclusions: Men undergoing MIRP or ORP with high volume surgeons were less likely to require additional cancer therapies. Additionally, patients of high volume ORP surgeons were more likely to experience shorter hospital stays, fewer transfusions, 30-day complications, and anastomotic strictures, while MIRP surgeon volume did not affect these perioperative outcomes. © 2010 Elsevier Inc. All rights reserved.


IMPORTANCE As many surgical procedures have undergone a transition from a standard, open surgical approach to a minimally invasive one in the past 2 decades, the diffusion of minimally invasive surgery may have had sizeable but overlooked effects on medical expenditures and worker productivity. OBJECTIVE To examine the impact of standard vs minimally invasive surgery on health plan spending and workplace absenteeism for 6 types of surgery. DESIGN Cross-sectional regression analysis. SETTING National health insurance claims data and matched workplace absenteeism data from January 1, 2000, to December 31, 2009. PARTICIPANTS A convenience sample of adults with employer-sponsored health insurance who underwent either standard or minimally invasive surgery for coronary revascularization, uterine fibroid resection, prostatectomy, peripheral revascularization, carotid revascularization, or aortic aneurysm repair. MAIN OUTCOMES AND MEASURE Health plan spending and workplace absenteeism from 14 days before through 352 days after the index surgery. RESULTS There were 321 956 patients
who underwent surgery; 23,814 were employees with workplace absenteeism data. After multivariable adjustment, mean health plan spending was lower for minimally invasive surgery for coronary revascularization (-$30,850; 95% CI, -$31,629 to -$30,091), uterine fibroid resection (-$15,093; 95% CI, -$17,543 to -$12,820), and peripheral revascularization (-$12,031; 95% CI, -$15,552 to -$8,717) and higher for prostatectomy ($1,350; 95% CI, $1,611 to $2,212) and carotid revascularization ($4,900; 95% CI, $1,772 to $8,370). Undergoing minimally invasive surgery was associated with missing significantly fewer days of work for coronary revascularization (mean difference, -37.7 days; 95% CI, -41.1 to -34.3), uterine fibroid resection (mean difference, -11.7 days; 95% CI, -14.0 to -9.4), prostatectomy (mean difference, -9.0 days; 95% CI, -14.2 to -3.7), and peripheral revascularization (mean difference, -16.6 days; 95% CI, -28.0 to -5.2). CONCLUSIONS AND RELEVANCE For 3 of 6 types of surgery studied, minimally invasive procedures were associated with significantly lower health plan spending than standard surgery. For 4 types of surgery, minimally invasive procedures were consistently associated with significantly fewer days of absence from work.


Background: Pelvic lymph node dissection (PLND) is an important component of prostate cancer staging and treatment, especially for surgical patients who have high-risk tumor features. It is not clear how the shift from open radical prostatectomy (ORP) to minimally invasive radical prostatectomy (MIRP) has affected the use of PLND. The objectives of this study were to identify predictors of PLND and to assess the impact of surgical technique in a contemporary, population-based cohort. Methods: In Surveillance, Epidemiology, and End Results (SEER) cancer registry data linked with Medicare claims, the authors identified men who underwent ORP or MIRP for prostate cancer during 2003 to 2007. The impact of surgical approach on PLND was evaluated, and interactions were examined between surgical procedure, prostate-specific antigen (PSA), and Gleason score with the analysis controlled for patient and tumor characteristics. Results: Of 6608 men who underwent ORP or MIRP, 70% (n = 4600) underwent PLND. The use of PLND declined over time both overall and within subgroups defined by procedure type. PLND was 5 times more likely in men who underwent ORP than in men who underwent MIRP when the analysis was controlled for patient and tumor characteristics. Elevated PSA and biopsy Gleason score, but not clinical stage, were associated with a greater odds of PLND in both the ORP group and the MIRP group. However, the magnitude of the association between these factors and PLND was significantly greater for patients in the ORP group. Conclusions: PLND was less common among men who underwent MIRP, independent of tumor risk factors. A decline in PLND rates was not fully explained by an increase in MIRP. The authors concluded that these trends may signal a surgical approach-dependent disparity in prostate cancer staging and therapy. © 2011 American Cancer Society.


Context: Minimally invasive radical prostatectomy (MIRP) has diffused rapidly despite limited data on outcomes and greater costs compared with open retropubic radical prostatectomy (RRP). Objective: To determine the comparative effectiveness of MIRP vs RRP. Design, Setting, and Patients: Population-based observational cohort study using US Surveillance, Epidemiology, and End Results Medicare linked data from 2003 through 2007. We identified men with prostate cancer who underwent MIRP (n=1938) vs RRP (n=6899). Main Outcome Measures: We compared postoperative 30-day complications, anastomotic stricture 31 to 365 days postoperatively, long-term incontinence and erectile dysfunction more than 18 months postoperatively, and postoperative use of additional cancer
therapies, a surrogate for cancer control. Results: Among men undergoing prostatectomy, use of MIRP increased from 9.2% (95% confidence interval [CI], 8.1%-10.5%) in 2003 to 43.2% (95% CI, 39.6%-46.9%) in 2006-2007. Men undergoing MIRP vs RRP were more likely to be recorded as Asian (6.1% vs 3.2%), less likely to be recorded as black (6.2% vs 7.8%) or Hispanic (5.6% vs 7.9%), and more likely to live in areas with at least 90% high school graduation rates (50.2% vs 41.0%) and with median incomes of at least $60,000 (35.8% vs 21.5%) (all P<.001). In propensity score-adjusted analyses, MIRP vs RRP was associated with shorter length of stay (median, 2.0 vs 3.0 days; P<.001) and lower rates of blood transfusions (2.7% vs 20.8%; P<.001), postoperative respiratory complications (4.3% vs 6.6%; P=.004), miscellaneous surgical complications (4.3% vs 5.6%; P=.03), and anastomotic stricture (5.8% vs 14.0%; P<.001). However, MIRP vs RRP was associated with an increased risk of genitourinary complications (4.7% vs 2.1%; P=.001) and diagnoses of incontinence (15.9 vs 12.2 per 100 person-years; P=.02) and erectile dysfunction (26.8 vs 19.2 per 100 person-years; P=.009). Rates of use of additional cancer therapies did not differ by surgical procedure (8.2 vs 6.9 per 100 person-years; P=.35). Conclusion: Men undergoing MIRP vs RRP experienced shorter length of stay, fewer respiratory and miscellaneous surgical complications and strictures, and similar postoperative use of additional cancer therapies but experienced more genitourinary complications, incontinence, and erectile dysfunction. ©2009 American Medical Association. All rights reserved.


PURPOSE: Demand for minimally invasive radical prostatectomy (MIRP) to treat prostate cancer is increasing; however, outcomes remain unclear. We assessed utilization, complications, lengths of stay, and salvage therapy rates for MIRP versus open radical prostatectomy assessed whether MIRP surgeon volume is associated with better outcomes. METHODS: We identified 2,702 men undergoing MIRP and open radical prostatectomy during 2003 to 2005 from a national 5% sample of Medicare beneficiaries. We assessed the association between surgical approach and outcomes, adjusting for surgeon volume, age, race, comorbidity, and geographic region. RESULTS: MIRP utilization increased from 12.2% in 2003 to 31.4% in 2005. Men undergoing MIRP versus open radical prostatectomy had fewer perioperative complications (29.8% v 36.4%; P =.002) and shorter lengths of stay (1.4 v 4.4 days; P <.001); however, they were more likely to receive salvage therapy (27.8% v 9.1%, P <.001). In adjusted analyses, MIRP versus open radical prostatectomy was associated with fewer perioperative complications (odds ratio [OR], 0.73; 95% CI, 0.60 to 0.90), shorter lengths of stay (parameter estimate, -2.99; 95% CI, -3.45 to -2.53) but more anastomotic strictures (OR, 1.40; 95% CI, 1.04 to 1.87) and higher rates of salvage therapy (OR, 3.67; 95% CI, 2.81 to 4.81). Patients of high-volume MIRP experienced fewer anastomotic strictures (OR, 0.93; 95% CI, 0.87 to 0.99) and less salvage therapy (OR, 0.92; 95% CI, 0.88 to 0.98). CONCLUSION: Men undergoing MIRP versus open radical prostatectomy have lower risk for perioperative complications and shorter lengths of stay, but are at higher risk for salvage therapy and anastomotic strictures. However, risk for these unfavorable outcomes decreases with increasing MIRP surgical volume.

colectomy. MAIN OUTCOMES AND MEASURES In-hospital mortality, complications, ostomy rates, conversion to open procedure, length of stay, discharge disposition, and cost. RESULTS Of the 244 129 colectomies performed during the study period, 126 284 (51.7%) were OCs, 116 261 (47.6%) were LCs, and 1584 (0.6%) were RCs. In comparison with OC, LC was associated with a lower mortality rate (0.4% vs 2.0%), lower complication rate (19.8% vs 33.2%), lower ostomy rate (3.5 vs 13.0%), shorter median length of stay (4 vs 6 days), a higher routine discharge rate (86.1% vs 68.4%), and lower overall cost than OC ($11 742 vs $13 666) (all P < .05). Comparison between RC and LC showed no significant differences with respect to in-hospital mortality (0.0% vs 0.7%), complication rates (14.7% vs 18.5%), ostomy rates (3.0% vs 5.1%), conversions to open procedure (5.7% vs 9.9%), and routine discharge rates (88.7% vs 88.5%) (all P > .05). However, RC incurred a higher overall hospitalization cost than LC ($14 847 vs $11 966, P < .001). CONCLUSIONS AND RELEVANCE In this nationwide comparison of minimally invasive approaches for colon resection, LC demonstrated favorable clinical outcomes and lower cost than OC. Robot-assisted colectomy was equivalent in most clinical outcomes to LC but incurred a higher cost.


Purpose: We determined therapeutic trends in the management of adenocarcinoma of the prostate, and in the case of intensity modulated radiation therapy we investigated whether site of service influenced those trends. Materials and Methods: A variety of CPT codes to treat adenocarcinoma of the prostate were extracted from the Medicare Part B 5% sample for the years 2006 to 2008 inclusive. Data were stratified by year, type of service and, in the case of radiation therapy, site of service. Treatment trends were calculated by indexing the total number of Medicare beneficiaries receiving a service against needle biopsies of the prostate. Results: The percentage of Medicare beneficiaries receiving therapy indexed to needle biopsies of the prostate increased from 43.8% in 2006 to 49.0% in 2008. Trends in radiation and surgery were similar with 11.5% and 13% increases in each modality, respectively. Total Medicare beneficiaries receiving intensity modulated radiation therapy and laparoscopic radical prostatectomy increased by 25.4% and 22.1%, respectively, while Medicare beneficiaries treated with open radical prostatectomy and 3-dimensional conformal radiation therapy decreased by 27.9% and 37.6%, respectively. The pattern of use for intensity modulated radiation therapy was similar in physician office and hospital facility settings, increasing from 7.3% to 11.1% and 8.3% to 11.3% of Medicare beneficiaries indexed to needle biopsies of the prostate receiving intensity modulated radiation therapy at these sites in 2008, respectively. Conclusions: Treatment trends in surgery and radiation strongly favor newer technologies, and in the case of intensity modulated radiation therapy, utilization trends for treatment of adenocarcinoma of the prostate are similar across all sites of service. © 2011 American Urological Association Education and Research, Inc.


Background: Although the use of minimally invasive radical prostatectomy (MIRP) has increased, there are few comprehensive population-based studies assessing temporal trends and outcomes relative to retropubic radical prostatectomy (RRP). Objective: Assess temporal trends in the utilization and outcomes of MIRP and RRP among US Medicare beneficiaries from 2003 to 2007. Design, setting, and participants: A population-based retrospective study of 19 594 MIRP and 58 638 RRP procedures was performed from 2003 to 2007 from the 100% Medicare sample, composed of almost all US men ≥65 yr of age. Intervention: MIRP and RRP. Measurements: We measured 30-d outcomes (cardiac, respiratory, vascular, genitourinary, miscellaneous medical, miscellaneous surgical, wound
complications, blood transfusions, and death), cystography utilization within 6 wk of surgery, and late complications (anastomotic stricture, ureteral complications, rectourethral fistulae, lymphocele, and corrective incontinence surgery). Results and limitations: From 2003 to 2007, MIRP increased from 4.9% to 44.5% of radical prostatectomies while RRP decreased from 89.4% to 52.9%. MIRP versus RRP subjects were younger (p < 0.001) and had fewer comorbidities (p < 0.001). Decreased MIRP genitourinary complications (6.2-4.1%; p = 0.002), miscellaneous surgical complications (4.7-3.7%; p = 0.030), transfusions (3.5-2.2%; p = 0.005), and postoperative cystography utilization (40.3-34.1%; p < 0.001) were observed over time. Conversely, overall RRP perioperative complications increased (27.4-32.0%; p < 0.001), including an increase in perioperative mortality (0.5-0.8%, p = 0.009). Late RRP complications increased, with the exception of fewer anastomotic strictures (10.2-8.8%; p = 0.002). In adjusted analyses, RRP versus MIRP was associated with increased 30-d mortality (odds ratio [OR]: 2.67; 95% confidence interval [CI], 1.55-4.59; p < 0.001) and more perioperative (OR: 1.60; 95% CI, 1.45-1.76; p < 0.001) and late complications (OR: 2.52; 95% CI, 2.20-2.89; p < 0.001). Limitations include the inability to distinguish MIRP with versus without robotic assistance and also the lack of pathologic information. Conclusions: From 2003 to 2007, there were fewer MIRP transfusions, genitourinary complications, and miscellaneous surgical complications, whereas most RRP perioperative and late complications increased. RRP versus MIRP was associated with more postoperative mortality and complications. © 2011.


Purpose: Studies comparing pain after minimally invasive vs retropubic and perineal radical prostatectomy are conflicting. We characterized population based outpatient narcotic prescribing patterns after minimally invasive, retropubic and perineal radical prostatectomy. Materials and Methods: We evaluated outpatient prescription data after minimally invasive, retropubic and perineal radical prostatectomy from 2003 to 2006 using MarketScan®. Baseline and postoperative narcotic prescriptions were identified using the National Drug Code. Total prescribed narcotic strength in morphine sulfate equivalents, the number of prescriptions filled and costs were compared. We performed multivariate analysis adjusted for surgical approach, age, comorbidity, baseline narcotic use, health plan and geographic region. Results: We identified 2,206 minimally invasive, 8,037 retropubic and 463 perineal radical prostatectomies with no differences in baseline narcotic prescription use. Perineal and retropubic operations were associated with greater total morphine sulfate equivalent use than the minimally invasive operation. Perineal prostatectomy was associated with more narcotic refills than minimally invasive and retropubic prostatectomy (42.3% vs 20.2% and 28.9%, respectively, p <0.001). Median narcotic costs were lower for minimally invasive than for perineal and retropubic prostatectomy. On adjusted analysis perineal radical prostatectomy, younger age, baseline narcotic use and preferred provider organization health plan were associated with greater morphine sulfate equivalents and narcotic refills while minimally invasive surgery was associated with fewer refills and lower costs but not with total morphine sulfate equivalents. There was significant geographic variation in narcotic use and costs. Conclusions: Postoperatively minimally invasive radical prostatectomy required fewer narcotic refills and had lower narcotic costs while perineal radical prostatectomy required the greatest amount of narcotics. However, minimally invasive vs retropubic radical prostatectomy morphine sulfate equivalent requirements did not differ on adjusted analysis. While our findings support the purported advantage of minimally invasive radical prostatectomy of less postoperative pain, confirmatory prospective studies with objective outcomes are needed. © 2011 American Urological Association Education and Research, Inc.
OBJECTIVES: We sought to examine the trends in perioperative outcomes of kidney cancer surgery stratified by type (radical nephrectomy [RN] vs. partial nephrectomy [PN]) and approach (open vs. minimally invasive). METHODS: We queried the National Surgical Quality Improvement Program database to identify kidney cancer operations performed from 2005 to 2011. We examined 30-day perioperative outcomes including operative time, transfusion rate, length of stay, major morbidity (cardiovascular, pulmonary, renal, and infectious), and mortality. RESULTS: A total of 2,902 PN and 5,459 RN cases were identified. The use of PN increased over time, accounting for 39% of all nephrectomies in 2011. Minimally invasive approaches also increased over time for both RN and PN. Open surgery was associated with increased length of stay, receipt of transfusion, major complications, and perioperative mortality. Resident involvement and open approach were independent predictors of major complications for both PN and RN. Additionally, the presence of a medical comorbidity was also a risk factor for complications after RN. The overall complication rates decreased for all approaches over the study period. CONCLUSIONS: Minimally invasive approaches to kidney cancer renal surgery have increased with favorable outcomes. The safety of open and minimally invasive PN improved significantly over the study period. Although pathologic features cannot be determined from this data set, these data show that complications from renal surgical procedures are decreasing in an era of increasing use.

OBJECTIVE: To examine contemporary outcomes of minimally invasive radical prostatectomy (MIRP) compared with open prostatectomy, using a national, prospective perioperative database reflecting diverse practice settings. METHODS: The National Surgical Quality Improvement Program database was queried from 2005 to 2010 for laparoscopic or robotic prostatectomy (Current Procedural Terminology code 55866) and open retropubic prostatectomy (Current Procedural Terminology codes 55840, 55842, 55845). Perioperative outcomes examined were surgical and total operation duration, transfusion rates, length of stay, major morbidity (cardiovascular, pulmonary, renal, and infectious), and mortality. RESULTS: The study identified 5319 radical prostatectomies: 4036 MIRP and 1283 open. Although operative time was significantly longer in the MIRP group, there were significantly fewer perioperative blood transfusions and shorter mean length of stay. Major postoperative morbidity and mortality were 5% in the MIRP group and 9% in the open group (P < .001). Age, body mass index, presence of medical comorbidities, and open surgical technique were all independently predictive of major complications and mortality on multivariate analysis. CONCLUSION: In a nationwide database of diverse medical centers, MIRP was associated with longer operative time, but a significantly decreased rate of blood transfusions, length of stay, perioperative complication rate, and mortality compared with open prostatectomy. The minimally invasive surgical approach was independently associated with significantly fewer complications and deaths on multivariate analysis. Compared with other administrative databases that capture only inpatient events, the National Surgical Quality Improvement Program identifies complications up to 30 days postoperatively, providing more detailed characterization of complications after prostatectomy. These data reflect contemporary practice patterns and suggest that MIRP can be performed with low perioperative morbidity.

PURPOSE: Enthusiasm for laparoscopic surgical approaches to prostate cancer treatment has grown despite limited evidence of improved outcomes compared with open radical prostatectomy. We compared laparoscopic prostatectomy with or without robotic assistance vs open radical prostatectomy in terms of postoperative outcomes and subsequent cancer directed therapy. MATERIALS AND METHODS: Using a population based cancer registry linked with Medicare claims we identified men 66 years old or older with localized prostate cancer who underwent radical prostatectomy from 2003 to 2005. Outcome measures were general medical/surgical complications and mortality within 90 days after surgery, genitourinary/bowel complications within 365 days, radiation therapy and/or androgen deprivation therapy within 365 days and length of hospital stay. RESULTS: Of the 5,923 men 18% underwent laparoscopic radical prostatectomy. Adjusting for patient and tumor characteristics, there were no differences in the rate of general medical/surgical complications (OR 0.93 95% CI 0.77-1.14) or genitourinary/bowel complications (OR 0.96 95% CI 0.76-1.22), or in postoperative radiation and/or androgen deprivation (OR 0.80 95% CI 0.60-1.08). Laparoscopic prostatectomy was associated with a 35% shorter hospital stay (p <0.0001) and a lower bladder neck/urethral obstruction rate (OR 0.74, 95% CI 0.58-0.94). In laparoscopic cases surgeon volume was inversely associated with hospital stay and the odds of any genitourinary/bowel complication. CONCLUSIONS: Laparoscopic prostatectomy and open radical prostatectomy have similar rates of postoperative morbidity and additional treatment. Men considering prostate cancer surgery should understand the expected benefits and risks of each technique to facilitate decision making and set realistic expectations.


BACKGROUND: Evidence suggests that minimally invasive radical prostatectomy (MRP) and open radical prostatectomy (ORP) have similar short-term clinical and functional outcomes. MRP with robotic assistance is generally more expensive than ORP, but it is not clear whether subsequent costs of care vary by approach. METHODS: In the Surveillance, Epidemiology, and End Results (SEER) cancer registry linked with Medicare claims, men aged 66 years or older who received MRP or ORP in 2003 through 2006 for prostate cancer were identified. Total cost of care was estimated as the sum of Medicare payments from all claims for hospital care, outpatient care, physician services, home health and hospice care, and durable medical equipment in the first year from the date of surgical admission. The impact of surgical approach on costs was estimated, controlling for patient and disease characteristics. RESULTS: Of 5445 surgically treated prostate cancer patients, 4454 (82%) had ORP and 991 (18%) had MRP. Mean total first-year costs were more than $1200 greater for MRP compared with ORP ($16,919 vs $15,692; P = .08). Controlling for patient and disease characteristics, MRP was associated with 2% greater mean total payments, but this difference was not statistically significant. First-year costs were greater for men who were older, black, lived in the Northeast, had lymph node involvement, more advanced tumor stage, or greater comorbidity. CONCLUSIONS: In this population-based cohort of older men, MRP and ORP had similar economic outcomes. From a payer's perspective, any benefits associated with MRP may not translate to net savings compared with ORP in the first year after surgery. Cancer 2011. (c) 2011 American Cancer Society.


BACKGROUND: Race represents an established barrier to health care access in the United States and elsewhere. We examined whether race affects the utilization rate of minimally invasive radical
prostatectomy (MIRP) in a population-based sample of individuals from the United States. METHODS: Within the Healthcare Cost and Utilization Project Nationwide Inpatient Sample (NIS), we focused on patients in whom MIRP and open radical prostatectomy (ORP) were performed between 2001 and 2007. We assessed the proportions and temporal trends in race distributions between MIRP and ORP. Multivariable logistic regression analyses further adjusted for age, year of surgery, baseline Charlson Comorbidity Index, annual hospital caseload tertiles, hospital region, insurance status, and median zip code income. RESULTS: Of 65,148 radical prostatectomies, 3581 (5.5%) were MIRPs. African Americans accounted for 11.4% of patients versus 78.8% for Caucasians versus 9.9% for others. Between 2001 and 2007, the annual proportions of Caucasian patients treated with MIRP were 2.2%, 0.9%, 2.6%, 7.2%, 4.7%, 9.3%, and 11.6%, respectively (chi-square trend p<0.001). For the same years in African American patients, the proportions were 0.8, 0.3, 1.4, 4.4, 3.5, 9.0 and 8.4% (chi-square trend P < .001). In multivariable analyses relative to Caucasian patients, African American patients were 14% less likely to undergo MIRP (P = .01). After period stratification between years 2001-2005 versus 2006-2007, African Americans were 22% less likely to undergo a MIRP in the early period (P = .007) versus 11% less likely to have a MIRP in the contemporary period (P = .1). CONCLUSIONS: The racial discrepancies in MIRP utilization rates are gradually improving. © 2011 American Cancer Society.


Background: Prior to the introduction and dissemination of robot-assisted radical prostatectomy (RARP), population-based studies comparing open radical prostatectomy (ORP) and minimally invasive radical prostatectomy (MIRP) found no clinically significant difference in perioperative complication rates. Objective: Assess the rate of RARP utilization and reexamine the difference in perioperative complication rates between RARP and ORP in light of RARP's supplanting laparoscopic radical prostatectomy (LRP) as the most common MIRP technique. Design, setting, and participants: As of October 2008, a robot-assisted modifier was introduced to denote robot-assisted procedures. Relying on the Nationwide Inpatient Sample between October 2008 and December 2009, patients treated with radical prostatectomy (RP) were identified. The robot-assisted modifier (17.4x) was used to identify RARP (n = 11 889). Patients with the minimally invasive modifier code (54.21) without the robot-assisted modifier were classified as having undergone LRP and were removed from further analyses. The remainder were classified as ORP patients (n = 7389). Intervention: All patients underwent RARP or ORP. Measurements: We compared the rates of blood transfusions, intraoperative and postoperative complications, prolonged length of stay (pLOS), and in-hospital mortality. Multivariable logistic regression analyses of propensity score-matched populations, fitted with general estimation equations for clustering among hospitals, further adjusted for confounding factors. Results and limitations: Of 19 462 RPs, 61.1% were RARPs, 38.0% were ORPs, and 0.9% were LRPs. In multivariable analyses of propensity score-matched populations, patients undergoing RARP were less likely to receive a blood transfusion (odds ratio [OR]: 0.34; 95% confidence interval [CI], 0.28-0.40), to experience an intraoperative complication (OR: 0.47; 95% CI, 0.31-0.71) or a postoperative complication (OR: 0.86; 95% CI, 0.77-0.96), and to experience a pLOS (OR: 0.28; 95% CI, 0.26-0.30). Limitations of this study include lack of adjustment for tumor characteristics, surgeon volume, learning curve effect, and longitudinal follow-up. Conclusions: RARP has supplanted ORP as the most common surgical approach for RP. Moreover, we demonstrate superior adjusted perioperative outcomes after RARP in virtually all examined outcomes. © 2011 European Association of Urology.

Purpose: Minimally invasive radical prostatectomy has supplanted radical retropubic prostatectomy in popularity despite the absence of strong comparative effectiveness data demonstrating its superiority. We examined the influence of patient, surgeon and hospital characteristics on the use of minimally invasive radical prostatectomy vs radical retropubic prostatectomy.

Materials and Methods: Using SEER (Surveillance, Epidemiology and End Results)-Medicare linked data we identified 11,732 men who underwent radical prostatectomy from 2003 to 2007. We assessed the contribution of patient, surgeon and hospital characteristics to the likelihood of undergoing minimally invasive radical prostatectomy vs radical retropubic prostatectomy using multilevel logistic regression mixed models.

Results: Patient factors (36.7%) contributed most to the use of minimally invasive radical prostatectomy vs radical retropubic prostatectomy, followed by surgeon (19.1%) and hospital (11.8%) factors. Among patient specific factors Asian race (OR 1.86, 95% CI 1.27-2.72, p = 0.001), clinically organ confined tumors (OR 2.71, 95% CI 1.60-4.57, p <0.001) and obtaining a second opinion from a urologist (OR 3.41, 95% CI 2.67-4.37, p <0.001) were associated with the highest use of minimally invasive radical prostatectomy while lower income was associated with decreased use of minimally invasive radical prostatectomy. Among surgeon and hospital specific factors, higher surgeon volume (OR 1.022, 95% CI 1.015-1.028, p <0.001), surgeon age younger than 50 years (OR 2.68, 95% CI 1.69-4.24, p <0.001) and greater hospital bed size (OR 1.001, 95% CI 1.001-1.002, p <0.001) were associated with increased use of minimally invasive radical prostatectomy, while solo or 2 urologist practices were associated with decreased use of minimally invasive radical prostatectomy (OR 0.48, 95% CI 0.27-0.86, p = 0.013). Conclusions: The adoption of minimally invasive radical prostatectomy vs radical retropubic prostatectomy is multifactorial, and associated with specific patient, surgeon and hospital related factors. Obtaining a second opinion from another urologist was the strongest factor associated with opting for minimally invasive radical prostatectomy. © 2012 American Urological Association Education and Research, Inc.


Objective To characterize factors associated with positive surgical margins (PSMs) and derive population-based PSM cutoffs to evaluate surgeon performance in radical prostatectomy (RP). Patients and Methods SEER-Medicare data were used to identify 4247 men diagnosed with prostate cancer during 2004-2005 who underwent RP up to 2006. We performed logistic regression to assess the impact of tumour characteristics, surgeon volume and surgical approach on the likelihood of PSMs for pT2 and PT3a disease. Moreover, we derived 25th and 10th percentile cutoffs from binomial distribution equations. Results Overall, 19.4% of men experienced PSMs with a pT2 vs pT3a PSM rate of 14.9% vs 42% (P < 0.001). Extrapolating from our population-based results, a surgeon incurring more than three PSMs in 10 cases of pT2 disease performed below the 25th percentile. There was a trend for fewer PSMs with minimally invasive vs open RP (17.4% vs 20.1%, P= 0.086), and the PSM rate also decreased over the study period from 21.3% in 2004 to 16.6% in 2006 (P= 0.028) with significant geographic variation (P < 0.001). In adjusted analyses, temporal and geographic variation in PSM persisted, and men with high (odds ratio 3.68, 95% CI 2.82-4.81) and intermediate (odds ratio 2.52, 95% CI 2.03-3.13) vs low-risk disease were at greater odds to experience PSMs. Notably, neither surgical approach nor surgeon volume was significantly associated with PSMs. Conclusion Our population-based PSM benchmarks allow identification of under-performing outliers who may seek courses or video self-study to improve outcomes. There was significant temporal and geographic variation in PSMs but neither surgeon volume nor surgical approach was associated with PSMs. © 2010 BJU INTERNATIONAL.

There is an increasing trend of minimally invasive treatments for prostate cancer with increased utilization of robotic technology contributing largely to this trend. Our study found that increased utilization of MIRP corresponded with a decreasing trend for complications, blood transfusions, lengths of stay and need for reoperation. Additionally, MIRP was found to have fewer associated complications compared with men undergoing open procedures. OBJECTIVE • To determine differences in surgical outcomes by surgical approach during a period of rapid adoption of minimally invasive surgical approaches in radical prostatectomy. PATIENTS AND METHODS • We identified 19,542 men undergoing minimally invasive (MIRP), perineal (PRP), and retropubic (RRP) radical prostatectomy from 2003 to 2006 from the MarketScan® Medstat database, a national employer-based administrative database. • We assessed for temporal trends in perioperative complications, use of postoperative cystography and anastomotic strictures by surgical approach. RESULTS • Between 2003 and 2006, MIRP use increased 33.6% vs 31.8% and 1.7% decreases in RRP and PRP, respectively. During the 4-year study, median length of stay for MIRP decreased from 2.0 to 1.0 day (P= 0.004) and overall perioperative complications decreased from 13.8 to 10.7%, (P= 0.023). • These findings were driven by reductions in genitourinary complications (3.3 to 2.5%, P= 0.049), miscellaneous surgical complications (3.6 to 2.3%, P= 0.006) and intestinal injury (1.5 to 0.1%, P= 0.009). • Median length of stay for RRP decreased from 3.2 to 2.9 days, (P < 0.001), overall perioperative complications decreased from 18.1 to 14.6%, (P= 0.007), because of reductions in both wound/bleeding complications (2.0 to 1.1%, P= 0.002) and heterologous blood transfusions. • Men undergoing MIRP vs RRP were less likely to have perioperative complications (12.5 vs 17.1%, P < 0.001), blood transfusions (1.5 vs 8.9%, P < 0.001) and anastomotic strictures (6.3 vs 12.8%, P < 0.001), and they had shorter mean lengths of stay (1.8 vs 3.1 days, P < 0.001) during the study period. CONCLUSION • The increased use of MIRP corresponds with a decreasing trend for complications, blood transfusions, lengths of stay and need for reoperation. Additionally, MIRP was found to have fewer associated complications compared with men undergoing open procedures. Further study is needed to assess the impact of tumour characteristics and surgeon volume on these perioperative outcomes as well as effects on long-term cancer control. © 2010 BJU International.