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Short-term Outcomes of Vaginal Mesh Placement Among Female Medicare Beneficiaries

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Abstract

Objectives—To compare short-term outcomes between prolapse repairs with and without mesh using a national dataset. Mesh use in surgical treatment of pelvic organ prolapse (POP) has gained wide popularity. However, mesh complications have increased concomitantly with its use.

Methods—Public Use File data were obtained for a 5% random national sample of female Medicare beneficiaries age 65 and over. Women who underwent prolapse surgery were identified by CPT-4 codes. Since the code for mesh placement was effected in 2005, we separated patients into three cohorts: those who underwent prolapse repairs from 1999–2000 (presumably without mesh), those who underwent repairs in 2007–2008 (presumably without mesh), and those with mesh (based on CPT-4 code 57267) in 2007–2008. One-year outcomes were identified using ICD-9 diagnosis and procedure codes and CPT-4 procedure codes.

Results—9,180 prolapse repairs without mesh were performed in 1999–2000, 7,729 without mesh in 2007–2008, and 1,804 prolapse repairs with mesh were performed in 2007–2008. Prolapse re-operation within one year of surgery was higher in non-mesh vs. mesh cohorts (6–7%

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Disclosures

Karyn S. Eilber is a speaker for Astellas; an investigator and consultant for American Medical Systems; and an investigator for Boston Scientific.

J. Quentin Clemens is a consultant for Medtronic, Afferent Pharmaceuticals, and Amphora Medical; a speaker for Endo Pharmaceuticals; involved in trial participation with Taris; and a meeting participant with Allergan.

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vs. 4%, $p < 0.02$). Mesh removal rates were higher in mesh vs. non-mesh group (4% vs. 0–1%, $p < 0.001$). Mesh use was associated with more dyspareunia, mesh-related complications, and urinary retention, even when controlling for concomitant sling.

Conclusions—Mesh to treat POP and stress urinary incontinence (SUI) was associated with a small decrease in early re-operation for prolapse. This decrease came at the expense of increased rates of pelvic pain, retention, mesh-related complications, and mesh removal.

Keywords

claims data; complications; mesh; pelvic organ prolapse; re-operation

Introduction

The prevalence of pelvic floor disorders, including pelvic organ prolapse (POP), urinary incontinence (UI), and fecal incontinence (FI), continues to rise as the global population ages. The number of women in the United States with at least one pelvic floor disorder is estimated to be 28.1 million.¹ A woman has an approximate 11% lifetime risk of undergoing surgery for correction of stress urinary incontinence (SUI) or pelvic organ prolapse (POP); however, the percentage of women with SUI or POP is most likely higher given that many individuals do not seek treatment.^{2–5}

In a movement towards less invasive procedures in the early 2000's, POP surgery shifted towards an extraperitoneal vaginal approach instead of traditional vaginal or abdominal approaches. Additionally, synthetic mesh began to replace autologous skin grafts to provide better durability than native tissue. Mesh for POP repair gained rapid popularity despite a relative lack of level I data to assess its safety and efficacy.^{6–8} While several studies have demonstrated that mesh repair can successfully treat both POP and SUI, a concurrent increase in mesh related complications has been observed.^{9–10} Such complications culminated in an FDA warning in October of 2008,⁹ followed by a second FDA warning in July of 2011, after the number of reported complications reached 3,874 and were no longer considered to be rare events.¹¹

Appropriate surgical recommendations regarding the use of mesh in POP treatment require a better understanding of mesh-related outcomes in the US. To further investigate this matter, we sought to analyze longitudinal mesh-related outcomes over time using a national dataset.

Materials and Methods

The UCLA Institutional review board (IRB) determined the study to be exempt and Public Use File data were obtained from the Centers for Medicare and Medicaid Services (CMS) for a 5% national random sample of female Medicare beneficiaries age 65 and over. A 5% random sample has been shown to identify meaningful clinical findings between cohorts while sampling a heterogeneous population of patients and providers.^{12–13} Patients were identified by Current Procedural Terminology Coding system, 4th edition (CPT-4) codes for prolapse surgery during the years 1999–2000, to define a two-year cohort of patients who underwent prolapse repair without mesh (Appendix 1). Since the CPT-4 code for mesh was

not effected until 2005, we defined the mesh cohort as those who underwent prolapse surgery with the additional code for mesh insertion (CPT-4 code 57267, insertion of mesh or other prosthesis for repair of pelvic floor defect, each site) in 2007–2008. An additional cohort of patients who underwent prolapse repair without a mesh insertion code was created from the 2007–2008 years. Because the mesh insertion code did not come into use until 2005, all prolapse repairs from this earlier time period were presumed to be non-mesh surgeries, though concomitant slings may have been composed of mesh in some cases. Inclusion of this cohort would allow us to determine if outcomes (unrelated to mesh) changed between the non-mesh groups over time. Also, it would allow for the detection of possible mesh-related complications in the non-mesh group, suggesting the possibility of under-coding of mesh insertion. Both non-mesh groups were independently compared with the mesh group with respect to demographic and clinical characteristics. These included such factors as age group, race, geographic region, and Charlson Comorbidity Index (an assessment of overall patient comorbidity).¹⁴

Each subject in the three cohorts was followed for one year to track outcomes using ICD-9 diagnosis and procedure codes along with CPT-4 procedure codes for complications and early re-operations for POP (Appendix 2). Subset analysis was performed to compare outcomes related to concomitant sling surgery for stress urinary incontinence (CPT-4 code 57288). The primary outcomes analyzed included re-operations for prolapse and mesh removal procedures. Other short-term outcomes assessed included surgical complications, bleeding, post-operative urinary tract infections, pelvic pain, urinary retention, and implant-related complications (including device-induced infection or inflammation).

Results

Patient demographic characteristics of the analytical cohorts are presented in Table 1 for years 1999–2000 and years 2007–2008, demonstrating little change in the patient population undergoing prolapse surgery over the decade beginning in 1999. Overall, the patients were predominantly among the younger Medicare population (age 65–74), Caucasian, and relatively healthy, as evidenced by a Charlson score of 0–1. Prolapse repair overall (with and without mesh) was more frequent in the South and Midwest than in the West and Northeast (Table 1). Of 9,180 prolapse repairs performed during 1999–2000, 1,484 included a sling procedure (16.2%, Table 2). Of 1,804 prolapse repairs with mesh performed during 2007–2008, 870 had a concurrent sling procedure (48.2%). In this same time period, 7,729 repairs were done without mesh, and 457 (5.9%) of those included a concomitant sling. In total, 18,713 prolapse repairs were assessed, 2,811 (15.0%) with concomitant sling procedures.

Early re-operation for prolapse was higher in both non-mesh groups compared with the mesh group. Six percent of the non-mesh group in 2007–2008 and 7% of the 1999–2000 non-mesh cohort had repeat prolapse surgery within one year, compared with only 4% in the mesh group ($p < 0.001$, respectively). By one year post-operatively, 4% of mesh recipients underwent mesh removal compared with 0% (1999–2000) and 1% (2007–2008) of the non-mesh patients that same year ($p = 0.018$, Table 3). Excluding specific codes for sling

removals (CPT-4 code 57287, ICD-9 code 58.5), mesh removal rate was approximately 2.0% in the mesh group (vs. 0% in both non-mesh groups).

Most intra-operative complications were similar between groups. However, a code for bleeding was more frequent in the mesh group compared to the 1999–2000 non-mesh cohort but not the more recent non-mesh cohort. Medical (non-technical) complications, such as cardiac and thromboembolic events, were significantly higher in the non-mesh cohort. There were no deaths in either group.

Post-operative complication rates were higher in the mesh cohort. 17% of mesh recipients had a code for urinary retention vs. 9–13% in the non-mesh groups ($p < 0.001$ for both analyses). Concomitant sling placement independently increased the risk of urinary retention. However, after controlling for sling placement, the mesh group had a higher rate of urinary retention than the non-mesh groups. Among those receiving concomitant slings, 19% of mesh and 15% of both non-mesh groups had a code for urinary retention ($p < 0.001$, data not shown). Urinary tract infections were common in both groups post-operatively though patients receiving mesh had a higher incidence. 34% and 38% of the non-mesh groups (1999–2000, 2007–2008, respectively) had urinary tract infections within one year after surgery compared with 41% of the mesh group (Table 4). Pelvic pain, including dyspareunia, was commonly coded postoperatively in both groups, but at a higher rate in those with mesh (27% vs. 20% for both non-mesh groups, respectively, $p < 0.001$).

Comment

This study had several notable findings. Over the course of one year, women who received a mesh repair were less likely than those receiving non-mesh to undergo early re-operation for prolapse (4% of mesh procedures vs. 6% and 7% of non-mesh procedures in 1999–2000, 2007–2008 respectively). Altman et al. in 2011 compared one year outcomes of anterior colporrhaphy versus transvaginal mesh for POP repair, and found that 60.8% of mesh recipients had no prolapse recurrence compared with 34.5% of traditional colporrhaphy patients. Early re-operation, however, occurred in only one patient in the non-mesh group.¹⁵ Other randomized controlled trials (RCTs) have shown better anatomical results with mesh compared with non-mesh, though this finding has not been consistent.^{16–20, 10} Though re-operation is a surrogate for a symptomatic recurrence, it likely represents only a fraction of those women with recurrent prolapse.

Though mesh had a modestly lower early re-operation rate, it was associated with a 5% rate of diagnosis of mechanical device related complications. Mesh was also associated with a 4% mesh removal rate (including sling removals) compared with 0–1% of non-mesh patients. A recent RCT by Altman et al had similar rates of surgical revision; of 200 women who were randomly selected to undergo POP repair with mesh, 6 (3%) underwent revision for exposed mesh compared with 0% of the 189 women assigned to traditional colporrhaphy.¹⁵ Other RCTs have demonstrated slightly higher mesh removal rates, ranging from 5–9%.^{18, 20} We were pleased to find that mesh removal rates among patients with Medicare coverage were not higher than those reported in the literature, as claims-based outcomes assessments are often inferior to those of published clinical series.^{21–22}

Like Altman's study, we found a higher rate of bleeding in the mesh cohort.¹⁵ Otherwise, surgical complications were similar between groups. We also found that post-operative urinary retention was common, affecting 9%–13% of non-mesh groups and 17% of the mesh group. While both prolapse repair and sling placement are independent risk factors for urinary retention, the combination of both procedures may further increase this risk.²³ We previously found in a Medicare population that women undergoing combined prolapse repair and sling were more likely to experience postoperative retention compared with the sling-only group (9.4% vs. 5.5%).²⁴ Though other studies have identified retention as a complication of prolapse repair, the rates among Medicare beneficiaries appear to be even higher.¹⁵ This may be partly due to the manner in which we used both diagnosis codes (which include voiding difficulty or incomplete emptying) and procedure codes (such as catheter placement) to identify retention. Also, it is likely that women with higher stage prolapse are more likely to undergo mesh augmentation. These women may be at higher risk of retention after surgery than women with lower stage prolapse.

Urinary tract infections (UTIs) were also quite common and affected 41% of mesh groups and 34%–38% of the two non-mesh groups. The higher rate of UTIs in the mesh group was likely associated with the higher rates of retention and associated catheterizations, both known to predispose patients to UTIs.^{25–27} Mesh placement was associated with higher rates of UTIs, regardless of concomitant sling placement. A UTI diagnosis appearing in a Medicare claim may or may not be culture-proven. Hence irritative voiding symptoms related to pelvic surgery might be coded as a UTI. However, even if this diagnosis is “overcoded”, the increase in the mesh group warrants further investigation.

Our study also showed a surprisingly high rate of dyspareunia in both groups, though a much higher prevalence in the mesh group. While many women experience improvement in dyspareunia after prolapse repair, others experience a new onset in pain symptoms.^{18–19} Prior data have been inconsistent in showing whether new onset dyspareunia is higher in mesh patients than in non-mesh patients.^{15, 18–19} Though we lacked baseline dyspareunia data, the increased rate of pelvic pain in the mesh group compared with both non-mesh groups is significant. It is possible, however, that this pain resolved over time.

While Medicare claims data allow for a nationwide population sampling and encompass the care provided from a variety of clinical settings, there are inherent limitations to claims-based analyses. Data analysis is reliant on codes, which are meant primarily for billing purposes and lack clinical detail and rationale for certain procedures. Prolapse codes are numerous and may be combined in a multitude of ways, complicating our ability to analyse them. The mesh insertion code 57267 also includes the use of biologic grafts. Though grafts are unlikely to significantly impact our findings, due to the very widespread use of mesh relative to graft, we were unable to determine what percentage of patients with the mesh insertion code actually had a graft. Also, the degree of prolapse may have affected the type of repair chosen – mesh vs. non-mesh – and may have been associated with ensuing complications. Also, the higher rate of concomitant slings in the mesh group suggests that some surgeons may have assigned the mesh code (CPT-4 code 57267) to a sling alone, which signifies that some non-mesh prolapse repairs may have been performed with a mesh

sling and therefore included in the 2007–2008 mesh group. Lastly, by using Medicare data we excluded a younger population of women undergoing prolapse repair.

Conclusions

Mesh to treat POP and stress urinary incontinence (SUI) was associated with a small decrease in early re-operation for prolapse among female Medicare beneficiaries. However, this decrease came at the expense of increased rates of pelvic pain, retention, mesh-related complications, and mesh removal.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Appendix 1. Prolapse procedure codes used for analysis

		ICD-9 PROCEDURE CODES	CPT-4 PROCEDURE CODES
Prolapse Surgery	(A) Non-surgical		57160 pessary 57150 vag irrigation after pessary 57415 removal of impacted pessary 99211–99215 F/u office visit HCPCS A4561/A4562 outpt pessary
	(B) Colpocleisis	70.8: Le Fort	57120 Le Fort
	(C) Anterior	Cystocele	
		70.51: repair of cystocele 70.54: repair of cystocele with graft or prosthesis	57240 ant colporrhaphy +/- repair of urethrocele 57289 pteryra +/- cystocele
		Paravaginal Repair	

			ICD-9 PROCEDURE CODES	CPT-4 PROCEDURE CODES
		<i>Abd</i>		57284 paravag defect w/ cystocele (abd); 57423 paravag defect +/- cystocele (lap)
		<i>Vag</i>		57285 paravag defect w/ cystocele (vag);
	(D) Ant & Apical			C+I
	(E) Ant & Post		70.50: repair of cystocele and rectocele 70.53: repair of cystocele and rectocele with graft or prosthesis	57260 ant/post colporrhaphy C+G
	(F) Ant & Post & Apical			57265 ant/post colporrhaphy w/ enterocele C+G+I E+I D+G C+H
	(G) Posterior		70.52: repair of rectocele 70.55: repair of rectocele with graft or prosthesis	45560 rectocele 56810 perineoplasty, repair of perineum, non-obstetric 57250 post colporrhaphy +/- perineorrhaphy
	(H) Post & Apical			G+I
	(I) Apical	Enterocoele		
		<i>Abd</i>		57270 enterocele (abdominal)
		<i>Vag</i>		57268 enterocele (vaginal)
		<i>Unspec</i>	70.92: repair of vaginal enterocele 70.93: repair of vaginal enterocele with graft or prosthesis	
		Uterine or Vaginal Suspension/Colpopexy		
		<i>Abd</i>		57280 colpopexy abdominal approach 57425 laparoscopy, colpopexy (+/- ICD-9 procedure code 17.4 - robot assisted)
		<i>Vag</i>		57282 colpopexy, vaginal, extra- peritoneal (sacrospinous, iliococcygeus) 57283 colpopexy, vaginal, intra- peritoneal (uterosacral, levator myorrhaphy)
		<i>Unspec</i>	69.22: uterine suspension (placation of uterine ligament, hysteropexy, Manchester) 70.77: vaginal suspension and fixation 70.78: vaginal suspension and fixation with graft or prosthesis	58400 uterine suspension 58410 uterine suspension w/ presacral sympathectomy
		Hysterectomy		

			ICD-9 PROCEDURE CODES	CPT-4 PROCEDURE CODES
		<i>Abd</i>	68.31: laparoscopic supracervical hysterectomy 68.39: other unspecified subtotal abdominal hysterectomy	58150 TAH 58152 TAH w/ colpo-urethrocystopexy (Marshall-Marchetti-Kranz, Burch) 58180 supracervical abd hysterectomy 58541/58570 lap hyst <250gm; 58543/58571 lap hyst >250gm;
		<i>Vag</i>	68.5: vaginal hysterectomy for prolapse 68.51: laparoscopic vaginal hysterectomy 68.59: other unspecified vaginal hysterectomy	58260 vaginal hysterectomy <250gm 58267 vaginal hysterectomy with colpo-urethrocystopexy (MMK, pereyra) 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, pereyra) 58294 vag hyst >250gm w/ enterocele
		<i>Unspec</i>	68.3: subtotal hysterectomy	
	(J) Unspecified		70.62: vaginal reconstruction 70.64: vaginal reconstruction with graft or prosthesis	56800 plastic repair of introitus
	(K) Mesh			57267 mesh

Appendix 2 - Mesh Paper Codes

1	Mesh		PLUS: 57267 mesh
2	Sling Procedure	PLUS: 59.4: suprapubic sling operation 59.5: retropubic urethral suspension 59.6: paraurethral suspension	PLUS: 57288 Sling operation for stress incontinence, fascia or synthetic 51990, 51992 Laparoscopic sling/urethral suspension
3	Diagnosis of Surgical Complications	ICD-9 DIAGNOSIS CODES 553.21 Incisional hernia; 568.81, 608.83, 998.1, 998.10 Hemorrhage or hematoma complicating a procedure; 593.3 Stricture or kinking of ureter (postoperative); 595, 595.0, 595.3, 595.89, 595.9, 599 Urinary tract infection, site not specified 596.1x; 596.9x Disorder of bladder; 596.6 Rupture of bladder, nontraumatic; 596.7 Hemorrhage into bladder wall; 597.0 Abscess of urethra; 596.1, 565.11 Urethral fistula/rectal injury; 624.5 Hematoma of vulva; 665.7 Pelvic hematoma; 996.76 Other complication of internal (biologic/synthetic) prosthetic device, implant, & graft; 997.5 Urinary complications; 998.2 Accidental puncture or laceration during a procedure; 998.3 Disruption of operative wound; 998.6 Persistent postoperative fistula; 998.8x, 998.9x, 998.2 Surgical complications, accidental laceration; 998.5 Postoperative infection VOIDING DYSFUNCTION: 596.0, 596.00 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	
4	Diagnosis of Mesh-related Complications	ICD-9 DIAGNOSIS CODES 596.2 Urethrovaginal fistula; 619 Vesicovaginal fistula, urethrovesic fistula; 619.1 Rectovaginal fistula 625 Dyspareunia; 625.8, 625.9 Pelvic pain; 788.9, 789.9 Vesical pain, tenesmus 635.7 vulvodynia 625.1 vaginismus 996.3 Mech comp of GU device, implant, graft; 998.4x, 998.7x Foreign body/substance	
5	Removal of Mesh	58.5 Removal or revision of sling;	57287 Removal or revision of sling; 57295 revision/removal of graft (vag) 57296 revision/removal of graft (abd)

Table 1

Demographic characteristics of female Medicare beneficiaries undergoing prolapse surgery (5% sample, first and last year of analyses)

	1999–2000		2007–2008			
	Non-Mesh		Non-Mesh		Mesh	
	N	%	N	%	N	%
Age						
65–69	2246	24.5	1919	24.8	609	33.8
70–74	2430	26.5	1791	23.2	551	30.5
75–79	2272	24.8	1669	21.6	407	22.5
80–84	1390	15.1	1347	17.4	182	10.1
85+	841	9.2	1002	13.0	56	3.1
Race/Ethnicity						
Unknown	54	0.6	13	0.2	6	0.4
White	8539	93.0	7147	92.5	1690	93.7
Black	288	3.1	325	4.2	52	2.9
Other	117	1.3	52	0.7	9	0.5
Asian	38	0.4	74	1.0	12	0.7
Hispanic	135	1.5	82	1.1	29	1.6
North American Native	8	0.1	35	0.5	5	0.3
Region of residence	0		0		0	
Northeast	1883	20.5	1652	21.4	246	13.6
Midwest	2381	25.9	1871	24.2	389	21.6
South	3488	38.0	2925	37.8	849	47.1
West	1327	14.5	1253	16.2	307	17.0
Other/Unknown	100	1.1	27	0.3	13	0.7

Table 2

Summary of Prolapse Repair surgery with and without mesh, with and without sling surgery

Year	Use of mesh	Prolapse Repair without sling	Prolapse Repair with Sling	Total
1999–2000	Non-mesh	7,696	1,484	9,180
2007–2008	Mesh	934	870	1,804
2007–2008	Non-Mesh	7,272	457	7,729
Totals		15,902	2,811	18,713

Table 3

Repeat Surgery within one year of Prolapse Repair

Type of Surgery	99-00 Non-mesh		07-08 Mesh		P value	07-08 Non-mesh		07-08 Mesh		P value
	n	(%)	n	(%)		n	(%)	n	(%)	
Any repeated prolapse surgery	640	(7%)	78	(4%)	<0.001	443	(6%)	78	(4%)	0.018
Colpodeisis	54	(1%)	3	(0%)	0.019	52	(1%)	3	(0%)	0.009
Anterior	109	(1%)	25	(1%)	0.481	86	(1%)	25	(1%)	0.33
Ant & Apical	81	(1%)	16	(1%)	1	52	(1%)	16	(1%)	0.35
Ant & Post	120	(1%)	1	(0%)	<0.001	71	(1%)	1	(0%)	<0.001
Ant & Post & Apical	233	(3%)	9	(1%)	<0.001	147	(2%)	9	(1%)	<0.001
Posterior	67	(1%)	13	(1%)	1	38	(0%)	13	(1%)	0.28
Post & Apical	88	(1%)	10	(1%)	0.101	46	(1%)	10	(1%)	1
Apical	157	(2%)	23	(1%)	0.223	96	(1%)	23	(1%)	0.906
Repeat Mesh placement	0	(0%)	39	(2%)	<0.001	52	(1%)	39	(2%)	<0.001
Removal of Mesh	2	(0%)	63	(4%)	<0.001	46	(1%)	63	(4%)	<0.001
Revision/removal of prosthetic vaginal graft (code 57295)	1	(0%)	34	(2%)	<0.001	15	(0%)	34	(2%)	<0.001
Revision/removal of prosthetic vaginal graft (code 57296)	1	(0%)	2	(0%)	0.019	1	(0%)	2	(0%)	0.28
Removal or revision of sling (code 57287)	2	(0%)	27	(2%)	<0.001	31	(0%)	27	(2%)	<0.001
Removal or revision of Sling/urethrolisis (code 58.5)	1	(0%)	2	(0%)	0.389	1	(0%)	2	(0%)	0.217

Table 4

Short-term Complications of Prolapse Surgery (by Diagnosis Codes)

Complications	99-00 Non-mesh		07-08 Mesh		P value	07-08 Non-mesh		07-08 Mesh		P value
	n	(%)	n	(%)		n	(%)	n	(%)	
Surgical	315	(3%)	71	(4%)	0.294	249	(3%)	71	(4%)	0.128
Bleeding	2122	(23%)	496	(27%)	<0.001	2143	(28%)	496	(27%)	0.861
Urinary Tract Infection	3123	(34%)	737	(41%)	<0.001	2927	(38%)	737	(41%)	0.019
590.80 Pyelonephritis unspecified	48	(1%)	7	(0%)	0.585	52	(1%)	7	(0%)	0.185
595 Cystitis	622	(7%)	148	(8%)	0.034	562	(7%)	148	(8%)	0.179
595.0 Acute cystitis	320	(3%)	89	(5%)	0.004	307	(4%)	89	(5%)	0.067
595.9 Cystitis unspecified	218	(2%)	34	(2%)	0.228	181	(2%)	34	(2%)	0.253
599.0 Urinary tract infection, site not specified	2749	(30%)	657	(36%)	<0.001	2639	(34%)	657	(36%)	0.070
Pelvic pain	1805	(20%)	486	(27%)	<0.001	1491	(19%)	486	(27%)	<0.001
625 Dyspareunia	1781	(19%)	484	(27%)	<0.001	1480	(19%)	484	(27%)	<0.001
Retention	814	(9%)	313	(17%)	<0.001	978	(13%)	313	(17%)	<0.001
599.6 Urinary obstruction	37	(0%)	14	(1%)	0.055	41	(1%)	14	(1%)	0.226
788.2 Retention of urine	593	(6%)	214	(12%)	<0.001	640	(8%)	214	(12%)	<0.001
51701 Urethral/bladder catheterization (simple)	24	(0%)	137	(8%)	<0.001	412	(5%)	137	(8%)	<0.001
52281 cystourethroscopy with dilation of stricture	62	(1%)	19	(1%)	0.097	53	(1%)	19	(1%)	0.129
53660/53661/53665 Dilation of female urethral stricture	87	(1%)	16	(1%)	0.894	34	(0%)	16	(1%)	0.028
57.1 Cystostomy	79	(1%)	1	(0%)	<0.001	16	(0%)	1	(0%)	0.225
57.94 Urethral/bladder catheterization (simple)	48	(1%)	1	(0%)	0.003	20	(0%)	1	(0%)	0.157
Mechanical Device	89	(1%)	91	(5%)	<0.001	115	(1%)	91	(5%)	<0.001
996.3 Mechanical complication of genitourinary device, implant, and graft	30	(0%)	37	(2%)	<0.001	35	(0%)	37	(2%)	<0.001
996.30 Mechanical complication of unspecified genitourinary device, implant, and graft	5	(0%)	13	(1%)	<0.001	9	(0%)	13	(1%)	<0.001
996.39 Other mechanical complication of GU device, implant, and graft	18	(0%)	29	(2%)	<0.001	24	(0%)	29	(2%)	<0.001
996.6 Infection and inflammatory reaction due to internal prosthetic device implant and graft	42	(0%)	15	(1%)	0.049	45	(1%)	15	(1%)	0.246
996.76 Other complication of internal (biologic/synthetic) prosthetic device, implant, & graft	16	(0%)	32	(2%)	<0.001	23	(0%)	32	(2%)	<0.001
Non-surgical	3138	(34%)	536	(30%)	<0.001	2664	(34%)	536	(30%)	<0.001

Complications	99-00 Non-mesh		07-08 Mesh		P value	07-08 Non-mesh		07-08 Mesh		P value
	n	(%)	n	(%)		n	(%)	n	(%)	
Cardiac	1156	(13%)	127	(7%)	<0.001	901	(12%)	127	(7%)	<0.001
Pulmonary	1675	(18%)	312	(17%)	0.349	1455	(19%)	312	(17%)	0.139
Neurologic/Cerebrovascular	989	(11%)	182	(10%)	0.404	984	(13%)	182	(10%)	0.002
Thromboembolic	289	(3%)	35	(2%)	0.005	199	(3%)	35	(2%)	0.128
Renal	166	(2%)	40	(2%)	0.254	259	(3%)	40	(2%)	0.013