

## SUPPLEMENTAL MATERIAL

**Supplemental Tables A-G.** Code lists for index surgery, AAA-related reintervention, abdominal wall procedures, vascular and other procedures and surveillance imaging events

### A. *Index open repair* (ICD-9-CM procedure codes)

38.04	Incision of vessel, aorta
38.06	Incision of vessel, abdominal arteries
38.08	Incision of vessel, lower limb arteries
38.14	Endarterectomy, aorta
38.16	Endarterectomy, abdominal arteries
38.18	Endarterectomy, lower limb arteries
38.34	Resection of vessel with anastomosis, aorta
38.36	Resection of vessel with anastomosis, abdominal arteries
38.38	Resection of vessel with anastomosis, lower limb arteries
38.44	Resection of vessel with replacement, aorta, abdominal
38.46	Resection of vessel with replacement, abdominal arteries
38.48	Resection of vessel with replacement, lower limb arteries
38.64	Other excision of vessels, aorta, abdominal
38.66	Other excision of vessels, abdominal arteries
38.68	Other excision of vessels, lower limb arteries
38.84	Other surgical occlusion of vessels, aorta, abdominal
38.86	Other surgical occlusion of vessels, abdominal arteries
38.88	Other surgical occlusion of vessels, lower limb arteries
38.91	Arterial catheterization
39.24	aortic renal bypass
39.25	Aorta-iliac-femoral bypass
39.26	Other intra-abdominal vascular shunt or bypass
39.29	Other (peripheral) vascular shunt or bypass
39.30	Suture of unspecified blood vessel
39.31	Suture of artery
39.50	Angioplasty of other non-coronary vessel(s)
39.51	Clipping of aneurysm
39.52	Other repair of aneurysm
39.54	Re-entry operation (aorta)
39.56	Repair of blood vessel with tissue patch graft
39.57	Repair of blood vessel with synthetic patch graft
39.58	Repair of blood vessel with unspecified type of patch graft
39.59	Other repair of vessel

### B. *Index endovascular repair* (ICD-9-CM procedure codes)

39.71	Endovascular implantation of other graft in abdominal aorta
39.72	Endovascular (total) embolization or occlusion of head and neck vessels
39.73	Endovascular implantation of graft in thoracic aorta
39.74	Endovascular removal of obstruction from head and neck vessel(s)
39.75	Endovascular embolization or occlusion of vessel(s) of head or neck using bare coils
39.76	Endovascular embolization or occlusion of vessel(s) of head or neck using bioactive coils
39.77	Temporary (partial) therapeutic endovascular occlusion of vessel
39.78	Temporary (partial) therapeutic endovascular occlusion of vessel
39.79	Other endovascular procedures on other vessels
39.90	Insertion of non-drug-eluting peripheral (non-coronary) vessel stent(s)

**C. AAA-related reintervention (ICD-9-CM procedure codes)**

39.24	Aorta-renal bypass
39.49	Other revision of vascular procedure
39.73	Endovascular implantation of graft in thoracic aorta
38.04	Incision of vessel, aorta
38.06	Incision of vessel, abdominal arteries
38.08	Incision of vessel, lower limb arteries
38.14	Endarterectomy, aorta
38.16	Endarterectomy, abdominal arteries
38.18	Endarterectomy, lower limb arteries
38.34	Resection of vessel with anastomosis, aorta
38.38	Resection of vessel with anastomosis, lower limb arteries
38.44	Resection of vessel with replacement, aorta, abdominal
38.46	Resection of vessel with replacement, abdominal arteries
38.64	Other excision of vessels, aorta, abdominal
38.66	Other excision of vessels, abdominal arteries
38.68	Other excision of vessels, lower limb arteries
38.84	Other surgical occlusion of vessels, aorta, abdominal
38.86	Other surgical occlusion of vessels, abdominal arteries
38.88	Other surgical occlusion of vessels, lower limb arteries
38.91	Arterial catheterization
39.25	Aorta-iliac-femoral bypass
39.26	Other intra-abdominal vascular shunt or bypass
39.29	Other (peripheral) vascular shunt or bypass
39.30	Suture of unspecified blood vessel
39.31	Suture of artery
39.51	Clipping of aneurysm
39.52	Other repair of aneurysm
39.54	Re-entry operation (aorta)
39.56	Repair of blood vessel with tissue patch graft
39.57	Repair of blood vessel with synthetic patch graft
39.58	Repair of blood vessel with unspecified type of patch graft
39.59	Other repair of vessel
39.71	Endovascular implantation of other graft in abdominal aorta
39.72	Endovascular (total) embolization or occlusion of head and neck vessels
39.74	Endovascular removal of obstruction from head and neck vessel(s)
39.75	Endovascular embolization or occlusion of vessel(s) of head or neck using bare coils
39.76	Endovascular embolization or occlusion of vessel(s) of head or neck using bioactive coils
39.77	Temporary (partial) therapeutic endovascular occlusion of vessel
39.78	Temporary (partial) therapeutic endovascular occlusion of vessel
39.79	Other endovascular procedures on other vessels
39.90	Insertion of non-drug-eluting peripheral (non-coronary) vessel stent(s)

**D. Abdominal wall procedures (ICD-9-CM procedure codes)**

53.9x	Other hernia repair
54.4x	Excision or destruction of peritoneal tissue
54.11	Exploratory laparotomy
54.19	Other laparotomy
54.59	Other lysis of peritoneal adhesions
54.64	Suture of peritoneum
54.73	Other repair of peritoneum
54.92	Removal of foreign body from peritoneal cavity
54.95	Incision of peritoneum
54.0x	Incision of abdominal wall
54.3x	Excision or destruction of lesion or tissue of abdominal wall or umbilicus

53.41	Other and open repair of umbilical hernia with graft or prosthesis
53.42	Laparoscopic repair of umbilical hernia with graft or prosthesis
53.43	Other laparoscopic umbilical herniorrhaphy
53.49	Other open umbilical herniorrhaphy
53.51	Incisional hernia repair
53.59	Repair of other hernia of anterior abdominal wall
53.61	Other open incisional hernia repair with graft or prosthesis
53.62	Laparoscopic incisional hernia repair with graft or prosthesis
53.63	Other laparoscopic repair of other hernia of anterior abdominal wall with graft or prosthesis
53.69	Other and open repair of other hernia of anterior abdominal wall with graft or prosthesis
53.71	Laparoscopic repair of diaphragmatic hernia, abdominal approach
53.72	Other and open repair of diaphragmatic hernia, abdominal approach
53.75	Repair of diaphragmatic hernia, abdominal approach, not otherwise specified
53.80	Repair of diaphragmatic hernia with thoracic approach, not otherwise specified
53.81	Plication of the diaphragm
53.82	Repair of parasternal hernia
53.83	Laparoscopic repair of diaphragmatic hernia, with thoracic approach
53.84	Other and open repair of diaphragmatic hernia, with thoracic approach
54.12	Reopening of recent laparotomy site
54.21	Laparoscopy
54.22	Biopsy of abdominal wall or umbilicus
54.61	Reclosure of postoperative disruption of abdominal wall
54.62	Delayed closure of granulating abdominal wound
54.63	Other suture of abdominal wall
54.71	Repair of gastroschisis
54.72	Other repair of abdominal wall

**E. Other vascular procedures (ICD-9-CM procedure codes)**

38.7x	Interruption of the vena cava
37.99	Other operations on heart and pericardium
38.00	Incision of vessel, unspecified site
38.01	Incision of vessel, intracranial vessels
38.02	Incision of vessel, other vessels of head and neck
38.03	Incision of vessel, upper limb vessels
38.05	Incision of vessel, other thoracic vessels
38.07	Incision of vessel, abdominal veins
38.09	Incision of vessel, lower limb veins
38.10	Endarterectomy, unspecified site
38.11	Endarterectomy, intracranial vessels
38.12	Endarterectomy, other vessels of head and neck
38.13	Endarterectomy, upper limb vessels
38.15	Endarterectomy, other thoracic vessels
38.21	Biopsy of blood vessel
38.26	Insertion of implantable pressure sensor without lead for intracardiac or great vessel hemodynamic monitoring
38.29	Other diagnostic procedures on blood vessels
38.30	Resection of vessel with anastomosis, unspecified site
38.31	Resection of vessel with anastomosis, intracranial vessels
38.32	Resection of vessel with anastomosis, other vessels of head and neck
38.33	Resection of vessel with anastomosis, upper limb vessels
38.35	Resection of vessel with anastomosis, other thoracic vessels
38.36	Resection of vessel with anastomosis, abdominal arteries
38.37	Resection of vessel with anastomosis, abdominal veins
38.39	Resection of vessel with anastomosis, lower limb veins
38.40	Resection of vessel with replacement, unspecified site
38.41	Resection of vessel with replacement, intracranial vessels
38.42	Resection of vessel with replacement, other vessels of head and neck
38.43	Resection of vessel with replacement, upper limb vessels
38.45	Resection of vessel with replacement, thoracic vessels

38.48	Resection of vessel with replacement, lower limb arteries
38.60	Other excision of vessels, unspecified site
38.61	Other excision of vessels, intracranial vessels
38.62	Other excision of vessels, other vessels of head and neck
38.63	Other excision of vessels, upper limb vessels
38.65	Other excision of vessels, thoracic vessels
38.67	Other excision of vessels, abdominal veins
38.69	Other excision of vessels, lower limb veins
38.80	Other surgical occlusion of vessels, unspecified site
38.81	Other surgical occlusion of vessels, intracranial vessels
38.82	Other surgical occlusion of vessels, other vessels of head and neck
38.83	Other surgical occlusion of vessels, upper limb vessels
38.85	Other surgical occlusion of vessels, thoracic vessels
38.87	Other surgical occlusion of vessels, abdominal veins
38.89	Other surgical occlusion of vessels, lower limb veins
39.23	Other intrathoracic vascular shunt or bypass
39.50	Angioplasty of other non-coronary vessel(s)
39.53	Repair of arteriovenous fistula
39.55	Reimplantation of aberrant renal vessel
39.91	Freeing of vessel

**F. Other non-vascular procedures (ICD-9-CM procedure codes)**

41.5x	Total splenectomy
43.5x	Partial gastrectomy with anastomosis to esophagus
43.6x	Partial gastrectomy with anastomosis to duodenum
43.7x	Partial gastrectomy with anastomosis to jejunum
47.2x	Drainage of appendiceal abscess
48.0x	Proctotomy
48.1x	Proctostomy
41.43	Partial splenectomy
42.39	Other destruction of lesion or tissue of esophagus
42.40	Esophagectomy, not otherwise specified
42.41	Partial esophagectomy
42.42	Total esophagectomy
42.51	Intrathoracic esophagoesophagostomy
42.52	Intrathoracic esophagogastrostomy
42.53	Intrathoracic esophageal anastomosis with interposition of small bowel
42.54	Other intrathoracic esophagoenterostomy
42.55	Intrathoracic esophageal anastomosis with interposition of colon
42.56	Other intrathoracic esophagocolostomy
42.58	Intrathoracic esophageal anastomosis with other interposition
42.59	Other intrathoracic anastomosis of esophagus
42.61	Antesternal esophagoesophagostomy
42.62	Antesternal esophagogastrostomy
42.63	Antesternal esophageal anastomosis with interposition of small bowel
42.64	Other antesternal esophagoenterostomy
42.65	Antesternal esophageal anastomosis with interposition of colon
42.66	Other antesternal esophagocolostomy
42.68	Other antesternal esophageal anastomosis with interposition
42.69	Other antesternal anastomosis of esophagus
43.81	Partial gastrectomy with jejunal transposition
43.89	Open and other partial gastrectomy
44.99	Other operations on stomach
45.00	Incision of intestine, not otherwise specified
45.01	Incision of duodenum
45.02	Other incision of small intestine
45.03	Incision of large intestine
45.11	Transabdominal endoscopy of small intestine

45.15	Open biopsy of small intestine
45.61	Multiple segmental resection of small intestine
45.62	Other partial resection of small intestine
45.63	Total removal of small intestine
45.71	Open and other multiple segmental resection of large intestine
45.72	Open and other cecectomy
45.73	Open and other right hemicolectomy
45.74	Open and other resection of transverse colon
45.75	Open and other left hemicolectomy
45.76	Open and other sigmoidectomy
45.79	Other and unspecified partial excision of large intestine
45.82	Open total intra-abdominal colectomy
45.83	Other and unspecified total intra-abdominal colectomy
45.90	Intestinal anastomosis, not otherwise specified
45.91	Small-to-small intestinal anastomosis
45.92	Anastomosis of small intestine to rectal stump
45.93	Other small-to-large intestinal anastomosis
45.94	Large-to-large intestinal anastomosis
45.95	Anastomosis to anus
46.01	Exteriorization of small intestine
46.02	Resection of exteriorized segment of small intestine
46.03	Exteriorization of large intestine
46.04	Resection of exteriorized segment of large intestine
46.10	Colostomy, not otherwise specified
46.11	Temporary colostomy
46.13	Permanent colostomy
46.14	Delayed opening of colostomy
46.20	Ileostomy, not otherwise specified
46.21	Temporary ileostomy
46.22	Continent ileostomy
46.23	Other permanent ileostomy
46.24	Delayed opening of ileostomy
46.31	Delayed opening of other enterostomy
46.32	Percutaneous (endoscopic) jejunostomy [PEJ]
46.39	Other enterostomy
46.40	Revision of intestinal stoma, not otherwise specified
46.41	Revision of stoma of small intestine
46.42	Repair of pericostomy hernia
46.43	Other revision of stoma of large intestine
46.50	Closure of intestinal stoma, not otherwise specified
46.51	Closure of stoma of small intestine
46.52	Closure of stoma of large intestine
46.60	Fixation of intestine, not otherwise specified
46.61	Fixation of small intestine to abdominal wall
46.62	Other fixation of small intestine
46.63	Fixation of large intestine to abdominal wall
46.64	Other fixation of large intestine
46.71	Suture of laceration of duodenum
46.72	Closure of fistula of duodenum
46.73	Suture of laceration of small intestine, except duodenum
46.74	Closure of fistula of small intestine, except duodenum
46.75	Suture of laceration of large intestine
46.76	Closure of fistula of large intestine
46.79	Other repair of intestine
46.80	Intra-abdominal manipulation of intestine, not otherwise specified
46.81	Intra-abdominal manipulation of small intestine
46.82	Intra-abdominal manipulation of large intestine
46.85	Dilation of intestine
46.86	Endoscopic insertion of colonic stent(s)

46.87	Other insertion of colonic stent(s)
46.91	Myotomy of sigmoid colon
46.92	Myotomy of other parts of colon
46.93	Revision of anastomosis of small intestine
46.94	Revision of anastomosis of large intestine
46.95	Local perfusion of small intestine
46.96	Local perfusion of large intestine
46.97	Transplant of intestine
46.99	Other operations on intestines
47.09	Other appendectomy
47.19	Other incidental appendectomy
47.91	Appendicostomy
47.92	Closure of appendiceal fistula
47.99	Other operations on appendix
48.21	Transabdominal proctosigmoidoscopy
48.22	Proctosigmoidoscopy through artificial stoma
48.23	Rigid proctosigmoidoscopy
48.25	Open biopsy of rectum
48.26	Biopsy of perirectal tissue
48.29	Other diagnostic procedures on rectum, rectosigmoid and perirectal tissue
48.31	Radical electrocoagulation of rectal lesion or tissue
48.32	Other electrocoagulation of rectal lesion or tissue
48.33	Destruction of rectal lesion or tissue by laser
48.34	Destruction of rectal lesion or tissue by cryosurgery
48.35	Local excision of rectal lesion or tissue
48.40	Pull-through resection of rectum, not otherwise specified
48.41	Soave submucosal resection of rectum
48.43	Open pull-through resection of rectum
48.49	Other pull-through resection of rectum
48.50	Abdominoperineal resection of the rectum, not otherwise specific
48.52	Open abdominoperineal resection of the rectum
48.59	Other abdominoperineal resection of the rectum
48.61	Transsacral rectosigmoidectomy
48.62	Anterior resection of rectum with synchronous colostomy
48.63	Other anterior resection of rectum
48.64	Posterior resection of rectum
48.65	Duhamel resection of rectum
48.69	Other resection of rectum
48.71	Suture of laceration of rectum
48.72	Closure of proctostomy
48.73	Closure of other rectal fistula
48.74	Rectorectostomy
48.75	Abdominal proctopexy
48.76	Other proctopexy
48.79	Other repair of rectum
48.81	Incision of perirectal tissue
48.82	Excision of perirectal tissue
48.91	Incision of rectal stricture
48.92	Anorectal myectomy
48.93	Repair of perirectal fistula
48.99	Other operations on rectum and perirectal tissue
49.01	Incision of perianal abscess
49.02	Other incision of perianal tissue
49.03	Excision of perianal skin tags
49.04	Other excision of perianal tissue
49.11	Anal fistulotomy
49.12	Anal fistulectomy
49.21	Anoscopy
49.22	Biopsy of perianal tissue

51.03	Other cholecystostomy
51.04	Other cholecystotomy
51.21	Other partial cholecystectomy
51.22	Cholecystectomy
51.31	Anastomosis of gallbladder to hepatic ducts
51.32	Anastomosis of gallbladder to intestine
51.33	Anastomosis of gallbladder to pancreas
51.34	Anastomosis of gallbladder to stomach
51.35	Other gallbladder anastomosis
51.36	Choledochoenterostomy
51.37	Anastomosis of hepatic duct to gastrointestinal tract
51.39	Other bile duct anastomosis
51.41	Common duct exploration for removal of calculus
51.42	Common duct exploration for relief of other obstruction
51.43	Insertion of choledochohepatic tube for decompression
51.49	Incision of other bile ducts for relief of obstruction
51.51	Exploration of common duct
51.59	Other incision of other bile duct
51.61	Excision of cystic duct remnant
51.62	Excision of ampulla of Vater (with reimplantation of common duct)
51.63	Other excision of common duct
54.23	Biopsy of peritoneum
54.25	Peritoneal lavage
54.29	Other diagnostic procedures on abdominal region
54.74	Other repair of omentum
54.75	Other repair of mesentery
54.91	Percutaneous abdominal drainage
54.93	Creation of cutaneoperitoneal fistula
54.94	Creation of peritoneovascular shunt
44.00	Vagotomy, not otherwise specified
44.13	Other gastroscopy
44.15	Open biopsy of stomach
44.42	Suture of duodenal ulcer site

**G. Surveillance Imaging (CPT codes)**

CT: 72191-72194, 74150-74179, 74262, 74263, 75635

MRI: 72195-72198, 74181-74185

Ultrasound: 76770, 76775, 93975, 93976, 93978, 93979

**Supplemental Table H.** Other DRGs assigned to index endovascular and open AAA repair \*

<i>DRG</i>	<i>% (n)</i>	<i>Mean payment, \$</i>	<i>CMS Description</i>
3	15.6 (35)	\$183,192	ECMO or tracheostomy with mechanical ventilation 96+ hours or principal diagnosis except face, mouth & neck with major OR procedure
219	5.3 (12)	\$84,460	Cardiac valve and other major cardiothoracic procedure without cardiac catheterization with MCC
233	4.9 (11)	\$61,801	Coronary bypass with cardiac catheterization with MCC
253	8.9 (20)	\$22,894	Other vascular procedures with CC
254	22.2 (50)	\$15,814	Other vascular procedures without CC/MCC

\* 46 other DRG index codes were also assigned to index endovascular or open repair with a frequency of <11

**Supplemental Table I.** Number at risk, mortality, censorship and event rates by interval of follow-up

	<b>Follow-up Interval</b>							
	<i>1-90 days</i>	<i>91-365 days</i>	<i>1-2 years</i>	<i>2-3 years</i>	<i>3-4 years</i>	<i>4-5 years</i>	<i>5-6 years</i>	<i>6-7 years</i>
<b>Number at risk</b>								
EVR	6775	6222	4767	3173	1927	1021	557	326
Open	1822	1718	1467	1116	832	618	443	342
<b>Mortality, % (n)</b>								
EVR	1.8 (121)	4.4 (273)	6.3 (299)	6.4 (203)	7.0 (135)	7.3 (75)	9.9 (55)	10.7 (35)
Open	2.7 (49)	3.7 (64)	4.2 (62)	5.2 (59)	5.6 (47)	7.4 (46)	9.3 (41)	11.4 (39)
<b>Censored, % (n)</b>								
EVR	6.4 (432)	19.0 (1182)	27.2 (1295)	32.9 (1043)	40.0 (771)	38.1 (389)	31.6 (176)	24.2 (79)
Open	3.0 (55)	10.9 (187)	19.7 (289)	20.2 (225)	20.1 (167)	20.9 (129)	13.5 (60)	9.4 (32)
<b>AAA-related procedure, % (n)</b>								
EVR	1.9 (131)	2.2 (134)	2.5 (119)	2.9 (92)	2.1 (41)	2.7 (28)	2.5 (14)	*
Open	1.4 (26)	1.9 (32)	1.3 (19)	1.3 (15)	2.0 (17)	*	*	*
<b>Abdominal wall procedure, % (n)</b>								
EVR	0.3 (19)	0.4 (26)	0.6 (28)	*	*	*	*	*
Open	0.8 (15)	1.5 (25)	1.4 (21)	1.1 (12)	*	*	*	*
<b>Other vascular procedure, % (n)</b>								
EVR	0.6 (44)	0.9 (56)	1.0 (46)	0.5 (16)	0.7 (13)	*	*	*
Open	0.8 (14)	1.2 (21)	1.1 (16)	*	*	*	*	*
<b>Other abdominopelvic procedure, % (n)</b>								
EVR	0.7 (50)	1.0 (64)	1.1 (51)	0.9 (27)	0.7 (13)	1.3 (13)	*	*
Open	1.3 (23)	1.3 (23)	1.0 (15)	*	*	*	*	*
<b>Inpatient admissions, % (n)</b>								
EVR	13.3 (900)	18.9 (1174)	22.6 (1079)	21.1 (668)	20.9 (403)	20.9 (213)	27.3 (152)	24.5 (80)
Open	18.1 (329)	17.8 (305)	19.0 (278)	22.4 (250)	21.2 (176)	22.7 (140)	25.3 (112)	29.5 (101)
<b>Imaging, % (n)</b>								
EVR	81.6 (5529)	76.6 (4769)	79.0 (3764)	71.1 (2255)	66.0 (1272)	65.3 (667)	60.3 (336)	58.9 (192)
Open	23.7 (431)	37.4 (642)	46.1 (677)	36.6 (408)	36.3 (302)	32.5 (201)	33.0 (146)	35.7 (122)

\* Cells with counts <11 suppressed per CMS requirements