

## Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

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# Long-Term Outcomes for Endovascular vs. Open Repair of Abdominal Aortic Aneurysms

## Appendix

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**Methods****Author contributions**

Marc L. Schermerhorn and Bruce E. Landon designed the study; The data were gathered through CMS; Lawrence B. Zaborski and A. James O'Malley analyzed the data; A. James O'Malley tailored statistical analysis code not available in existing software to the needs of these analyses; Marc L. Schermerhorn and Bruce E. Landon vouch for the data and the analysis, Dominique B. Buck and Marc L. Schermerhorn wrote the first draft of the manuscript. All authors substantially contributed to discussion of content and reviewed and edited the manuscript before submission. All authors were involved in the decision and agreed to publish the paper. This research is sponsored by NIH grants RO1HL105453, T32 HL007734 & 1RC4MH092717-01.

## HMO enrollment

Medicare beneficiaries enrolled in an HMO subsequent to their surgery made up 3.2% in 2001, 3.5% in 2002, 3.1% in 2003, 3.2% in 2004, 2.4% in 2005, 1.2% in 2006, 0.6% in 2007 and 0.2% in 2008. Ultimately, 1,911 total patients, including 975 from the endovascular group and 936 from the open repair group enrolled in Medicare Advantage at some time during the follow up period. Endovascular treatment was equally distributed by year.

## **Statistical Analysis**

### **Modeling Long Term Outcomes and Cumulative Benefits**

As noted in the text, we used an adaptation of the Cox Proportional Hazards method to model the long term outcomes of endovascular versus open repair. Previously, we and others have theorized about the differential survival of the fittest phenomena whereby the risk of death conditional on survival to that point (the hazard ratio) reverses direction (i.e., changes from favoring one procedure to favoring the other procedure). In the case of endovascular and open repair the argument is that following an initial period of follow-up the surviving patients the open arm will on average be healthier (in unmeasured ways) in order to have endured the more invasive procedure and so have a better prognosis going forward than the surviving patients in the less invasive endovascular repair arm, resulting in an increase in the hazard-ratio of endovascular to open repair from less than 1 to greater than 1. Under such reasoning, the proportional hazards assumption of the basic Cox survival analysis method is violated. However, we may extend the Cox regression model to allow the effect of endovascular repair (vs. open repair) to change across time.<sup>17</sup> To determine a suitable form of time dependence, we initially allowed separate effects of endovascular

repair for the perioperative period, the next 60-days, the remainder of the first year, and over each year of follow-up thereafter. We found extensive heterogeneity in the effect of endovascular repair in the perioperative period to that over the next 60-days and in-turn to the remainder of follow-up. However, the hazard ratio varied minimally from 90-days post procedure to 4-years post-procedure, and then varied minimally from 4 through 8 years post-procedure. Therefore, we settled on an extended Cox regression model that allowed the effect of endovascular repair to vary and thus accommodate non-proportionality of hazards at 30-days, 90-days, and 4-years post-procedure. The model is estimated by setting up our analysis data set in the counting process form (essentially defining multiple time-intervals for each patient based on the above break-points) of survival analysis and including an endovascular repair by time-period interaction effect in the specification of the model. We used the R statistical package to estimate the model.

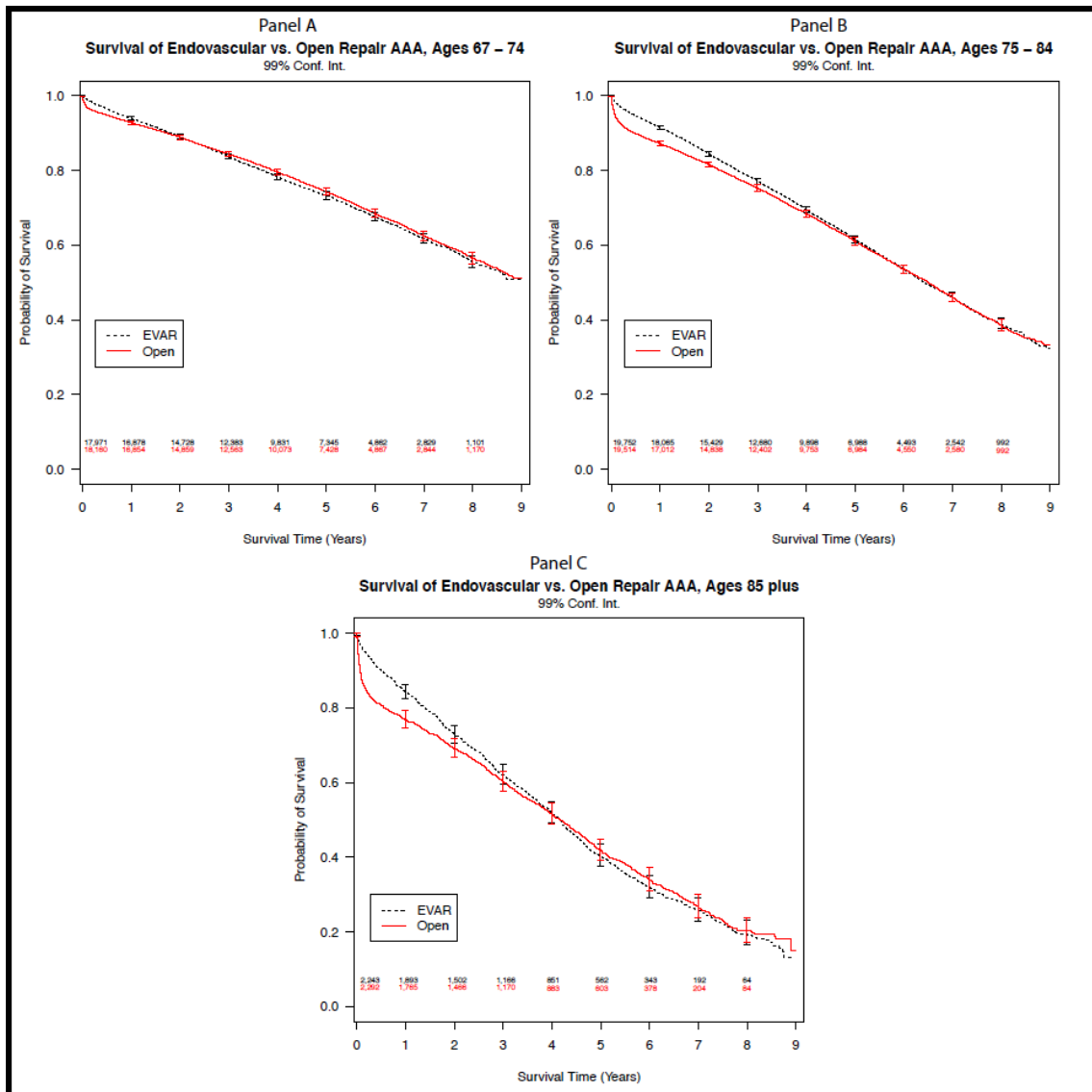
Having estimated the extended Cox regression model, one is faced with a dilemma on how best to report the results from the analysis. While the time-period specific estimates of endovascular repair enable the change in the hazard-ratio of death to be compared across time and thus the above differential-survival theory to be tested, one cannot simply add the estimates together to obtain an overall measure of survival benefit (or not) of endovascular repair. To overcome this problem, we compute the Restricted Mean Survival Time (RMST) – the total amount of time over a specified period of follow-up that a patient with given characteristics is expected to survive.<sup>18</sup> A graphical interpretation of the RMST is that it equals the area beneath the survival curve.

Early survival confers a greater advantage in terms of RMST than late survival (the reasoning is the same as that for why an early investment yields more interest than a later investment because it has a longer period of time to grow) and so when assessing the overall

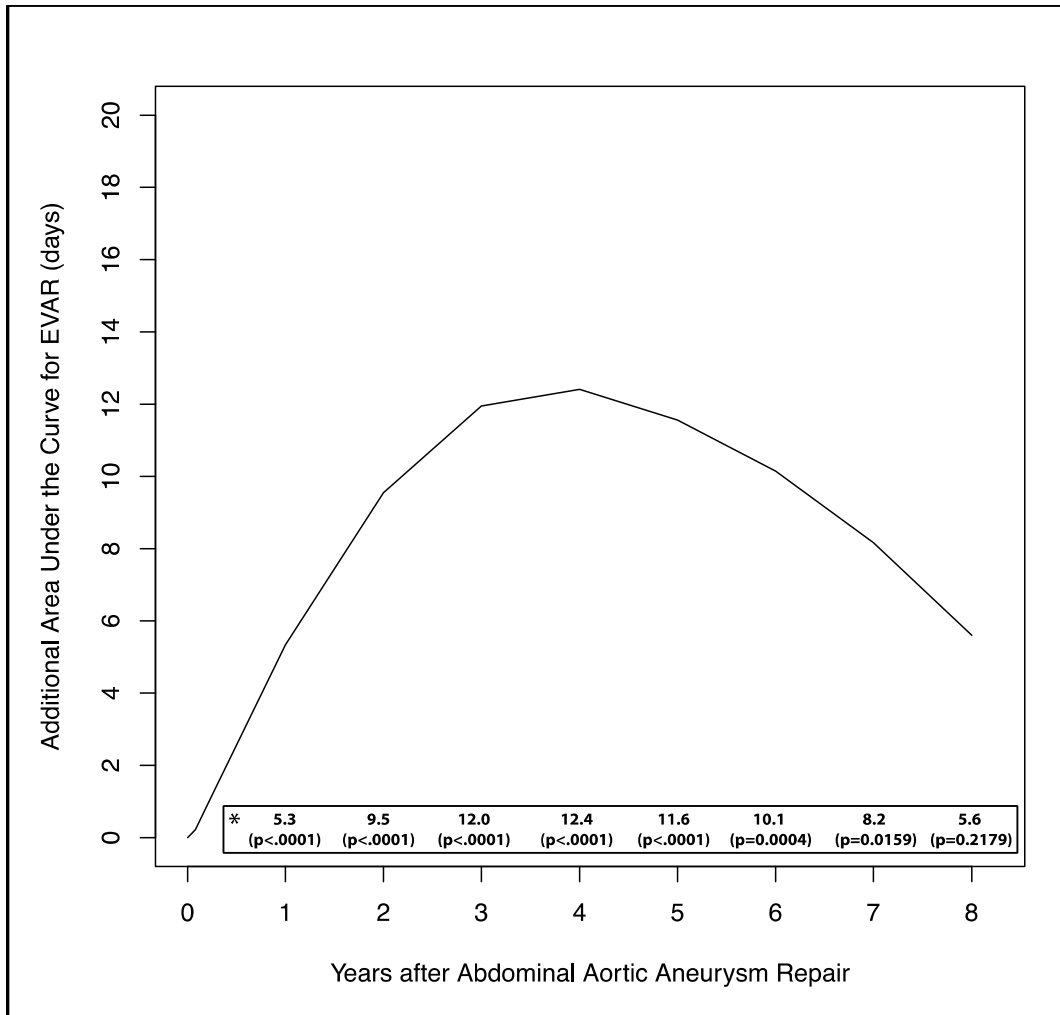
effect of endovascular repair (vs. open repair) the comparison is incomplete if only the likelihood of survival for a sub-interval of the follow-up time-period of interest is presented. The RMST on the other hand aggregates the probability a patient with given characteristics survives each interval of time into an overall measure of expected survival. The RMST (or its proportional equivalent obtained by dividing the RMST by the follow-up time) may be plotted against follow-up time to reveal how the aggregate advantage of endovascular repair relative to open repair changes with the length of follow-up, thereby summarizing and presenting the overall risk of death across all follow-up times of interest.

The above described behavior of the effect of endovascular repair is seen in the RMSTs at the end of each interval; the difference in the RMST increases from 0.2 days at 30 days of follow-up to 12.4 days at time 4 years and then reduces to 5.6 days by 8-years. In summary, the analysis presented here suggests there is a substantial, immediate benefit of endovascular repair that endures for a considerable period of time despite the fact that patients who receive open and survive through 90-days of follow-up have a slightly more optimistic risk-profile from that time forward.

**Figure S1. Survival of Patients Undergoing Endovascular Repair or Open Repair of Abdominal Aortic Aneurysms, According to Age. Data are shown for those 67 to 74 years of age (Panel A), those 75 to 84 years of age (Panel B), and those 85 years of age or older (Panel C)**



**Figure S2. Survival Benefit for Endovascular Repair Compared to Open Repair of Abdominal Aortic Aneurysm over Time (Additional Area under the Curve)**



**\* net days of survival advantage of endovascular compared to open repair**



<b>Table S1: Baseline Characteristics of Medicare Beneficiaries Undergoing Endovascular Repair (EVAR) or Open Repair of Abdominal Aortic Aneurysms in 2001-2008 before Propensity Score Matching</b>			
<b>All Study Subjects</b>			
<b>Variable</b>	<b>EVAR (n=79,463)</b>	<b>Open (n=49,135)</b>	<b>P Value</b>
<b>Year</b>			
2001	5,423 (6.8)	9,748 (19.8)	<.001
2002	6,768 (8.5)	8,139 (16.6)	<.001
2003	7,456 (9.4)	7,213 (14.7)	<.001
2004	9,327 (11.7)	6,812 (13.9)	<.001
2005	11,493 (14.5)	5,821 (11.9)	<.001
2006	12,541 (15.8)	4,668 (9.5)	<.001
2007	13,049 (16.4)	2,984 (7.6)	<.001
2008	13,406 (16.9)	2,984 (6.1)	<.001
Male sex	65,446 (82.4)	36,303 (73.9)	<.001
<b>Race or ethnic group *</b>			
Other	997 (1.3)	632 (1.3)	0.623
White	75,824 (95.4)	46,801 (95.3)	0.158
Black	2,212 (2.8)	1,421 (2.9)	0.255
Hispanic	430 (0.5)	281 (0.6)	0.47
Mean age (years)	76.8	75.2	<.001
<b>Age category (years)</b>			
67-69	9,465 (11.9)	7,777 (15.8)	<.001
70-74	20,692 (26.0)	15,712 (32.0)	<.001
75-79	23,307 (29.3)	15,145 (30.8)	<.001
80-84	17,440 (22.0)	8,128 (16.5)	<.001
85+	8,559 (10.8)	2,373 (4.8)	<.001
Urgent admission	2,974 (3.7)	3,451 (7.0)	<.001
Prior AAA diagnosis	59,587 (75.0)	31,152 (63.4)	<.001
<b>Coexisting conditions</b>			
MI within 6 mo *	1,208 (1.5)	795 (1.6)	0.169
MI within 6-18 mo *	6,096 (7.7)	3,093 (6.3)	<.001
Valvular heart disease	8,240 (10.4)	3,969 (8.1)	<.001
Congestive heart failure	11,573 (14.6)	5,240 (10.7)	<.001
Peripheral vascular disease	15,187 (19.1)	9,887 (20.1)	<.001
Neurovascular disease	10,901 (13.7)	7,020 (14.3)	0.004
Hypertension	52,138 (65.6)	30,429 (61.9)	<.001
Diabetes	15,287 (19.2)	7,215 (14.7)	<.001
Chronic obstructive pulmonary disease	22,980 (28.9)	13,407 (27.3)	<.001
Renal failure	5,946 (7.5)	2,482 (5.1)	<.001
End-stage renal disease	508 (0.6)	148 (0.3)	<.001
History of cancer	16,119 (20.3)	7,590 (15.5)	<.001
Obesity	2,179 (2.7)	854 (1.7)	<.001

\* MI = Myocardial Infarction. Race or ethnic group was self-reported

<b>Table S2: Baseline Characteristics of Medicare Beneficiaries Undergoing Endovascular Repair of Abdominal Aortic Aneurysms in 2001-2008, who were Propensity Score Matched vs. Unmatched</b>			
	<b>Matched Cohort</b>	<b>Unmatched Cohort</b>	
<b>Variable</b>	<b>N=39,966</b>	<b>N=39,497</b>	<b>P Value</b>
<b>Year</b>			
2001	5,150 (12.9%)	273 (0.7%)	<.001
2002	5,860 (14.7%)	908 (2.3%)	<.001
2003	5,800 (14.5)	1,656 (4.2%)	<.001
2004	6,073 (15.2%)	3,254 (8.2%)	<.001
2005	5,584(14.0%)	5,909 (15.0%)	<.001
2006	4,588 (11.5%)	7,953 (20.1%)	<.001
2007	3,825 (9.6%)	9,224 (23.4%)	<.001
2008	3,086 (7.7%)	10,320 (26.1%)	<.001
Male sex	31,047 (77.7%)	34,399 (87.1%)	<.001
<b>Race or ethnic group *</b>			
Other	500 (1.3%)	497 (1.3%)	0.937
White	38,120 (95.4%)	37,704 (95.5%)	0.861
Black	1,119 (2.8%)	1,093 (2.8%)	0.968
Hispanic	227 (0.6%)	203 (0.5%)	0.482
Mean age (years)	75.7	78.0	<.001
<b>Age category (years)</b>			
67-69	5,851 (14.6%)	3,614 (9.2%)	<.001
70-74	12,120 (30.3%)	8,572 (21.7%)	<.001
75-79	12,468 (31.2%)	10,839 (27.4%)	<.001
80-84	7,284 (18.2%)	10,156 (25.7%)	<.001
85+	2,243 (5.6%)	6,316 (16.0%)	<.001
Urgent admission	2,071 (5.2%)	903 (2.3%)	<.001
Prior AAA diagnosis	27,534 (68.9%)	32,053 (81.2%)	<.001
<b>Coexisting conditions</b>			
MI within 6 mo *	629 (1.6%)	579 (1.5%)	0.214
MI within 6-18 mo *	2,709 (6.8%)	3,387 (8.6%)	<.001
Valvular heart disease	3,467 (8.7%)	4,773 (12.2%)	<.001
Congestive heart failure	4,671 (11.7%)	6,902 (17.5%)	<.001
Peripheral vascular disease	7,897 (19.8%)	7,290 (18.5%)	<.001
Neurovascular disease	5,562 (13.9%)	5,339 (13.5%)	0.102
Hypertension	25,257 (63.2%)	26,881 (68.1%)	<.001
Diabetes	6,427 (16.1%)	8,860 (22.4%)	<.001
Chronic Pulmonary Disease	11,117 (27.8%)	11,863 (30.0%)	<.001
Renal failure	2,250 (5.6%)	3,696 (9.4%)	<.001
End-stage renal disease	165 (0.4%)	343 (0.9%)	<.001
History of cancer	6,710 (16.8%)	9,409 (23.8%)	<.001
Obesity	811 (2.0%)	1,368 (3.5%)	<.001

\* MI = Myocardial Infarction. Race or ethnic group was self-reported

**Table S3. Perioperative Outcomes after Endovascular Repair of Abdominal Aortic Aneurysm in Patients who were Propensity Score Matched vs. Unmatched**

Perioperative Outcome	Matched N = 39,966	Unmatched N = 39,497	P Value	Relative Risk (95% CI)
Death (% of patients)				
All ages	651 (1.6%)	619 (1.6%)	0.488	1.04 (0.93-1.16)
67-69 yr	51 (0.9%)	29 (0.8%)	0.721	1.09 (0.69-1.71)
70-74 yr	138 (1.1%)	73 (0.9%)	0.043	1.34 (1.01-1.77)
75-79 yr	191 (1.5%)	148 (1.4%)	0.290	1.12 (0.91-1.39)
80-84 yr	187 (2.6%)	177 (1.7%)	<.001	1.47 (1.20-1.81)
≥85 yr	84 (3.7%)	192 (3.0%)	0.104	1.23 (0.96-1.58)
Medical complications (% of patients)				
Myocardial Infarction	1,013 (2.5%)	1,007 (2.6%)	0.894	0.99 (0.91-1.08)
Pneumonia	1,522 (3.8%)	1,570 (4.0%)	0.224	0.96 (0.89-1.03)
Acute Renal Failure	1,726 (4.3%)	2,049 (5.2%)	<.001	0.83 (0.78-0.89)
Hemodialysis	174 (0.4%)	243 (0.6%)	0.001	0.71 (0.58-0.86)
Deep-vein Thrombosis	362 (0.9%)	484 (1.2%)	<.001	0.74 (0.65-0.85)
Surgical complications (% of patients)				
Re-operation for Bleeding	232 (0.6%)	172 (0.4%)	0.004	1.33 (1.09-1.62)
Tracheostomy	78 (0.2%)	66 (0.2%)	0.352	1.17 (0.84-1.62)
Embolectomy	446 (1.1%)	365 (0.9%)	0.007	1.21 (1.05-1.39)
Conversion to Open Repair	445 (1/1%)	168 (0.4%)	<.001	2.62 (2.19-3.12)
Mesenteric Ischemia	232(0.6%)	243 (0.6%)	0.525	0.94 (0.79-1.13)
Major Amputation	15 (0.0%)	4 (0.0%)	0.013	3.71 (1.23-11.17)
Complications related to laparotomy				
Lysis of adhesions without resection	17 (0.0%)	20 (0.1%)	0.597	0.84 (0.44-1.60)
Bowel Resection (Small)	43(0.1%)	24 (0.1%)	0.023	1.77 (1.07-2.92)
Bowel Resection (Large)	114 (0.3%)	110 (0.3%)	0.858	1.02 (0.79-1.33)
Ileus or bowel obstruction w/o resection	1,071 (2.7%)	977 (2.5%)	0.067	1.08 (0.99-1.18)
Discharged home (% of survivors)				
All ages	N=39,506	N=39,104	<.001	1.01 (1.01-1.02)
67-69 yr	37,517 (95.0%)	36,707 (93.9%)	0.349	1.00 (0.99-1.00)
70-74 yr	5,703 (98.0%)	3,536 (98.3%)	0.866	1.00 (0.99-1.00)
75-79 yr	11,689 (97.2%)	8,299 (97.3%)	0.866	1.00 (0.99-1.00)
80-84 yr	11,733 (95.2%)	10,286 (95.8%)	0.020	0.99 (0.99-1.00)
80-84 yr	6,539 (91.4%)	9,240 (92.1%)	0.128	0.99 (0.98-1.00)
≥85 yr	1,853 (85.0%)	5,346 (86.2%)	0.140	0.99 (0.97-1.01)
Readmission in 30 days after Discharge	4,278 (10.7%)	4,423 (11.2%)	0.026	0.96 (0.92-0.99)

\* Plus-minus values are means ± SD.

Table S4. Late Outcomes after Endovascular and Open Repair of Abdominal Aortic Aneurysm*												
	Year 1			Year 2			Year 5			Year 8		
Kaplan-Meier estimates of 8-year event probabilities (number of patients at-risk of an event at start of year)	Endovascular Repair N=39,966	Open Repair N=39,966	P Value	Endovascular Repair	Open Repair	P Value	Endovascular Repair	Open Repair	P Value	Endovascular Repair	Open Repair	P Value
Total amount of time (years) patients were at risk of death	38,100	36,749		72,309	70,201		142,226	140,292		165,712	164,278	
Death	3,131 (7.8%)	4,339 (10.9%)	<.001	5,543 (14.1%)	6,257 (15.8%)	<.001	11,705 (34.4%)	11,842 (34.2%)	0.567	14,548 (54.9%)	14,681 (54.7%)	0.758
Rupture	304 (0.8%)	167 (0.5%)	<.001	487 (1.4%)	247 (0.7%)	<.001	820 (3.0%)	326 (1.1%)	<.001	962 (5.4%)	353 (1.4%)	<.001
Any aneurysm-related Intervention	1,497 (4.0%)	254 (0.7%)	<.001	2,405 (6.7%)	393 (1.1%)	<.001	3,816 (13.3%)	651 (2.4%)	<.001	4,165 (18.8%)	754 (3.7%)	<.001
Major re-intervention	103 (0.3%)	100 (0.3%)	0.975	175 (0.5%)	124 (0.3%)	0.003	333 (1.3%)	168 (0.6%)	<.001	392 (2.3%)	186 (0.8%)	<.001
Minor re-intervention	1,422 (3.8%)	161 (0.4%)	<.001	2,279 (6.4%)	283 (0.8%)	<.001	3,609 (12.6%)	509 (1.9%)	<.001	3,924 (17.5%)	597 (3.1%)	<.001
Embolization	631 (1.7%)	28 (0.1%)	<.001	1,113 (3.2%)	56 (0.2%)	<.001	1,727 (6.0%)	125 (0.5%)	<.001	1,857 (8.0%)	161 (1.0%)	<.001
AAA Hospitalization without re-intervention	60 (0.2%)	20 (0.1%)	<.001	103 (0.3%)	25 (0.1%)	<.001	199 (0.7%)	45 (0.2%)	<.001	233 (1.2%)	55 (0.3%)	<.001
Laparotomy-related re-intervention	522 (1.4%)	1,816 (5.1%)	<.001	903 (2.6%)	3,024 (8.8%)	<.001	1,509 (5.3%)	4,182 (14.2%)	<.001	1,695 (8.2%)	4,427 (17.7%)	<.001
Repair of an abdominal-wall hernia	198 (0.5%)	1,304 (3.7%)	<.001	352 (1.0%)	2,268 (6.6%)	<.001	562 (2.0%)	2,980 (9.9%)	<.001	610 (2.7%)	3,070 (11.2%)	<.001
Lysis of adhesions without bowel resection	55 (0.1%)	232 (0.6%)	<.001	101 (0.3%)	366 (1.1%)	<.001	198 (0.8%)	586 (2.1%)	<.001	238 (1.4%)	654 (3.1%)	<.001
Bowel resection	304 (0.8%)	371 (1.0%)	0.002	524 (1.5%)	606 (1.8%)	0.004	901 (3.2%)	1,048 (3.9%)	<.001	1,035 (5.2%)	1,199 (6.0%)	0.008
Laparotomy related hospitalization without intervention	1,026 (2.7%)	1,723 (4.7%)	<.001	1,758 (4.9%)	2,728 (7.8%)	<.001	3,083 (11.1%)	4,303 (15.2%)	<.001	3,510 (17.3%)	4,805 (22.2%)	<.001
Aneurysm or Laparotomy-related re-intervention	1,989 (5.3%)	2,045 (5.7%)	0.017	3,238 (9.1%)	3,365 (9.8%)	<.001	5,138 (17.8%)	4,710 (16.0%)	<.001	5,614 (25.1%)	5,034 (20.6%)	<.001
Aneurysm or Laparotomy related hospitalization without intervention	1,100 (2.9%)	1,772 (4.9%)	<.001	1,884 (5.3%)	2,796 (8.0%)	<.001	3,287 (11.7%)	4,371 (15.4%)	<.001	3,710 (17.9%)	4,846 (22.0%)	<.001
Rupture, AAA- or laparotomy-related re-intervention or hospitalization without intervention	2,293 (6.1%)	2,213 (6.1%)	0.768	3,666 (10.3%)	3,591 (10.4%)	0.535	5,755 (19.8%)	5,007 (17.0%)	<.001	6,279 (27.8%)	5,355 (21.8%)	<.001

\*Percentages are Kaplan-Meier estimates at each time point

Table S5. Late Outcomes after Endovascular of Abdominal Aortic Aneurysm in patients who were Propensity Score Matched vs. Unmatched																				
Variable	Year 1					Year 2					Year 5					Year 8				
	Matched N=36,835	Unmatched N=35,967	P Value	Matched N=31,659	Unmatched N=24,256	P Value	Matched N=14,899	Unmatched N=3,211	P Value	Matched N=2,178	Unmatched N=34	P Value								
Death	3,131	7.8%	3,521	8.9%	<.001	5,543	14.1%	6,091	16.4%	<.001	11,705	34.4%	10,150	41.9%	<.001	14,548	54.9%	10,708	71.1%	<.001
Rupture	304	0.8%	308	0.8%	0.636	487	1.4%	459	1.4%	0.840	820	3.0%	674	3.6%	0.003	962	5.4%	692	5.8%	0.612
Any aneurysm-related Intervention	1,497	4.0%	1,415	3.9%	0.385	2,405	6.7%	2,149	6.5%	0.195	3,816	13.3%	2,868	13.0%	0.455	4,165	18.8%	2,898	16.8%	0.186
Major re-intervention	103	0.3%	84	0.2%	0.232	175	0.5%	119	0.4%	0.004	333	1.3%	196	1.2%	0.473	392	2.3%	203	1.9%	0.274
Minor re-intervention	1,422	3.8%	1,354	3.7%	0.516	2,279	6.4%	2,067	6.3%	0.481	3,609	12.6%	2,747	12.4%	0.649	3,924	17.5%	2,773	15.8%	0.228
Embolization	631	1.7%	602	1.7%	0.719	1,113	3.2%	1,036	3.2%	0.634	1,727	6.0%	1,442	6.8%	0.002	1,857	8.0%	1,452	7.8%	0.794
AAA Hospitalization without re-intervention	60	0.2%	49	0.1%	0.351	103	0.3%	69	0.2%	0.023	199	0.7%	113	0.6%	0.166	233	1.2%	115	0.8%	0.051
Laparotomy-related re-intervention	522	1.4%	568	1.5%	0.070	903	2.6%	878	2.7%	0.326	1,509	5.3%	1,180	5.6%	0.258	1,695	8.2%	1,207	8.4%	0.748
Repair of an abdominal-wall hernia	198	0.5%	208	0.6%	0.452	351	1.0%	311	0.9%	0.450	562	2.0%	405	1.8%	0.313	610	2.7%	416	2.6%	0.846
Lysis of adhesions without bowel resection	55	0.1%	86	0.2%	0.006	101	0.3%	126	0.4%	0.036	198	0.8%	165	0.8%	0.538	238	1.4%	169	1.2%	0.326
Bowel resection	304	0.8%	314	0.9%	0.471	524	1.5%	513	0.6%	0.307	901	3.2%	720	3.6%	0.051	1,035	5.2%	740	5.9%	0.378
Laparotomy related hospitalization without intervention	1,026	2.7%	1,045	2.8%	0.527	1,758	4.9%	1,673	5.1%	0.374	3,083	11.1%	2,408	12.2%	0.003	3,510	17.3%	2,466	17.9%	0.655
Aneurysm or Laparotomy-related re-intervention	1,989	5.3%	1,948	5.3%	0.912	3,238	9.1%	2,964	9.0%	0.557	5,138	17.8%	3,932	17.8%	0.943	5,614	25.1%	3,985	22.9%	0.044
Aneurysm or Laparotomy related hospitalization without intervention	2,293	6.1%	2,226	6.1%	0.837	3,666	10.3%	3,336	10.0%	0.331	5,755	19.8%	4,402	19.8%	0.855	6,279	27.8%	4,462	26.2%	0.239
Rupture, AAA- or laparotomy-related re-intervention or hospitalization without intervention	2,243	6.0%	2,180	5.9%	0.872	3,593	10.1%	3,284	9.9%	0.464	5,643	19.5%	4,335	19.5%	0.990	6,164	27.4%	4,396	26.0%	0.260

This comparison of the matched versus unmatched endovascular patients shows that the unmatched endovascular patients are in general older and sicker, yet perioperative outcomes were the same. Because of the age difference, the late survival was worse for the unmatched endovascular patients. Late outcomes also were very similar except that unmatched patients had slightly fewer re-interventions. Altogether, there was no substantial difference that would suggest that our findings in the matched cohort are not broadly representative of the population of patients undergoing endovascular repair in general.

**Table S6. Time Trend for Perioperative and Postoperative Outcomes After Endovascular and Open Repair of Abdominal Aortic Aneurysm**

<b>Perioperative outcomes</b>										
	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>P Value (linear trend)</b>	<b>P Value (Interaction between EVAR and Open)</b>
	<b>Endovascular Repair</b>									
	<b>N=5,150</b>	<b>N=5,860</b>	<b>N=5,800</b>	<b>N=6,073</b>	<b>N=5,584</b>	<b>N=4,588</b>	<b>N=3,825</b>	<b>N=3,086</b>		
Death (all ages)	2.20%	2.10%	1.60%	1.20%	1.50%	1.60%	1.60%	1.40%	0.001	0.129
Re-operation for bleeding	0.80%	0.70%	0.50%	0.50%	0.40%	0.40%	0.50%	0.20%	<.001	<.001
Conversion to open repair	2.20%	2.10%	1.60%	0.90%	0.90%	0.50%	0.60%	0.30%	<.001	
Readmission in 30 days after discharge	10.80%	11.20%	9.30%	9.70%	9.40%	9.70%	9.40%	9.40%	<.001	0.001
Length of stay (mean)	3.52	3.66	3.46	3.43	3.34	3.33	3.41	3.32	<.001	0.013
	<b>Open Repair</b>									
	<b>N=5,166</b>	<b>N=5,858</b>	<b>N=5,839</b>	<b>N=6,107</b>	<b>N=5,663</b>	<b>N=4,623</b>	<b>N=3,731</b>	<b>N=2,979</b>		
Death (all ages)	5.70%	6.10%	5.80%	5.20%	5.50%	5.10%	5.00%	5.10%	0.013	
Re-operation for bleeding	0.90%	1.00%	1.00%	1.10%	1.10%	0.80%	1.20%	1.20%	0.313	
Readmission in 30 days after discharge	9.60%	10.40%	10.20%	10.30%	10.20%	10.60%	10.30%	10.50%	0.236	
Length of stay (mean)	10	9.99	9.64	9.63	9.86	9.82	9.93	9.89	<.001	
<b>Postoperative outcomes at two years</b>										
	<b>Endovascular Repair</b>									
	<b>N=4,312</b>	<b>N=5,015</b>	<b>N=4,978</b>	<b>N=5,287</b>	<b>N=4,840</b>	<b>N=3,957</b>	<b>N=3,267</b>			
Death	838 (16.3%)	845 (14.4%)	822 (14.2%)	786 (13.0%)	744 (13.3%)	631 (13.7%)	558 (14.6%)		<.001	0.014
Rupture	59 (1.3%)	86 (1.6%)	82 (1.5%)	72 (1.3%)	69 (1.4%)	50 (1.2%)	40 (1.2%)		0.175	0.250
Any aneurysm-related Intervention	372 (7.9%)	394 (7.3%)	354 (6.6%)	342 (6.2%)	351 (7.0%)	243 (6.0%)	221 (6.5%)		<.001	0.002
Major re-intervention	22 (0.5%)	33 (0.6%)	27 (0.5%)	21 (0.4%)	23 (0.5%)	19 (0.5%)	18 (0.5%)		0.424	0.280
Minor re-intervention	358 (7.6%)	370 (6.9%)	337 (6.3%)	326 (5.9%)	336 (6.7%)	228 (5.6%)	205 (6.0%)		<.001	0.007
Embolization	194 (4.2%)	191 (3.6%)	175 (3.3%)	172 (3.1%)	141 (2.9%)	111 (2.8%)	82 (2.5%)		<.001	0.576
AAA Hospitalization without re-intervention	19 (0.4%)	19 (0.4%)	13 (0.2%)	15 (0.3%)	13 (0.3%)	11 (0.3%)	7 (0.2%)		0.033	0.568
Laparotomy-related re-intervention	118 (2.5%)	130 (2.4%)	148 (2.8%)	143 (2.6%)	132 (2.7%)	94 (2.3%)	97 (2.9%)		0.550	0.533
Repair of an abdominal-wall hernia	48 (1.0%)	55 (1.0%)	55 (1.0%)	54 (1.0%)	50 (1.0%)	42 (1.0%)	34 (1.0%)		0.320	0.499
Lysis of adhesions without bowel resection	17 (0.4%)	16 (0.3%)	14 (0.3%)	16 (0.3%)	15 (0.3%)	9 (0.2%)	10 (0.3%)		0.179	0.267
Bowel resection	63 (1.4%)	74 (1.4%)	86 (1.6%)	82 (1.5%)	81 (1.6%)	50 (1.2%)	60 (1.8%)		0.604	0.265
Laparotomy related hospitalization without intervention	253 (5.4%)	275 (5.1%)	301 (5.7%)	280 (5.1%)	233 (4.6%)	168 (4.1%)	162 (4.8%)		<.001	0.001
Aneurysm or Laparotomy-related re-intervention	487 (10.4%)	511 (9.4%)	490 (9.2%)	470 (8.5%)	473 (9.5%)	330 (8.1%)	311 (9.1%)		<.001	0.001
Aneurysm or Laparotomy related hospitalization without intervention	271 (5.8%)	295 (5.5%)	319 (6.0%)	302 (5.4%)	252 (5.0%)	182 (4.4%)	173 (5.1%)		<.001	0.001
Rupture, AAA- or laparotomy-related re-intervention or hospitalization without intervention	546 (11.6%)	590 (10.9%)	561 (10.5%)	540 (9.7%)	524 (10.5%)	376 (9.2%)	343 (10.1%)		<.001	<.001

	Open Repair							
	N=4,295	N=4,918	N=4,891	N=5,173	N=4,821	N=3,902	N=3,156	
Death	871 (16.8%)	940 (16.1%)	948 (16.2%)	934 (15.3%)	842 (14.9%)	721 (15.6%)	576 (15.4%)	0.241
Rupture	33 (0.7%)	35 (0.7%)	43 (0.8%)	35 (0.6%)	29 (0.6%)	27 (0.7%)	25 (0.8%)	0.674
Any aneurysm-related Intervention	42 (0.9%)	58 (1.1%)	5.3 (1.0%)	55 (1.0%)	74 (1.5%)	50 (1.2%)	33 (1.0%)	0.112
Major re-intervention	16 (0.3%)	18 (0.3%)	18 (0.3%)	12 (0.2%)	20 (0.4%)	13 (0.3%)	17 (0.5%)	0.474
Minor re-intervention	29 (0.6%)	41 (0.8%)	36 (0.7%)	44 (0.8%)	58 (1.2%)	38 (1.0%)	18 (0.6%)	0.212
Embolization	7 (0.2%)	13 (0.3%)	9 (0.2%)	4 (0.1%)	10 (0.2%)	7 (0.2%)	3 (0.1%)	0.512
AAA Hospitalization without re-intervention	4 (0.1%)	5 (0.1%)	3 (0.1%)	6 (0.1%)	4 (0.1%)	2 (0.1%)	1 (0.0%)	0.097
Laparotomy-related re-intervention	406 (8.9%)	421 (8.1%)	480 (9.3%)	476 (8.9%)	428 (8.8%)	332 (8.4%)	306 (9.5%)	0.845
Repair of an abdominal-wall hernia	309 (6.8%)	332 (6.4%)	365 (7.1%)	339 (6.4%)	319 (6.6%)	246 (6.3%)	236 (7.4%)	0.498
Lysis of adhesions without bowel resection	56 (1.2%)	51 (1.0%)	44 (0.9%)	64 (1.2%)	46 (1.0%)	46 (1.2%)	35 (1.1%)	0.845
Bowel resection	71 (1.6%)	67 (1.3%)	100 (1.9%)	103 (1.9%)	93 (1.9%)	72 (1.8%)	60 (1.9%)	0.030
Laparotomy related hospitalization without intervention	364 (7.9%)	393 (7.5%)	379 (7.3%)	475 (8.8%)	377 (7.6%)	307 (7.6%)	278 (8.5%)	0.592
Aneurysm or Laparotomy-related re-intervention	444 (9.7%)	473 (9.1%)	535 (10.2%)	524 (9.8%)	493 (10.1%)	373 (9.4%)	333 (10.3%)	0.650
Aneurysm or Laparotomy related hospitalization without intervention	370 (8.1%)	399 (7.6%)	391 (7.5%)	489 (9.0%)	395 (8.0%)	319 (7.9%)	278 (8.5%)	0.666
Rupture, AAA- or laparotomy-related re-intervention or hospitalization without intervention	476 (10.4%)	507 (9.8%)	567 (11.0%)	558 (10.4%)	520 (10.6%)	397 (10.0%)	352 (10.9%)	0.923

## List of Diagnosis (ICD-9) and procedure (CPT) codes

ICD-9	Description of diagnosis / complication
441.4	Abdominal aneurysm without mention of rupture
38.44	Resection of abdominal aortic aneurysm with replacement
39.25	Aortoiliac-femoral bypass
39.71	Endovascular implantation of graft
441.1	Thoracic aneurysm, ruptured
441.2	Thoracic aneurysm without mention of rupture
441.3	Abdominal aneurysm, ruptured
441.5	Aortic aneurysm of unspecified site, ruptured
441.6	Thoracoabdominal aneurysm, ruptured
441.7	Thoracoabdominal aneurysm, without mention of rupture
441.00	Unspecified aortic dissection
441.01	Thoracic aortic dissection
441.02	Abdominal aortic dissection
441.03	Thoracoabdominal aortic dissection
38.35	Resection of thoracic vessels with anastomosis
38.45	Resection of thoracic vessels with replacement
39.73	Endovascular implantation of graft in thoracic aorta
38.46	Resection of abdominal arteries with replacement
39.24	Aorta-renal bypass
39.26	Intra-abdominal vascular shunt of bypass
410.00	Acute myocardial infarction
481.00	Pneumococcal pneumonia
482.00	Other bacterial pneumonia
584.0	Acute renal failure
584.5	Acute renal failure with lesion of tubular necrosis
584.9	Acute renal failure, unspecified
V451	Renal dialysis status
V56x	Encounter for dialysis and dialysis catheter care
415.1	Pulmonary embolism and infarction



453.4	Venous embolism and thrombosis of deep vessels of lower extremity
557.0	Acute vascular insufficiency of intestine
560.x	Intestinal obstruction without mention of hernia
560.1	Paralytic ileus
560.8	Other specified intestinal obstruction
560.9	Unspecified intestinal obstruction
552.21	Incisional hernia of abdominal cavity, with obstruction
560.81	Intestinal of peritoneal adhesions with obstruction
560.89	Other intestinal obstruction without mention of hernia

CPT codes of prior abdominal operative procedures were assigned to each of these 5 laparotomy groups: 1) major open abdominal, 2) abdominal wall hernia, 3) minor open abdominal, 4) retroperitoneal or pelvic, and 5) laparoscopic.

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#### **MAJOR OPEN ABDOMINAL OPERATIONS**

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<b>CPT</b>	<b>Description of Procedure</b>
20102	Exploration of penetrating wound; abdomen/flank/back
43107	Total esophagectomy; with pharyngogastrostomy or cervical esophagogastronomy (transhiatal)
43108	... with colon interposition or small intestine reconstruction
43112	Total esophagectomy, with thoracotomy; with pharyngogastrostomy or cervical esophagogastronomy
43113	... with colon interposition or small intestine reconstruction
43116	Partial esophagectomy, cervical, with free intestinal graft, microvascular anastomosis and intestinal reconstruction
43117	Partial esophagectomy, distal two-thirds, with or without proximal gastrectomy (Ivor Lewis)
43118	With colon interposition or small intestine reconstruction
43121	Partial esophagectomy, distal two-thirds, with thoracotomy only
43122	Partial esophagectomy, thoracoabdominal or abdominal approach
43123	... with colon interposition or small intestine reconstruction
43320	Esophagogastronomy (cardioplasty), with or without vagotomy and pyloroplasty
43324	Esophagogastric fundoplasty (eg, Nissen, Belsey IV, Hill procedures)
43325	Esophagogastric fundoplasty; with fundic patch (Thal-Nissen procedure)
43326	... with gastroplasty (eg, Collis)
43340	Esophagojejunostomy (without total gastrectomy); abdominal approach
43360	Gastrointestinal reconstruction for previous esophagectomy; with stomach, with or without pyloroplasty
43361	... with colon interposition or small intestine reconstruction
43400	Ligation, direct, esophageal varices
43401	Transection of esophagus with repair, for esophageal varices
43405	Ligation or stapling at gastroesophageal junction for pre-existing esophageal perforation
43415	Suture of esophageal wound or injury; transthoracic or transabdominal approach
43425	Closure of esophagostomy or fistula; transthoracic or transabdominal approach

43496 Free jejunum transfer with microvascular anastomosis  
 43620 Gastrectomy, total; with esophagogastrostomy  
 43621 ... with Roux-en-Y reconstruction  
 43622 ... with formation of intestinal pouch, any type  
 43631 Gastrectomy, partial, distal; with gastroduodenostomy  
 43632 ... with gastrojejunostomy  
 43633 ... with Roux-en-Y reconstruction  
 43634 ... with formation of intestinal pouch  
 43635 Vagotomy when performed with partial distal gastrectomy  
 43640 Vagotomy including pyloroplasty, with or without gastrostomy; truncal or selective  
 43641 ... parietal cell (highly selective)  
 43810 Gastroduodenostomy  
 43820 Gastrojejunostomy; without vagotomy  
 43825 ... with vagotomy, any type  
 Gastric restrictive procedure, without gastric bypass, for morbid obesity; vertical banded  
 43842 gastroplasty  
 43843 ... other than vertical-bounded gastroplasty  
 Gastric restrictive procedure with partial gastrectomy, pylorus-preserving duodenoileostomy  
 43845 and ileoileostomy  
 Gastric restrictive procedure, with gastric bypass for morbid obesity; with short limb Roux-en-Y  
 43846 gastroenterostomy  
 43847 ... with small intestine reconstruction to limit absorption  
 Revision, open, of gastric restrictive procedure for morbid obesity, other than adjustable gastric  
 43848 restrictive device  
 Revision of gastroduodenal anastomosis (gastrojejunostomy) with reconstruction; without  
 43850 vagotomy  
 43855 ... with vagotomy  
 Revision of gastrojejunal anastomosis, with or without partial gastrectomy or intestine resection;  
 43860 without vagotomy  
 43865 ... with vagotomy  
 43880 Closure of gastrocolic fistula  
 44005 Enterolysis (freeing of intestinal adhesion)  
 44010 Duodenotomy, for exploration, biopsy(s), or foreign body removal  
 44015 Tube or needle catheter jejunostomy for enteral alimentation, intraoperative, any method  
 Enterotomy, small intestine, other than duodenum; for exploration, biopsy(s), or foreign body  
 44020 removal  
 44021 ... for decompression (eg, Baker tube)  
 44025 Colotomy, for exploration, biopsy(s), or foreign body removal  
 44050 Reduction of vulvulus, intussusception, internal hernia, by laparotomy  
 Correction of malrotation by lysis of duodenal bands and/or reduction of midgut volvulus (eg,  
 44055 Ladd procedure)  
 Excision of one or more lesions of small or large intestine not requiring anastomosis; single  
 44110 enterotomy  
 44111 ... multiple enterotomies  
 44120 Enterectomy, resection of small intestine; single resection and anastomosis  
 44121 ... each additional resection and anastomosis  
 44125 ... with enterostomy  
 Enterectomy, resection of small intestine for congenital atresia, single resection and  
 44126 anastomosis; without tapering  
 44127 ... with tapering  
 44128 ... each additional resection and anastomosis  
 44130 Enteroenterostomy, anastomosis of intestine, with or without cutaneous enterostomy  
 44133 Donor enterectomy, open; partial, from living donor

44135 Intestinal allotransplantation; from a cadaver donor  
 44136 ... from living donor  
 44137 Removal of transplanted intestinal allograft, complete  
 44139 Mobilization (take-down) of splenic flexure performed in conjunction with partial colectomy  
 44140 Colectomy, partial; with anastomosis  
 44141 ... with skin level cecostomy or colostomy  
 44143 ... with end colostomy and closure of distal segment (Hartmann type procedure)  
 44144 ... with resection, with colostomy or ileostomy and creation of mucofistula  
 44145 ... with coloproctostomy (low pelvic anastomosis)  
 44146 ... with coloproctostomy (low pelvic anastomosis); with colostomy  
 44147 ... abdominal and transanal approach  
 44150 Colectomy, total, abdominal, without proctectomy; with ileostomy or ileoproctostomy  
 44151 ... with continent ileostomy  
 44155 Colectomy, total, abdominal, with proctectomy; with ileostomy  
 44156 ... with continent ileostomy  
 44157 ... with ileoanal anastomosis, includes loop ileostomy, and rectal mucosectomy, when performed  
 ... with ileoanal anastomosis, creation of ileal reservoir (S or J), includes loop ileostomy, and  
 44158 rectal mucosectomy  
 44160 Colectomy, partial, with removal or terminal ileum with ileocolostomy  
 44314 Revision of ileostomy; complicated (reconstruction in-depth)  
 44345 Revision of colostomy; complicated (reconstruction in-depth)  
 Suture of small intestine (enterorrhaphy) for perforated ulcer, diverticulum, wound, injury or  
 44602 rupture; single perforation  
 44603 ... multiple perforations  
 Suture of large intestine (colorrhaphy) for perforated ulcer, diverticulum, wound, injury or  
 44604 rupture; without colostomy  
 44605 ... with colostomy  
 Intestinal stricturoplasty (enterotomy and enterorrhaphy) with or without dilation, for intestinal  
 44615 obstruction  
 44620 Closure of enterostomy, large or small intestine  
 44625 ... with resection and anastomosis other than colorectal  
 44626 ... with resection and colorectal anastomosis (eg, closure of Hartmann type procedure)  
 44640 Closure of intestinal cutaneous fistula  
 44650 Closure of enteroenteric or enterocolic fistula  
 44660 Closure of enterovesical fistula; without intestinal or bladder resection  
 44661 ... with intestine and/or bladder resection  
 44680 Intestinal plication  
 Exclusion of small intestine from pelvis by mesh or other prosthesis, or native tissue (eg, bladder  
 44700 or omentum)  
 44701 Intraoperative colonic lavage  
 44799 Unlisted procedure, intestine  
 45110 Proctectomy; complete, combined abdominoperineal, with colostomy  
 45111 Proctectomy; partial resection of rectum, transabdominal approach  
 45112 Proctectomy, combined abdominoperineal pull-through procedure (eg, colo-anal anastomosis)  
 Proctectomy, partial, with rectal mucosectomy, ileoanal anastomosis, creation of ileal reservoir  
 45113 (S or J)  
 45114 Proctectomy, partial, with anastomosis; abdominal and transsacral approach  
 Proctectomy, combined abdominoperineal pull-through procedure, with creation of colonic  
 45119 reservoir (eg, J pouch)  
 Proctectomy, complete, abdominal and perineal approach; with pull through procedure and  
 45120 anastomosis  
 45121 ... with subtotal or total colectomy, with multiple biopsies  
 45123 Proctectomy, partial, without anastomosis, perineal approach

45126 Pelvic exenteration for colorectal malignancy, with proctectomy (with or without colostomy)  
 45135 Excision of rectal procidentia, with anastomosis; abdominal and perineal approach  
 45136 Excision of ileoanal reservoir with ileostomy  
 45540 Proctopexy (eg, for prolapse); abdominal approach  
 45550 ... with sigmoid resection, abdominal approach  
 45560 Repair of rectocele  
 45562 Exploration, repair, and presacral drainage for rectal injury  
 45563 ... with colostomy  
 45800 Closure of rectovesical fistula  
 45805 ... with colostomy  
 45820 Closure of rectourethral fistula  
 45825 ... with colostomy  
 Repair of ileoanal pouch fistula/sinus, pouch advancement; combined transperineal and  
 46712 transabdominal approach  
 Repair of high imperforate anus without fistula; combined transabdominal and sacroperineal  
 46735 approaches  
 Repair of high imperforate anus with rectourethral or rectovaginal fistula; combined  
 46742 transabdominal and sacroperineal  
 Repair of cloacal anomaly by anorectovaginoplasty and urethroplasty, combined abdominal and  
 46746 sacroperineal  
 46748 ... with vaginal lengthening by intestinal graft or pedicle flaps  
 47010 Hepatotomy; open for drainage of abscess or cyst, one or two stages  
 47011 ... for percutaneous drainage of abscess or cyst, one or two stages  
 Laparotomy, with aspiration and/or injection of hepatic parasitic (eg, amoebic or echinococcal)  
 47015 cyst(s) or abscess(es)  
 47120 Hepatectomy, resection of liver, partial lobectomy  
 47122 ... trisegmentectomy  
 47125 ... total left lobectomy  
 47130 ... total right lobectomy  
 47135 Live allotransplantation; orthotopic, partial or whole, from cadaver or living donor, any age  
 47136 ... heterotopic, partial or whole, from cadaver or living donor, any age  
 Donor hepatectomy (including cold preservation), from living donor; left lateral segment only  
 47140 (segments II and III)  
 47141 ... total left lobectomy (segments II, II, and IV)  
 47142 ... total right lobectomy (segments V, VI, VII, and VIII)  
 47300 Marsupialization of cyst or abscess of liver  
 47350 Management of liver hemorrhage; simple suture of liver wound or injury  
 47360 ... complex suture of liver wound or injury, with or without hepatic artery ligation  
 ... exploration of hepatic wound, extensive debridement, coagulation and/or suture, with or  
 47361 without packing of liver  
 47362 ... re-exploration of hepatic wound for removal of packing  
 47400 Hepaticotomy or hepaticostomy with exploration, drainage or removal of calculus  
 47420 Choledochotomy or choledochostomy with exploration, drainage, or removal or calculus  
 47425 ... with transduodenal sphincterotomy or sphincteroplasty  
 Transduodenal sphincterotomy or sphincteroplasty, with or without transduodenal extraction of  
 47460 calculus  
 47480 Cholecystotomy or cholecystostomy with exploration, drainage, or removal of calculus  
 47600 Percutaneous cholecystostomy  
 47605 Cholecystectomy; with cholangiography  
 47610 Cholecystectomy with exploration of common duct  
 47612 ... with choledochenterostomy  
 47620 ... with transduodenal sphincterotomy or sphincteroplasty, with or without cholangiography  
 47700 Exploration for congenital atresia of bile ducts, without repair, with or without liver biopsy

47701 Portoenterostomy (eg, Kasai procedure)  
 47711 Excision of bile duct tumor, with or without primary repair of bile duct; extrahepatic  
 47712 ... intrahepatic  
 47715 Excision of choledochal cyst  
 47720 Cholecystoenterostomy; direct  
 47721 ... with gastroenterostomy  
 47740 ... roux-en-Y  
 47741 ... roux-en-Y with gastroenterostomy  
 47760 Anastomosis, of extrahepatic biliary ducts and gastrointestinal tract  
 47765 Anastomosis, on intrahepatic ducts and gastrointestinal tract  
 47780 Anastomosis, Roux-en-Y, of extrahepatic biliary ducts and gastrointestinal tract  
 47785 Anastomosis, Roux-en-Y, of intrahepatic biliary ducts and gastrointestinal tract  
 47800 Reconstruction, plastic, of extrahepatic biliary ducts with end-to-end anastomosis  
 47801 Placement of choledochal stent  
 47802 U-tube hepaticoenterostomy  
 47900 Suture of extrahepatic biliary duct for pre-existing injury  
 48000 Placement of drains, peripancreatic, for acute pancreatitis  
 48001 ... with cholecystostomy, gastrostomy and jejunostomy  
 48020 Removal of pancreatic calculus  
 48100 Biopsy of pancreas, open (eg, fine needle aspiration, needle core biopsy, wedge biopsy)  
 Resection or debridement of pancreas and peripancreatic tissue for acute necrotizing  
 48105 pancreatitis  
 48120 Excision of lesion of pancreas (eg, cyst, adenoma)  
 48140 Pancreatectomy, distal subtotal, with or without splenectomy; without pancreaticojejunostomy  
 48145 ... with pancreaticojejunostomy  
 48146 Pancreatectomy, distal, near-total with preservation of duodenum (Child type procedure)  
 48148 Excision of ampulla of Vater  
 48150 Pancreatectomy (Whipple-type procedure); with pancreaticojejunostomy  
 48152 ... without pancreaticojejunostomy  
 48153 Pancreatectomy (pylorus-sparing, Whipple-type procedure); with pancreaticojejunostomy  
 48154 ... without pancreaticojejunostomy  
 48155 Pancreatectomy, total  
 Pancreatectomy, total or subtotal, with autologous transplantation of pancreas or pancreatic  
 48160 islet cells  
 48500 Marsupialization of pancreatic cyst  
 48510 External drainage, pseudocyst of pancreas; open  
 48520 Internal anastomosis of pancreatic cyst to gastrointestinal tract; direct  
 48540 ... roux-en-Y  
 48545 Pancreatorrhaphy for injury  
 48547 Duodenal exclusion with gastrojejunostomy for pancreatic injury  
 48548 Pancreaticojejunostomy, side-to-side anastomosis (Puestow-type operation)  
 48554 Transplantation of pancreatic allograft  
 48556 Removal of transplanted pancreatic allograft  
 48999 Unlisted procedure, pancreas  
 49000 Exploratory laparotomy, with or without biopsy(s)  
 49002 Reopening of recent laparotomy  
 49010 Exploration, retroperitoneal area with or without biopsy(s)  
 49020 Drainage of peritoneal abscess or localized peritonitis, exclusive of appendiceal abscess; open  
 49040 Drainage of subdiaphragmatic or subphrenic abscess; open  
 49060 Drainage of retroperitoneal abscess; open  
 49062 Drainage of extraperitoneal lymphocele to peritoneal cavity; open  
 49203 Excision or destruction, open, intra-abdominal tumors; largest tumor 5 cm diameter or less  
 49204 ... largest tumor 5.1 - 10.0 cm diameter

49205	... largest tumor greater than 10.0 cm diameter
49220	Staging laparotomy for Hodgkins disease or lymphoma
49402	Removal or peritoneal foreign body from peritoneal cavity
50660	Ureterectomy, total, ectopic ureter, combination abdominal, vaginal and/or perineal approach
50800	Ureteroenterostomy, direct anastomosis of ureter to intestine Ureterosigmoidostomy, with creation of sigmoid bladder and establishment of abdominal or
50810	perineal colostomy
50815	Ureterocolon conduit, including intestine anastomosis
50820	Ureteroileal conduit (ileal bladder), including intestine anastomosis (Bricker operation) Continent diversion, including intestine anastomosis using any segment of small and/or large
50825	intestine Urinary diversion (eg, taking down of ureteroileal conduit, ureterosigmoidostomy or
50830	ureteroneocystostomy)
50840	Replacement of all or part of ureter by intestine segment, including intestine anastomosis
50860	Ureterostomy, transplantation of ureter to skin
50900	Ureterohhaphy, suture of ureter
50920	Closure of ureterocutaneous fistula
50930	Closure of ureterovisceral fistula (including visceral repair)
50940	Delegation of ureter
51570	Cystectomy, complete ... with bilateral pelvic lymphadenectomy, including external iliac, hypogastric, and obturator
51575	nodes
51580	Cystectomy, complete, with ureterosigmoidostomy or ureterocutaneous transplantations ... with bilateral pelvic lymphadenectomy, including external iliac, hypogastric, and obturator
51585	nodes Cystectomy, complete, with ureteroileal conduit or sigmoid bladder, including intestine
51590	anastomosis ... with bilateral pelvic lymphadenectomy, including external iliac, hypogastric, and obturator
51595	nodes Cystectomy, complete, with continent diversion, using segment of small and/or large intestine to
51596	construct neobladder
51597	Pelvic exenteration, complete, for vesical, prostatic or urethral malignancy
54535	Orchiectomy, radical, for tumor; with abdominal exploration
54560	Exploration for undescended testis with abdominal exploration
55535	Excision of varicocele or ligation of spermatic veins for varicocele; abdominal approach
55540	... with hernia repair
57305	Closure of rectovaginal fistula; abdominal approach
57307	... abdominal approach, with concomitant colostomy
58240	Pelvic exenteration for gynecologic malignancy Laparotomy, for staging or restaging of ovarian, tubal, or primary peritoneal malignancy (second
58960	look)

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#### **ABDOMINAL WALL HERNIA OPERATIONS**

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<b>CPT</b>	<b>Description of procedure</b>
49560	Repair initial incisional or ventral hernia; reducible
49561	Repair initial incisional or ventral hernia; incarcerated or strangulated
49565	Repair recurrent incisional or ventral hernia; reducible
49566	Repair recurrent incisional or ventral hernia; incarcerated or strangulated Implantation of mesh for incisional or ventral hernia repair or for closure of debridement for
49568	necrotizing tissue infection
49570	Repair epigastric hernia; reducible
49572	Repair epigastric hernia; incarcerated or strangulated
49580	Repair umbilical hernia, younger than 5 years; reducible

49582	Repair umbilical hernia, younger than 5 years; incarcerated or strangulated
49585	Repair umbilical hernia, age 5 years or older; reducible
49587	Repair umbilical hernia, age 5 years or older; incarcerated or strangulated
49590	Repair spigelian hernia
49600	Repair of small omphalocele, with primary closure
49605	Repair of large omphalocele or gastroschisis; with or without prosthesis
49606	Repair of large omphalocele or gastroschisis; with removal of prosthesis, final reduction and closure
49610	Repair of omphalocele (Gross type operation); first stage
49611	Repair of omphalocele (Gross type operation); second stage
49900	Suture, secondary, of abdominal wall for evisceration or dehiscence
49904	Omental flap, extra-abdominal (eg, for reconstruction of sternal and chest wall defects)
49905	Omental flap, intra-abdominal
49906	Free omental flap with microvascular anastomosis
49999	Unlisted procedure, abdomen, peritoneum and omentum

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### **MINOR OPEN ABDOMINAL OPERATIONS**

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<b>CPT</b>	<b>Description of Procedure</b>
43101	Excision of lesion, esophagus; thoracic or abdominal approach
43246	Upper gastrointestinal endoscopy with directional placement of percutaneous gastrostomy tube
43330	Esophagomyotomy (Heller type); abdominal approach
43350	Esophagomyotomy, fistulization of esophagus, external; abdominal approach
43500	Gastronomy; with exploration or foreign body removal
43501	Gastronomy; with suture repair of bleeding ulcer
43502	Gastronomy; with suture repair of pre-existing esophagogastric laceration (eg, Mallory-Weiss)
43510	Gastronomy; with esophageal dilation and insertion of permanent intraluminal tube
43520	Pyloromyotomy, cutting of pyloric muscle (Fredet-Ramstedt type operation)
43605	Biopsy of stomach; by laparotomy
43610	Excision, local; ulcer or benign tumor of stomach
43611	Excision, local; malignant tumor of stomach
43800	Pyloroplasty
43830	Gastrostomy, open; without construction of gastric tube (eg, Stamm procedure)
43832	Gastrostomy, open; with constriction of gastric tube (eg, Janeway procedure)
43840	Gastrorrhaphy, suture of perforated duodenal or gastric ulcer, wound, or injury
43870	Closure of gastrostomy, surgical
43881	Implantation or replacement of gastric neurostimulator electrodes, antrum, open
43882	Revision or removal of gastric neurostimulator electrodes, antrum, open
44300	Placement, enterostomy or cecostomy, tube open (eg, for feeding or decompression)
44310	Ileostomy or jejunostomy, non-tube
44312	Revision of ileostomy; simple (release of superficial scar)
44316	Continent ileostomy (Kock procedure)
44320	Colostomy or skin level cecostomy
44322	Colostomy or skin level cecostomy; with multiple biopsies (eg, for congenital megacolon)
44340	Revision of colostomy; simple (release of superficial scar)
44346	Revision of colostomy; with repair of paracolostomy hernia
44800	Excision of Meckel's diverticulum (diverticulectomy) or omphalomesenteric duct
44820	Excision of lesion of mesentery
44850	Suture of mesentery
44899	Unlisted procedure, Meckel's diverticulum and the mesentery
44900	Incision and drainage of appendiceal abscess; open
44950	Appendectomy
44955	Appendectomy; when done for indicated purpose at time of other major procedure
44960	Appendectomy; for ruptured appendix with abscess or generalized peritonitis

47100	Biopsy of liver, wedge
47380	Ablation, open, of one or more liver tumor(s); radiofrequency
47381	Ablation, open, of one or more liver tumor(s); cryosurgical
47382	Ablation, one or more liver tumor(s), percutaneous, radiofrequency
49250	Umbilectomy, omphalectomy, excision of umbilicus
49255	Omentectomy, epiploectomy, resection of omentum
49419	Insertion of intraperitoneal cannula or catheter, with subcutaneous reservoir, permanent
49420	Insertion of intraperitoneal cannula or catheter for drainage or dialysis; temporary
49421	Insertion of intraperitoneal cannula or catheter for drainage or dialysis; permanent
49422	Removal of permanent intraperitoneal cannula or catheter
49423	Exchange of previously placed abscess or cyst drainage catheter under radiological guidance
49425	Insertion of peritoneal-venous shunt
49426	Revision of peritoneal venous shunt
49428	Ligation of peritoneal-venous shunt
49429	Removal of peritoneal-venous shunt
49435	Insertion of subcutaneous extension to intraperitoneal cannula or catheter with remote chest exit site
49436	Delayed creation of exit site from embedded subcutaneous segment of intraperitoneal cannula or catheter
49440	Insertion of gastrostomy tube, percutaneous, under fluoroscopic guidance
49441	Insertion of duodenostomy or jejunostomy tube, percutaneous, under fluoroscopic guidance
49442	Insertion of cecostomy or other colonic tube, percutaneous, under fluoroscopic guidance
50845	Cutaneous appendico-vesicostomy
62223	Creation of shunt; ventriculo-peritoneal, -pleural, other terminus
62258	Removal of complete cerebrospinal fluid shunt system; with replacement
63303	Vertebral corpectomy; extradural, lumbar or sacral by transperitoneal or retroperitoneal approach
63307	Vertebral corpectomy; intradural, lumbar or sacral by transperitoneal or retroperitoneal approach
63740	Creation of shunt, lumbar, subarachnoid-peritoneal, -pleural, or other, including laminectomy

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#### **RETROPERITONEAL OR PELVIC OPERATIONS**

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<b>CPT</b>	<b>Description of Procedure</b>
50010	Renal exploration, not necessitating other specific procedures
50020	Drainage of perirenal or renal abscess; open
50040	Nephrostomy, nephrotomy with drainage
50045	Nephrotomy, with exploration
50060	Nephrolithotomy; removal of calculus
50065	Nephrolithotomy; secondary surgical operation for calculus
50070	Nephrolithotomy; complicated by congenital kidney abnormality
50075	Nephrolithotomy; removal of large staghorn calculus filling renal pelvis and calyces
50100	Transection of repositioning of aberrant renal vessels
50120	Pyelotomy; with exploration
50125	Pyelotomy; with drainage, pyelostomy
50130	Pyelotomy; with removal of calculus (pyelolithotomy, pelviolithotomy, including coagulum pyelolithotomy)
50135	Pyelotomy; complicated (eg, secondary operation, congenital kidney abnormality)
50205	Renal biopsy by surgical exposure of kidney
50220	Nephrectomy; including partial ureterectomy, any open approach including rib resection
50225	Nephrectomy; complicated because of previous surgery on same kidney
50230	Nephrectomy; radical, with regional lymphadenectomy and/or vena cava thrombectomy
50234	Nephrectomy with total ureterectomy and bladder cuff; through same incision
50236	Nephrectomy with total ureterectomy and bladder cuff; through separate incision



50240 Nephrectomy, partial  
Ablation, open, one or more renal mass lesion(s), cryosurgical, including intraoperative

50250 ultrasound

50280 Excision or unroofing of cyst(s) of kidney

50290 Excision of perinephric cyst

50320 Donor nephrectomy; open, from liver donor

50340 Recipient nephrectomy

50360 Renal allotransplantation, implantation of graft; without recipient nephrectomy

50365 Renal allotransplantation, implantation of graft; with recipient nephrectomy

50370 Removal of transplanted renal allograft

50380 Renal autotransplantation, reimplantation of kidney

50400 Pyeloplasty (Foley Y-pyeloplasty), plastic operation on renal pelvis; simple

50405 Pyeloplasty (Foley Y-pyeloplasty), plastic operation on renal pelvis; complicated

50500 Nephrorrhaphy, suture of kidney wound or injury

50520 Closure of nephrocutaneous or pyelocutaneous fistula

50525 Closure of nephrovisceral fistula (eg, renocolic), including visceral repair; abdominal approach  
Symphysiotomy for horseshoe kidney with or without pyeloplasty, unilateral or bilateral (one

50540 operation)

50600 Ureterotomy with exploration or drainage

50605 Ureterotomy for insertion of indwelling stent, all types

50650 Ureterectomy, with bladder cuff

50700 Ureteroplasty, plastic operation on ureter (eg stricture)

50715 Ureterolysis, with or without repositioning of ureter for retroperitoneal fibrosis

50722 Ureterolysis for ovarian vein syndrome

50725 Ureterolysis for retrocaval ureter, with reanastomosis of upper urinary tract or vena cava

50727 Revision of urinary-cutaneous anastomosis (any type urostomy);  
Revision of urinary-cutaneous anastomosis (any type urostomy); with repair of fascial defect and

50728 hernia

50740 Ureteropyelostomy, anastomosis of ureter and renal pelvis

50750 Ureterocalycostomy, anastomosis of ureter to renal calyx

50760 Ureteroureterostomy

50770 Transureteroureterostomy, anastomosis of ureter to contralateral ureter

50780 Ureteroneocystostomy; anastomosis of single ureter to bladder

50782 Ureteroneocystostomy; anastomosis of duplicated ureter to bladder

50783 Ureteroneocystostomy; with extensive ureteral tailoring

50785 Ureteroneocystostomy; with vesico-psoas hitch or bladder flap

51020 Cystotomy or cystostomy; with fulguration and/or insertion of radioactive material

51030 Cystotomy or cystostomy; with cryosurgical destruction of intravesical lesion

51040 Cystostomy, cystostomy with drainage

51045 Cystotomy, with intersection of ureteral catheter or stent

51050 Cystolithotomy, cystotomy with removal of calculus, without vesical neck resection

51060 Transvesical ureterolithotomy  
Cystotomy, with calculus basket extraction and/or ultrasonic or electrohydraulic fragmentation

51065 of ureteral calculus

51080 Drainage of perivesical or prevesical space abscess

51500 Excision of urachal cyst or sinus, with or without umbilical hernia repair

51520 Cystotomy; for simple excision of vesical neck

51525 Cystotomy; for excision of bladder diverticulum, single or multiple

51530 Cystotomy; for excision of bladder tumor

51535 Cystotomy for excision, incision, ,or repair of ureterocele

51550 Cystectomy, partial; simple

51555 Cystectomy, partial; complicated (eg, postradiation, previous surgery, difficult location)

51565 Cystectomy, partial, with reimplantation of ureter(s) into bladder (ureteroneocystostomy)

Cystoplasty or cystourethroplasty, plastic operation on bladder and/or vesicle neck, any procedure vesical neck

51800 Cystourethroplasty with unilateral or bilateral ureteroneocystostomy

51820 Anterior vesicourethropexy, or urethropexy; simple

51841 Anterior vesicourethropexy, or urethropexy; complicated (eg, secondary repair)  
Abdomino-vaginal vesical neck suspension, with or without endoscopic control (eg, Stamey, Raz, modified Pereyra)

51845 Cystorrhaphy, suture of bladder wound, injury or rupture; simple

51860 Cystorrhaphy, suture of bladder wound, injury or rupture; complicated

51865 Closure of cystostomy

51880 Closure of vesicovaginal fistula, abdominal approach

51900 Closure of vesicouterine fistula

51920 Closure of vesicouterine fistula with hysterectomy

51925 Closure, exstrophy of bladder

51940 Enterocystoplasty, including intestinal anastomosis

51960 Cutaneous vesicostomy

51980 Prostatectomy; suprapubic, subtotal, one or two stages

55821 Excision of cervical stump, abdominal approach

57540 Excision of cervical stump, abdominal approach with pelvic floor repair

57545 Myomectomy, excision of fibroid tumor(s), 1 to 4 intramural myoma(s) with total weight of 250 g or less

58140 Myomectomy, excision of fibroid tumor(s), 5 or more intramural myomas with total weight greater than 250 g

58146 Total abdominal hysterectomy, with or without removal of tube(s), with or without removal of ovary(s)

58150 Total abdominal hysterectomy with colpo-urethrocytopexy (eg, Marshall-Marchetti, Krantz, Burch)

58152 Supracervical abdominal hysterectomy (subtotal), with or without removal tube(s), with or without removal of ovary(s)

58180 Total abdominal hysterectomy, including partial vaginectomy, with para-aortic and pelvic lymph node sampling

58200 Radical abdominal hysterectomy, with bilateral total pelvic lymphadenectomy and para-aortic lymph node sampling

58210 Uterine suspension, with or without shortening of round ligaments or sacrouterine ligaments

58400 Uterine suspension, with presacral sympathectomy

58410 Hysterorrhaphy, repair of ruptured uterus (nonobstetrical)

58520 Hysteroplasty, repair of uterine anomaly (Strassman type)

58540 Ligation or transection of fallopian tube(s), abdominal or vaginal approach, unilateral or bilateral

58600 Ligation or transection of fallopian tube(s), abdominal or vaginal approach, postpartum, unilateral or bilateral

58605 Ligation or transection of fallopian tube(s) when done at the time of cesarean delivery or intra-abdominal surgery

58611 Salpingectomy, complete or partial, unilateral or bilateral

58700 Salpingo-oophorectomy, complete or partial, unilateral or bilateral

58720 Lysis of adhesions (salpingolysis, ovariolysis)

58740 Tubotubal anastomosis

58750 Tubouterine implantation

58752 Fimbrioplasty

58760 Salpingostomy (salpingoneostomy)

58770 Drainage of ovarian cyst(s), unilateral or bilateral; abdominal approach

58805 Drainage of ovarian abscess; abdominal approach

58822 Transposition, ovary(s)

58825 Biopsy of ovary, unilateral or bilateral

58900

58920	Wedge resection or bisection of ovary, unilateral or bilateral
58925	Ovarian cystectomy, unilateral or bilateral
58940	Oophorectomy, partial or total, unilateral or bilateral
	Oophorectomy, partial or total, unilateral or bilateral for ovarian, tubal or primary peritoneal
58943	malignancy
	Resection of ovarian, tubal or primary peritoneal malignancy w/ bilateral salpingo-
58950	oophorectomy and omentectomy
58951	... with total abdominal hysterectomy
58952	... with radical dissection for debulking
	Bilateral salpingo-oophorectomy with omentectomy, total abdominal hysterectomy and radical
58953	dissection for debulking
58954	... with pelvic lymphadenectomy
	Bilateral salpingo-oophorectomy with total omentectomy, total abdominal hysterectomy for
58956	malignancy
	Resection (tumor debulking) of recurrent ovarian, tubal, primary peritoneal, uterine malignancy,
58957	with omentectomy
58958	... with pelvic lymphadenectomy and limited para-aortic lymphadenectomy
59100	Hysterotomy, abdominal (eg, for hydatidiform mole, abortion)
	Surgical treatment of ectopic pregnancy; tubal or ovarian, requiring salpingectomy and/or
59120	oophorectomy
	Surgical treatment of ectopic pregnancy; tubal or ovarian, without salpingectomy and/or
59121	oophorectomy
59130	Surgical treatment of ectopic pregnancy; abdominal pregnancy
	Surgical treatment of ectopic pregnancy; interstitial, uterine pregnancy requiring total
59135	hysterectomy
	Surgical treatment of ectopic pregnancy; interstitial, uterine pregnancy with partial resection of
59136	uterus
59325	Cerclage of cervix, during pregnancy; abdominal
59350	Hysterorrhaphy of ruptured uterus
59510	Routine obstetric care including antepartum care, cesarean delivery, and postpartum care
59514	Cesarean delivery only
59515	Cesarean delivery only including postpartum care
59525	Subtotal or total hysterectomy after cesarean delivery
	Routine obstetric care including antepartum care and cesarean delivery following attempted
59618	vaginal delivery
59620	Cesarean delivery only, following attempted vaginal delivery after previous cesarean
	Cesarean delivery only, following attempted vaginal delivery after previous cesarean including
59622	postpartum care
	Adrenalectomy, partial or complete, or exploration of adrenal gland with or without biopsy,
60540	transabdominal
60545	... with excision of adjacent retroperitoneal tumor

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## LAPAROSCOPIC OPERATIONS

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CPT	Description of procedure
43280	Esophagogastric fundoplasty (Nissen, Toupet)
43289	Unlisted procedure, esophagus
43644	Gastric restrictive procedure; with gastric bypass and Roux-en-Y gastroenterostomy
43645	Gastric restrictive procedure; with gastric bypass and small intestine reconstruction
43647	Implantation or replacement of gastric neurostimulator electrodes, antrum
43648	Revision or removal of gastric neurostimulator electrodes, antrum
43651	Transection of vagus nerves, truncal
43652	Transection of vagus nerves, selective or highly selective
43653	Gastrostomy, without construction of gastric tube (Stamm procedure)

43659 Unlisted procedure, stomach  
 43770 Gastric restrictive procedure; placement of adjustable gastric restrictive device  
 43771 Revision of adjustable gastric restrictive device component only  
 43772 Removal of adjustable gastric restrictive device component only  
 43773 Removal and replacement of adjustable gastric restrictive device component only  
 43774 Removal of adjustable gastric restrictive device and subcutaneous port components  
 43775 Gastric restrictive procedure; longitudinal gastrectomy (sleeve)  
 44186 Jejunostomy  
 44187 Ileostomy or jejunostomy, non-tube  
 44188 Colostomy or skin level cecostomy  
 44202 Enterectomy, resection of small intestine, single resection and anastomosis  
 44203 Each additional small intestine resection and anastomosis  
 44204 Colectomy, partial, with anastomosis  
 44205 Colectomy, partial, with removal of terminal ileum with ileocolostomy  
 44206 Colectomy, partial, with end colostomy and closure of distal segment (Hartmann)  
 44207 Colectomy, partial, with anastomosis, with coloproctostomy  
 44208 Colectomy, partial, with anastomosis, with coloproctostomy with colostomy  
 44210 Colectomy, total, abdominal, without proctectomy, with ileostomy or ileoproctostomy  
 Colectomy, total, abdominal, with proctectomy, with ileoanal anastomosis, creation of ileal  
 44211 reservoir  
 44212 Colectomy, total, abdominal, with proctectomy, with ileostomy  
 44213 Mobilization of splenic flexure performed in conjunction with partial colectomy  
 44227 Closure of enterostomy, large or small intestine, with resection and anastomosis  
 44238 Unlisted procedure, intestine  
 44970 Appendectomy  
 44979 Unlisted procedure, appendix  
 45395 Proctectomy, complete, combined abdominoperineal, with colostomy  
 Proctectomy, combined abdominoperineal pull-through procedure with creation of colonic  
 45397 reservoir  
 45400 Proctopexy  
 45402 Proctopexy, with sigmoid resection  
 45499 Unlisted procedure, rectum  
 47370 Ablation of one or more liver tumors; radiofrequency  
 47371 Cryosurgical  
 47379 Unlisted procedure, liver  
 47562 Cholecystectomy  
 47563 Cholecystectomy with cholangiography  
 47564 Cholecystectomy with exploration of common duct  
 47570 Cholecystoenterostomy  
 47579 Unlisted procedure, biliary tract  
 49320 Diagnostic, with or without collection of specimens by brushing or washing  
 49321 ... with biopsy  
 49322 ... with aspiration of cavity or cyst  
 49323 ... with drainage of lymphocele to peritoneal cavity  
 49324 ... with insertion of intraperitoneal cannula or catheter, permanent  
 49325 ... with revision of previously placed intraperitoneal cannula or catheter  
 49326 ... with omentopexy  
 49329 Unlisted procedure, abdomen, peritoneum, and omentum  
 49650 Repair initial inguinal hernia  
 49651 Repair recurrent inguinal hernia  
 49652 Repair ventral, umbilical, spigelian or epigastric hernia; reducible  
 49653 Repair ventral, umbilical, spigelian or epigastric hernia; incarcerated or strangulated  
 49659 Unlisted procedure, hernioplasty, herniorrhaphy, herniotomy

50541 Ablation of renal cysts  
50542 Ablation of renal mass lesion  
50543 Partial nephrectomy  
50544 Pyeloplasty  
50545 Radical nephrectomy  
50546 Nephrectomy, including partial ureterectomy  
50547 Donor nephrectomy, from living donor  
50548 Nephrectomy with total ureterectomy  
50549 Unlisted procedure, renal  
51990 Urethral suspension for stress incontinence  
51992 Sling operation for stress incontinence  
51999 Unlisted procedure, bladder  
54692 Orchiopexy for intra-abdominal testis  
55550 Ligation of spermatic veins for varicocele  
55559 Unlisted procedure, spermatic cord  
58541 Supracervical hysterectomy  
58542 ... with removal of tubes and/or ovary  
58543 Supracervical hysterectomy  
58544 ... with removal of tubes and/or ovary  
58545 Myomectomy; 1 to 4 intramural myomas  
58546 ... 5 or more intramural myomas  
Radical hysterectomy, with bilateral total pelvic lymphadenectomy and para-aortic lymph node  
58548 sampling  
58550 ... with vaginal hysterectomy  
58552 ... with removal of tubes and/or ovary  
58553 ... with vaginal hysterectomy  
58554 ... with removal of tubes and/or ovary  
58570 Total hysterectomy  
58571 ... with removal of tubes and/or ovary  
58572 Total hysterectomy  
58573 ... with removal of tubes and/or ovary  
58578 Unlisted procedure, uterus  
58660 Lysis of adhesions (salpingolysis, ovariolysis)  
58661 ... with removal of adnexal structures  
58662 ... with fulguration or excision of lesions of the ovary, pelvic viscera, or peritoneal surface  
58670 ... with fulguration of oviducts  
58671 ... with occlusion of oviducts by device  
58672 ... with fimbrioplasty  
58673 ... with salpingostomy  
58679 Unlisted procedure, oviduct, ovary  
59150 Treatment of ectopic pregnancy; without salpingectomy and/or oophorectomy  
59151 ... with salpingectomy and/or oophorectomy  
60650 Adrenalectomy, partial or complete, or exploration of adrenal gland

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