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COMPARATIVE OUTCOMES OF OPEN VERSUS LAPAROSCOPIC SACROCOLPOPEXY AMONG MEDICARE BENEFICIARIES

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Abstract

Introduction—Since the first reported laparoscopic sacrocolpopexy in 1991, a limited number of single-center studies have attempted to assess the procedure’s effectiveness and safety. Therefore, we analyzed a national Medicare database to compare real-world short-term outcomes of open and laparoscopic-assisted (including robotic) sacrocolpopexy on a United States sample of patients.

Methods—Public Use File data for a 5% random national sample of all Medicare beneficiaries age 65 and older were obtained from the Centers for Medicare and Medicaid Services for years 2004–2008. Women with pelvic organ prolapse were identified using ICD-9 diagnosis codes. CPT-4 procedure codes were used to identify women who underwent open (code 57280) or laparoscopic (code 57425) sacrocolpopexy. Individual subjects were followed for one year post-

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operatively. Outcomes measured, using ICD-9 and CPT-4 codes, included medical and surgical complications and re-treatment rates.

Results—794 women underwent open and 176 underwent laparoscopic sacrocolpopexy. Laparoscopic sacrocolpopexy was associated with a significantly increased rate of re-operation for anterior vaginal wall prolapse (3.4% vs. 1.0%, $p = 0.018$). However, more medical (primarily cardiopulmonary) complications occurred post-operatively in the open group (31.5% vs. 22.7%, $p = 0.023$). When sacrocolpopexy was performed with concomitant hysterectomy, mesh-related complications were significantly higher in the laparoscopic group (5.4% vs. 0%, $p = 0.026$).

Conclusion—Laparoscopic sacrocolpopexy resulted in increased rate of reoperation for prolapse in anterior compartment. When hysterectomy was performed at the time of sacrocolpopexy, the laparoscopic approach was associated with an increased risk of mesh-related complications.

Keywords

Claims data; pelvic prolapse; sacrocolpopexy; laparoscopy

INTRODUCTION

The abdominal sacrocolpopexy (ASC) is considered the gold standard in the surgical management of apical prolapse, with long-term success rates up to 78–100% and with reported patient satisfaction rates of 85–100% [1]. Randomized comparative effectiveness trials and systematic literature reviews have demonstrated the anatomic superiority of ASC to vaginal apical suspension procedures [2–3]. Although it is the most durable operation available to date, the morbidity associated with a laparotomy limits its broad use in women with multiple medical co-morbidities or relative contraindications to the approach.

Laparoscopy offers a minimally invasive but technically challenging alternative to open sacrocolpopexy. The use of robotic technology has made laparoscopic sacrocolpopexy a feasible procedure for many pelvic surgeons who find traditional laparoscopic procedure too arduous to perform. The technological advancements associated with the use of a robot contributed to a fast and wide spread of this procedure [4]. Two single center observational studies, one comparative and the other not, involving a total of 77 patients, suggest comparable effectiveness between open and laparoscopic (including robotic-assisted) sacrocolpopexy with respect to short-term cure of prolapse, though convalescence has been shown to be shorter in the laparoscopic/robotic group [5–6]. To date, the one published randomized trial of 47 women, focused on non-inferiority of laparoscopic sacrocolpopexy, when compared to open sacrocolpopexy, demonstrated a 15% recurrence of symptomatic prolapse 1 year post-operatively, with less patient satisfaction reported in the laparoscopic group [7]. Despite paucity of data, the minimally invasive approach to sacrocolpopexy has become ubiquitous, making recruitment into a randomized trial of open vs. laparoscopic colpopexies more difficult. In this study we sought to use a national dataset to compare one-year post-operative outcomes between open and laparoscopic (including robotic-assisted) sacrocolpopexies performed outside of a study setting.

MATERIALS AND METHODS

After obtaining an exemption from the University of California, Los Angeles Institutional Review Board, Public Use Files from the Centers for Medicare and Medicaid Services were obtained for a 5% random national sample of beneficiaries age 65 and over. Randomization was achieved using the last two digits of the patient Health Insurance Claim number, which is based on the Social Security Number. International Classification of Disease, 9th edition (ICD-9) codes were used to identify women diagnosed with pelvic organ prolapse (POP)

(Appendix A). Current Procedural Terminology, 4th edition (CPT-4) codes were used to identify women that underwent either open (code 57280) or laparoscopic (code 57425) sacrocolpopexy in years 2004 to 2008. Although 2003 data was available for analysis, there were no laparoscopic sacrocolpopexies in the Medicare database; therefore, analysis began with 2004 data. Because of the relatively small numbers in the laparoscopic arm, data for each of the five years was pooled and each subject was followed for one year, through 2009.

Our primary endpoints were perioperative complications and early treatment failure. ICD-9 diagnosis codes were used to identify complications. Treatment failure was defined as repeat treatment for prolapse, including pessary placement or repeat prolapse surgery, including obliterative procedures. These procedures were identified by ICD-9 and CPT-4 procedure codes (Appendix B). Patient data obtained included age, race/ethnicity, and co-morbidities as measured by the Charlson co-morbidity index [8]. The Charlson index sums up scores from nineteen weighted co-morbidities to predict the likelihood of one-year mortality for a patient, with higher score indicating a greater burden of co-morbidity. Frequencies were determined for categorical variables and the Chi-square test was used to detect a statistically significant difference between cohorts. To assess the association between type of surgical procedures and occurrence of complications, time-to-event models using Cox proportional hazard regression were estimated. The failure event was defined as the occurrence of the first repeat treatment for POP. Time to event was assessed as the number of quarters (three-month periods) between the initial surgery and the quarter during which the repeat treatment for POP occurred. A set of pre-specified covariates including demographic characteristics and co-morbidities were included in the regression model. Hazard ratios and 95% confidence intervals are reported. Separate models were estimated for individual types of adverse events (including bleeding, infection, urinary retention), and for all adverse events combined. To account for potential confounders of urinary retention and mesh-related complications, subset analyses were performed on subjects who underwent concomitant sling and concomitant hysterectomy. All analyses were conducted using SAS version 9.2 (SAS Institute, Inc., Cary, North Carolina), and findings with p-values <0.05 were considered statistically significant.

RESULTS

In this population, a total of 970 women underwent sacrocolpopexy from 2004 to 2008. Of these, 794 were open and 176 were laparoscopic. The proportion of sacrocolpopexies performed laparoscopically increased from 15% in 2004 to 55% in 2008 in this cohort of Medicare beneficiaries 65 years of age or older (Table 1). Demographic characteristics are listed in Table 2. Open and laparoscopic sacrocolpopexy groups differed by race/ethnicity (likely due to a large proportion of unknown race in the laparoscopic group) and geographic region (defined by the US Census Bureau), with the open approach utilized more frequently in the Midwest. The Charlson score of subjects in the open group was significantly higher, indicating more co-morbidities in this group. The number of concomitantly performed slings and hysterectomies did not differ between the groups (Table 3).

Perioperative morbidity was greater in the open sacrocolpopexy group due to a higher rate of medical complications (31.5% vs. 22.7%, $p = 0.023$) and febrile morbidity (6.0% vs. 1.1%, $p = 0.004$). A trend towards a higher rate of perioperative pain was noted in the open sacrocolpopexy group. The rates of urinary retention (15.9% vs. 8.0%, $p = 0.006$), and urinary tract infections (UTIs) (38.8% vs. 26.7%, $p = 0.002$) were also greater in the open vs. laparoscopic group (Table 4). Within the concomitant sling cohort, which had the highest rates of urinary retention, urinary retention remained significantly higher in the open subset (20.8% vs. 2.3%, $p = 0.0021$). UTIs were also higher in this group (43.4% vs. 20.9%, $p =$

0.01) possibly due to a collinear relationship with urinary retention and associated elevated post-void residual and/or need for catheterization (data not shown).

At one-year post operatively, the number of re-operations for anterior vaginal wall prolapse was significantly higher in the laparoscopic group (3.4% vs. 0.9%, $p < 0.02$). The rates of reoperation in posterior compartment or for recurrent apical prolapse were low and did not differ between the groups.

Overall rate of mesh-related complications did not differ between the groups; however in the subset of subjects who underwent sacrocolpopexy with concomitant hysterectomy mesh-related complications were significantly higher in the laparoscopic group (5.4% vs. 0%, $p = 0.026$). All mesh-related complications in this subset occurred in subjects who had a total as oppose to a supracervical hysterectomy. In women who had a sling performed at the time of sacrocolpopexy, 4.7% underwent a revision of prosthetic vaginal graft (code 57295) in the laparoscopic group (unknown if due to complication from sling or prolapse repair), compared to none in the open group ($p = 0.02$).

DISCUSSION

Our study yielded several important findings. First, we observed a rapid increase in the number of laparoscopic sacrocolpopexies over the years 2004 through 2008, with the most significant increase in 2007 and 2008. These patterns may reflect the introduction of robotic technology in the field of Urogynecology; however, the robotic procedure's assistance was not reflected in CPT-4 procedure codes; therefore we were unable to separately analyze outcomes of laparoscopic vs. robotically assisted laparoscopic sacrocolpopexies.

Because data on prolapse stage or degree of symptoms is not available in the claims database, we relied on repeat prolapse operations (based on CPT-4 procedure codes) as a surrogate for symptomatic recurrence. Overall reoperation rate at one-year postoperatively was low in both groups. However, the laparoscopic approach resulted in a significantly higher rate of reoperation for anterior compartment prolapse than the open sacrocolpopexy. Unfortunately, the only published RCT of laparoscopic vs. open sacrocolpopexy did not report post-operative objective measures of the anterior compartment [7]. Reoperation rate in our study was higher than the 1.8% rate in a recent trial, comparing laparoscopic sacrocolpopexy with transvaginal mesh procedures for vaginal vault prolapse [9]. However, our findings are consistent with previously published studies that have shown higher rates of prolapse recurrence after laparoscopic sacrocolpopexies vs. open [10–12]. This is possibly due to technical difficulties of distal anterior dissection in laparoscopic approach, but studies specifically comparing the extent of dissection in the vesico-vaginal plane in open vs. laparoscopic sacrocolpopexies are necessary to explore this possibility. Robotic assistance may have a potential for better anterior vaginal dissection and more distal placement of mesh; however recent RCTs comparing laparoscopic with robotic sacrocolpopexy performed for vaginal vault prolapse did not identify any differences in anatomic outcomes or quality-of-life measures between groups at one year post-operatively [13–14].

A higher overall perioperative complication rate in the open sacrocolpopexy group is likely a reflection of a greater baseline level of co-morbidities in this group. Despite reports of longer operative times with the laparoscopic approach [5], our data showed an increased rate of cardiopulmonary complications with the open approach. As surgeons become more comfortable with the technical aspects of laparoscopic sacrocolpopexies as well as robotically assisted procedures, we expect these minimally invasive approaches to dominate in patients with higher level of co-morbidities. As might be expected, perioperative pain was greater in the open group, but the difference did not reach statistical significance.

A higher rate of urinary retention occurred in women who underwent slings concomitantly with open as oppose to laparoscopic sacrocolpopexies. This is possibly due to open procedures causing more post-operative pain and therefore a delay in return of voiding function. The increased rate of UTIs in this same subset is likely attributable to the urinary retention and associated need for catheterization.

Overall rate of mesh-related complications was low and did not differ between the groups at one-year follow up. However, mesh-related complications were significantly higher in the laparoscopic group in the subset of women who underwent a concomitant total hysterectomy. Our findings that supracervical hysterectomy is protective from mesh exposure is consistent with a recently published study by Tan-Kim *et al.* which reports a significantly higher rate of vaginal mesh exposure in cases of total vs. supracervical hysterectomies performed at the time of sacrocolpopexies [15].

The strength of our study lies in the advantages of using national US data, which allow for analysis of a large representative sample of patients with a broad geographic distribution. These observational real world data are particularly valuable given the absence of level I evidence in the literature. The limitations of our research are inherent to the analysis of claims data. The accuracy of data is dependent on the proper coding by health care providers, and pertinent clinical details not reflected in the ICD-9 and/or CPT-4 codes are not available. Despite these limitations, the use of the Medicare data files have proven valuable in understanding clinical practice patterns and real world outcomes [16–17].

Laparoscopic sacrocolpopexy is an important addition to the armamentarium of the reconstructive procedures for pelvic organ prolapse. However, this procedure should not be presumed to be analogous to the open sacrocolpopexy. Our findings support a great need to vigilantly follow outcomes of this, now ubiquitous, approach to prolapse repair.

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Appendix A: Procedure Codes Used to Identify Index Surgery and Treatment Failure

ICD-9 & CPT-4 Codes
<u>CPT-4 PROCEDURE CODES:</u>
<i>Open Sacrocolpopexy:</i>
57280 colpopexy abdominal approach
<i>Laparoscopic Sacrocolpopexy: (+/- ICD-9 code robot-assisted 17.4)</i>
57425 laparoscopy, colpopexy
45560 rectocele
56800 plastic repair of introitus
56810 perineoplasty, repair of perineum, non-obstetric
57120 Le Forte
57240 ant colporrhaphy +/- repair of urethrocele
57250 post colporrhaphy +/- perineorrhaphy

ICD-9 & CPT-4 Codes
57260 ant/post colporrhaphy
57265 ant/post colporrhaphy w/ enterocele;
57267 mesh
57268 enterocele (vaginal)
57270 enterocele (abdominal)
57280 colpopexy abdominal approach
57282 colpopexy, vaginal, extra-peritoneal (sacrospinous, iliococcygeus)
57283 colpopexy, vaginal, intra-peritoneal (uterosacral, levator myorrhaphy)
57284 paravag defect w/ cystocele (abd);
57285 paravag defect w/ cystocele (vag);
57289 peryra +/- cystocele
57423 paravag defect +/- cystocele (lap)
57425 laparoscopy, colpopexy
58150 TAH
58152 TAH w/ colpo-urethrocystopexy (Marshall-Marchetti, Kranz, Burch);
58180 supracervical abd hysterectomy
58260 vaginal hysterectomy <250gm
58267 vaginal hysterectomy with colpo-urethrocystopexy (MMK, peryra)
58270 vag hyst w/ enterocele
58280 vag hyst and partial vaginectomy w/ enterocele
58290 vag hyst >250gm
58292 vag hyst <250gm w/ enterocele
58293 vag hyst >250gm w/ colpo-urethrocystopexy (MMK, peryra)
58294 vag hyst >250gm w/ enterocele
58400 uterine suspension
58410 uterine suspension w/ presacral sympathectomy
58541/58570 lap hyst <250gm;
58543/58571 lap hyst >250gm;
<u>ICD-9 PROCEDURE CODES:</u>
17.4, 68.3, 68.31, 68.39, 68.5, 68.51, 68.59, 69.22, 70.50, 70.51, 70.52, 70.53, 70.54, 70.55, 70.62, 70.64, 70.77, 70.78, 70.8, 70.92, 70.93
17.4: robot-assisted procedure
70.8: Le Fort
70.51: repair of cystocele
70.54: repair of cystocele with graft or prosthesis
70.50: repair of cystocele and rectocele
70.53: repair of cystocele and rectocele with graft or prosthesis
70.52: repair of rectocele
70.55: repair of rectocele with graft or prosthesis
70.92: repair of vaginal enterocele
70.93: repair of vaginal enterocele with graft or prosthesis
69.22: uterine suspension (placation of uterine ligament, hysteropexy, Manchester)

ICD-9 & CPT-4 Codes
70.77: vaginal suspension and fixation
70.78: vaginal suspension and fixation with graft or prosthesis
68.31: laparoscopic supracervical hysterectomy
68.39: other unspecified subtotal abdominal hysterectomy
68.5: vaginal hysterectomy for prolapse
68.51: laparoscopic vaginal hysterectomy
68.59: other unspecified vaginal hysterectomy
68.3: subtotal hysterectomy
70.62: vaginal reconstruction
70.64: vaginal reconstruction with graft or prosthesis
70.77: vaginal suspension and fixation
70.78: vaginal suspension and fixation with graft or prosthesis
70.8: Le Fort
70.92: repair of vaginal enterocele
70.93: repair of vaginal enterocele with graft or prosthesis

Appendix B: Codes for complications

	ICD-9 DIAGNOSIS	CPT-4 PROCEDURE	ICD-9 PROCEDURE
Surgical	553.21 Incisional hernia 569.83 Perforation of rectum 596.6 Rupture of bladder, nontraumatic 596.9 Unspecified disorder of bladder 998.2 Accidental puncture or laceration during a procedure 998.3 Disruption of operative wound 998.8 Other specified complication of procedures not elsewhere classified 998.9 Unspecified complication of procedure not elsewhere classified 593.3 Stricture or kinking of ureter (postoperative) 902.5, 902.50–902.59 Injury to iliac blood vessels 902.8, 902.81–902.89 Injury to other specified blood vessels of abdomen and pelvis 902.9 Injury of blood vessels of abdomen/pelvis 997.5 Urinary complications	49000 Exploratory laparotomy 50392 Percutaneous nephrostomy tube placement 50780 Ureteroneocystostomy 51800 Revision of bladder/urethra 51860 Cystorrhaphy, suture of bladder wound 57200 colporrhaphy, suture of injury of vagina 57210 Colpoperineorrhaphy, suture of injury of vagina/perineum 52332 Insertion of ureteral stent 57200 Colporrhaphy, suture of injury of vagina 58520 hysterorrhaphy, repair of ruptured uterus	54.11 Exploratory laparotomy 55.02 Percutaneous nephrostomy tube placement 56.74 Ureteroneocystostomy 57.81 Cystorrhaphy, suture of bladder wound 70.71 Colporrhaphy, suture of injury of vagina
Bleeding	285.9 Anemia 569.3 Hemorrhage of rectum and anus 569.4 Rupture/bleeding/ulcer of rectum 596.7 Hemorrhage into bladder wall 599.7 Hematuria 624.5 Hematoma of vulva 665.7 Pelvic hematoma 997.2 Peripheral vascular complications	36430 Blood transfusion	99.00 Blood transfusion

	ICD-9 DIAGNOSIS	CPT-4 PROCEDURE	ICD-9 PROCEDURE
	998.1 Hemorrhage or hematoma complicating a procedure 998.10 Hemorrhage complicating a procedure 998.12 Hematoma complicating a procedure 999.80 Transfusion reaction, unspecified 999.2 Other vascular complications		
Infection/Inflammation	590.10 Acute pyelonephritis without lesion of renal medullary necrosis 590.80 Pyelonephritis unspecified 590.9 Kidney Infection unspecified 595 Cystitis 595.0 Acute cystitis 595.3 Trigonitis 595.89 Other types of cystitis 595.9 Cystitis unspecified 597.0 Abscess of urethra 599.0 Urinary tract infection, site not specified 780.6 Fever 616.10 Vaginitis and vulvovaginitis, unspecified 616.11 Vaginitis and vulvovaginitis 616.8 Other inflammatory disease of cervix, vagina, vulva 616.81 Mucositis of vulva, vagina, or cervix 616.89 Other inflammatory disease of vulva, vagina, or cervix 616.9 Unspecified inflammatory disease of vulva, vagina, cervix 958.3 Post-traumatic wound infection not otherwise specified 998.5 Postoperative infection 998.51 Postoperative seroma 998.59 Other postoperative infection	51080 Drainage of perivesical or prevesical space abscess	
Pelvic pain	625 Dyspareunia 625.1 Vaginismus 635.7 Vulvodynia 625.8 Other specified symptoms associated with female genital organs 625.9 Unspecified symptom associated with female genital organs 789.9 Vesical pain, tenesmus		
Urinary Retention	596.0 Bladder neck obstruction 599.6 Urinary obstruction 788.2 Retention of urine 788.21 Incomplete bladder emptying 788.29 Other specified retention of urine 788.38 Overflow incontinence 788.62 Slowing of urinary stream	51040 Cystostomy, cystostomy with drainage 51701 Urethral/ bladder catheterization (simple) 52270 Cystourethroscopy with internal urethrotomy, female; 52281 cystourethroscopy with dilation of stricture 52285 Cystourethroscopy w/ dilation +/- urethrotomy 53620 Dilation of urethral stricture	57.1 Cystostomy 57.94 Urethral/ bladder catheterization (simple) 58.0 Cystourethroscopy with internal urethrotomy, female 58.6 Urethral dilation

	ICD-9 DIAGNOSIS	CPT-4 PROCEDURE	ICD-9 PROCEDURE
		53660/53661/53665 Dilation of female urethral stricture	
Mechanical Device	996.3 Mechanical complication of genitourinary device, implant, and graft 996.30 Mechanical complication of unspecified genitourinary device, implant, and graft 996.39 Other mechanical complication of GU device, implant, and graft 996.6 Infection and inflammatory reaction due to internal prosthetic device implant and graft 996.64 Infection and inflammatory reaction due to indwelling urinary catheter 996.65 Infection and inflammatory reaction due to other GU device, implant, and graft 996.69 Infxn & inflam reaction due to other internal prosthetic device, implant, and graft 996.76 Other complication of internal (biologic/synthetic) prosthetic device, implant, & graft	57295 revision (incl removal) of prosthetic vaginal graft (vag) 57296 revision (incl removal) of prosthetic vaginal graft (abd) 57426 revision (incl removal) of prosthetic vaginal graft (lap) 57287 Removal or revision of sling	58.5 Removal or revision of sling
Fistula	565.1 Anal fistula 596.1 Intestinovesical fistula 596.2 Urethrovesical fistula 599.1 Urethral fistula 619 Vesicovaginal fistula, urethrovesical fistula 998.6 Persistent postoperative fistula	51900 Closure of vesicovaginal fistula (abd) 51920 Closure of vesicouterine fistula 51925 Closure of vesicouterine fistula with hysterectomy 57300 Closure of rectovaginal fistula (vag, transanal) 57305 Closure of rectovaginal fistula (abd) 57307 Closure of rectovaginal fistula (abd) + colostomy 57308 Closure of rectovaginal fistula (tranperineal) 57310, 57311 Closure of urethrovaginal fistula 57320 Closure of vesicovaginal fistula (vag) 57330 Closure of vesicovaginal fistula (transves, vag)	57.84 Closure of vesicovaginal fistula 58.43 Closure of urethrovaginal fistula
Medical/Non-urollogic	402.01 Malignant hypertensive heart disease with heart failure 402.11 Benign hypertensive heart disease with heart failure 402.91 Unspecified hypertensive heart disease with heart failure 410 Acute myocardial infarction 410.0, 410.00, 410.01, 410.02 Anterolateral wall MI 410.1, 410.10, 410.11, 410.12 Anterior wall MI 410.2, 410.20, 410.21, 410.22 Inferolateral wall MI 410.3, 410.30, 410.31, 410.32 Inferoposterior wall MI		

	ICD-9 DIAGNOSIS	CPT-4 PROCEDURE	ICD-9 PROCEDURE
	410.4, 410.40, 410.41, 410.42 Inferior wall MI 410.5, 410.50, 410.51, 410.52 Lateral wall MI 410.6, 410.60, 410.61, 410.62 Posterior wall MI 410.7, 410.70, 410.71, 410.72 Subendocardial MI 410.8, 410.80, 410.81, 410.82 Acute other specified site MI 410.9, 410.90, 410.91, 410.92 Acute unspecified site MI 427.5 Cardiac arrest 428 Heart failure 428.0 CHF unspecified 428.1 Left heart failure 428.2, 428.20, 428.21, 428.22, 428.23 Systolic heart failure 428.3, 428.30, 428.31, 428.32, 428.33 Diastolic heart failure 428.4, 428.40, 428.41, 428.42, 428.43 Combined systolic/ diastolic heart failure 428.9 Heart failure unspecified 785.51 Cardiogenic shock 997.1 Cardiac complications not elsewhere classified 415.1 Pulmonary embolism and infarction 466, 466.0, 466.1 Acute bronchitis and bronchiolitis 480, 480.0, 480.1, 480.2, 480.3, 480.8, 480.9 Viral pneumonia 481 Pneumococcal pneumonia 482, 482.1–482.9 Other bacterial pneumonia 483, 483.0, 483.1, 483.8 Pneumonia due to other specified organism 485 Bronchopneumonia organism unspecified 486 Pneumonia organism unspecified 507.0 Pneumonitis due to inhalation of food or vomitus 511, 511.0, 511.1, 511.8, 511.9 Pleural effusion or pleurisy 518.0 Pulmonary collapse 518.4 Pulmonary edema 518.5 Pulmonary insufficiency following trauma and surgery 518.81 Acute respiratory failure 518.82 Other pulmonary insufficiency not elsewhere classified 799.1 Respiratory failure/arrest 997.3 Respiratory complications 433 Occlusion and stenosis of precerebral arteries 433.0, 433.00, 433.01 Occlusion and stenosis of basilar artery 433.1, 433.10, 433.11 Occlusion and stenosis of carotid artery 433.2, 433.20, 433.21 Occlusion and stenosis of vertebral artery 433.3, 433.30, 433.21 Occlusion and stenosis of multiple and bilateral precerebral arteries		

	ICD-9 DIAGNOSIS	CPT-4 PROCEDURE	ICD-9 PROCEDURE
	<p>433.8, 433.80, 433.81 Occlusion and stenosis of other specified precerebral artery 433.9, 433.90, 433.91 Occlusion and stenosis of unspecified precerebral artery 434 Occlusion of cerebral arteries 434.0, 434.00, 434.01 Cerebral thrombosis 434.1, 434.10, 434.11 Cerebral embolism 434.9, 434.90, 434.91 Cerebral artery occlusion unspecified 436 Acute but ill-defined cerebrovascular disease 437, 437.0–437.9 Other and ill-defined cerebrovascular disease 444.2 Embolism and thrombosis of arteries of the extremities 444.22 Arterial embolism and thrombosis of lower extremity 444.81 Embolism and thrombosis of iliac artery 451.1 Thrombophlebitis of deep veins of lower extremities 451.2 Phlebitis and thrombophlebitis of lower extremities unspecified 451.81 Phlebitis and thrombophlebitis of iliac vein 451.9 Phlebitis and thrombophlebitis of unspecified site 453.8 Acute venous embolism and thrombosis of other specified veins 560.1 Paralytic ileus 560.8 Other unspecified intestinal obstruction 560.81 Intestinal or peritoneal adhesions with obstruction (postoperative, postinfection) 560.89 Other specified intestinal obstruction 560.9 Unspecified intestinal obstruction 997.4 GI complications/bowel obstruction 584, 584.5, 584.6, 584.7, 584.8, 584.9 Acute kidney failure 586 Renal failure unspecified 785.5 Shock without mention of trauma 785.50 Shock unspecified 785.52 Septic shock 785.59 Other shock without trauma 995.0 Anaphylactic shock 995.4 Shock due to anesthesia 998.0 Post-op shock not elsewhere classified 999.4 Anaphylactic shock due to serum not elsewhere classified 798 Sudden death cause unknown 798.1 Instantaneous death 798.2 Death occurring less than 24hrs from onset of symptoms not otherwise explained 798.2 Unattended death</p>		

Table 1

Trends in Sacrocolpopexy, 2004–2008

Year and Quarter of Index Procedure	Cohort		
	Abdominal	Laparoscopic	Total
<i>2004-1</i>	54	1	55
2	63	3	66
3	45	7	52
4	40	4	44
<i>Total 2004</i>	202	15	217
<i>2005-1</i>	49	9	58
2	50	8	58
3	38	6	44
4	35	4	39
<i>Total 2005</i>	172	27	199
<i>2006-1</i>	44	11	55
2	34	10	44
3	39	2	41
4	40	5	45
<i>Total 2006</i>	157	28	185
<i>2007-1</i>	48	9	57
2	34	12	46
3	38	15	53
4	33	15	48
<i>Total 2007</i>	153	51	204
<i>2008-1</i>	14	10	24
2	31	17	48
3	38	12	50
4	27	16	43
<i>Total 2008</i>	110	55	165
<i>Total 2004–2008 cohort</i>	794	176	970

Table 2

Patient Demographics

	Cohort				
	Abdominal		Laparoscopic		P-value (by chi square)
	N	%	N	%	
All	794	100	176	100	
Race/Ethnicity					
Unknown	100	12.59	47	26.7	0.0005
White	650	81.86	124	70.45	
Black	27	3.4	4	2.27	
Other	11	1.39	1	0.57	
Asian	3	0.38	.	.	
Hispanic	2	0.25	.	.	
North American Native	1	0.13	.	.	
Age					
65–69	281	35.39	74	42.05	0.3368
70–74	249	31.36	55	31.25	
75–79	171	21.54	34	19.32	
80–84	71	8.94	10	5.68	
85+	22	2.77	3	1.7	
Region of residence					
Northeast	61	7.68	14	7.95	<0.0001
Midwest	191	24.06	22	12.5	
South	339	42.7	74	42.05	
West	109	13.73	20	11.36	
Other/Unknown	94	11.84	46	26.14	
Charlson Comorbidity Index					
0	427	53.78	107	60.8	<0.0001
1	122	15.37	23	13.07	

	Cohort				
	Abdominal		Laparoscopic		
	N	%	N	%	
	P-value (by chi square)				
2	122	15.37	26	14.77	
3	55	6.93	12	6.82	
4+	68	8.56	8	4.55	

Table 3

Number of patients per cohort, stratified by concomitant procedure at time of index surgery

N	Open	Laparoscopic	Total
Hysterectomy	190	37	227
Sling	265	43	308
Other prolapse repair	339	96	435
All	794	176	970

Table 4

Comparative one-year outcomes between open and laparoscopic sacrocolpopexy

CUMULATIVE OUTCOMES AT ONE YEAR	OPEN	LAPAROSCOPIC	P-VALUE
COMPLICATIONS			
Surgical complications (See Appendix)	7.7%	4.0%	0.1014
Urinary Tract Infection (590.10–599.0)	38.8%	26.7%	0.0025
Fever (780.6)	6.0%	1.1%	0.0043
Pain/Dyspareunia (625)	23.7%	18.2%	0.1354
Urinary Retention (See Appendix)	15.9%	8.0%	0.0062
Complication of Mechanical Device (996.3–996.76)	2.0%	2.8%	0.5641
Medical complications	31.5%	22.7%	0.0228
Cardiac	8.4%	4.0%	0.0419
Pulmonary	17.9%	11.9%	0.0585
Neurologic/Cerebrovascular	8.6%	6.8%	0.5450
Thromboembolic	2.9%	2.3%	0.8032
Gastrointestinal	4.3%	1.7%	0.1285
REOPERATIONS			
Prolapse Repair	3.8%	5.7%	0.2921
Anterior	0.9%	3.4%	0.0183
Ant & Apical	0.4%	0.6%	0.5517
Ant & Post	0.6%	0.6%	1
Ant & Post & Apical	0.5%	0.0%	1
Posterior	0.9%	0.0%	0.3620
Post & Apical	0.4%	0.6%	0.5517
Apical	1.0%	1.7%	0.4300
Sling	3.5%	2.8%	0.8194
Pessary	1.8%	2.8%	0.3653