Endovascular Stent Grafts for Abdominal Aortic Aneurysms

Policy # 00035
Original Effective Date: 01/27/2003
Current Effective Date: 06/21/2017

Applies to all products administered or underwritten by Blue Cross and Blue Shield of Louisiana and its subsidiary, HMO Louisiana, Inc. (collectively referred to as the “Company”), unless otherwise provided in the applicable contract. Medical technology is constantly evolving, and we reserve the right to review and update Medical Policy periodically.

Note: Endovascular Stent Grafts for Thoracic Aortic Aneurysms or Dissections is addressed separately in medical policy 00181.

When Services May Be Eligible for Coverage
Coverage for eligible medical treatments or procedures, drugs, devices or biological products may be provided only if:

- Benefits are available in the member’s contract/certificate, and
- Medical necessity criteria and guidelines are met.

Based on review of available data, the Company may consider endoprostheses as a treatment of abdominal aortic aneurysms (AAAs) to be eligible for coverage.

Patient Selection Criteria
Coverage eligibility for the use of endoprostheses will be considered when all of the following criteria are met:

- The device is U.S. Food and Drug Administration (FDA) approved and is used according to the U.S. Food and Drug Administration (FDA) labeling.
- As a treatment of abdominal aortic aneurysms (AAAs) in any of the following clinical situations:
  - An aneurysmal diameter greater than 5cm; or
  - An aneurysmal diameter of 4-5cm that has increased in size by 0.5cm in the last 6 months; or
  - An aneurysmal diameter that measures twice the size of the normal infrarenal aorta; or
  - A ruptured abdominal aortic aneurysm (AAA).

When Services Are Considered Investigational
Coverage is not available for investigational medical treatments or procedures, drugs, devices or biological products.

The use of endoprostheses approved by the U.S. Food and Drug Administration (FDA) as a treatment of abdominal aortic aneurysms (AAAs) is considered investigational* for the following clinical situations:

- Treatment of smaller aneurysms that do not meet the current recommended threshold for surgery;
- Treatment of aneurysms that do meet the recommended threshold for surgery in patients who are ineligible for open repair due to physical limitations or other factors.

The use of endoprostheses when patient selection criteria are not met is considered investigational.*
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**Policy Guidelines**

For treatment of ruptured abdominal aortic aneurysms with endoprostheses, several factors must be considered including the following:

- The patient must be sufficiently stable to undergo detailed computed tomography (CT) examination for anatomic measurements,
- The aneurysm should be anatomically appropriate for endovascular repair, and
- Specialized personnel should be available.

To monitor for leaking of the graft after implantation, patients will typically undergo routine imaging with either CT or ultrasonography every 6 to 12 months, or more frequently if perivascular leaks or aneurysm enlargement is detected.

**Background/Overview**

Endovascular grafts can be used as minimally invasive alternatives to open surgical repair for treatment of AAAs. Open surgical repair of AAAs has high morbidity and mortality, and endovascular grafts have the potential to reduce the operative risk associated with AAA repair.

The conventional management of a clinically significant AAA consists of surgical excision with placement of a sutured woven graft. Surgical excision is associated with a perioperative mortality rate between 1 and 5%. Perioperative morbidity and mortality are highest in older female patients with cardiac, pulmonary, or kidney disease; the most common cause of death is multisystem organ failure. Due to this high mortality rate, endovascular prostheses have been developed as a minimally invasive, catheter-based alternative to open surgical excision of AAAs. These devices are deployed across the aneurysm such that the aneurysm is effectively "excluded" from the circulation, with subsequent restoration of normal blood flow.

There are several types of grafts currently in use—straight grafts, in which both ends are anchored to the infrarenal aorta, and bifurcated grafts, in which the proximal end is anchored to the infrarenal aorta, and the distal ends are anchored to the iliac arteries. Recently, fenestrated grafts have also been investigated. These grafts are designed with openings in the wall that can be placed across the renal or celiac arteries while still protecting vessel patency through these critical arteries. In addition, extensions can be placed from inside the main endograft body into the visceral arteries to create a hemostatic seal.

**FDA or Other Governmental Regulatory Approval**

U.S. Food and Drug Administration (FDA)

A large number of endovascular grafts have been approved by the FDA through the premarket approval (PMA) process for treatment of abdominal aortic aneurysms (see Table 1). The original PMA dates are shown. Most stents have undergone device modification, name changes, and have approved supplements to the original PMA. FDA product code MIH

<table>
<thead>
<tr>
<th>Stent Name</th>
<th>PMA Applicant</th>
<th>Approval Date</th>
<th>PMA No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AneuRx® Prosthesis System (AneuRx)</td>
<td>Medtronic Vascular</td>
<td>1999</td>
<td>P990020</td>
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</table>

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AAAdvantage Stent Graft
Ancure® Aortoiliac System Guidant Endovascular Technologies 2002 P990017
Gore® Excluder® W.L. Gore & Associates 2002 P020004
Zenith® AAA Endovascular Graft Cook 2003 P020018
Endologix Powerlink® (Afx Endovascular AAA system) Endologix 2004 P040002
Talent® Abdominal Stent Graft System Medtronic 2008 P070027
Endurant® II AAA Stent Graft System Medtronic 2010 P100021
Ovation® Abdominal Stent Graft System TriVascular 2012 P120006
Aorfix™ AAA Flexible Stent Graft System Lombard Medical 2013 P110032

PMA: premarket approval.

Centers for Medicare and Medicaid Services (CMS)
There is no national coverage determination (NCD).

Rationale/Source
This policy is updated periodically with literature reviews. The most recent literature review covers the period through March 23, 2017. This policy is also supported by a 2001 TEC Assessment.

The main potential advantage of endovascular grafts for AAA is in offering a less invasive and risky approach to the repair of abdominal aneurysms. This approach has the potential to reduce the relatively high perioperative morbidity and mortality associated with open AAA repair.

The use of endovascular grafts also has potential disadvantages. In particular, there are concerns regarding the durability of the anchoring system, aneurysm expansion, and other late complications related to the prosthetic graft. Aneurysm expansion may result from perivascular leaks, also known as endoleaks, which are a unique complication of endoprostheses. Perivascular leaks may result from an incompetent seal at one of the graft attachment sites, blood flow in aneurysm tributaries (these tributaries are ligated during open surgery), or perforation of graft fabric.

EVAR as an Alternative to Open Repair for Elective Treatment of AAAs
A number of moderate- to large-sized randomized, controlled trials (RCTs) have been completed comparing endovascular aneurysm repair (EVAR) with open surgical repair, and these studies comprise the main body of literature on the comparative efficacy of the two procedures. Early reports of outcomes from these trials demonstrated that the perioperative morbidity and mortality of an endovascular approach were reduced compared to open surgical repair. These results were consistent with prior large observational studies. However, the midterm results of these studies suggest that the short-term improvements are not associated with a long-term benefit compared to an open approach. These studies are reviewed below:

Systematic Reviews
A 2014 Cochrane review assessed the evidence on the effectiveness of EVAR compared with open surgery for patients considered fit for surgery. Reviewers identified 4 trials considered high quality that compared EVAR with open repair (OVER, DREAM, EVAR 1, ACE; total N=2790 patients). In a pooled analysis, short-
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Term mortality (30-day or in-hospital mortality) was significantly lower in patients treated with EVAR (1.4% vs 4.2%; odds ratio [OR], 0.33; 95% confidence interval [CI], 0.2 to 0.55; p<0.001). There were no significant differences in mortality between EVAR and open repair groups at intermediate-term follow-up.

A 2017 individual patient data meta-analysis by Powell et al evaluated longer term outcomes from the 4 combined RCTs included in the 2014 Cochrane review (OVER, DREAM, EVAR-1, ACE), which are detailed below. The meta-analysis included 2783 patients with a median follow-up of 5.5 years. Mortality within 6 months of randomization was lower in the EVAR group, which was due primarily to a reduction in 30-day mortality (see Table 2). Beyond 3 years, aneurysm-related mortality was significantly higher in the EVAR group, resulting in a loss of survival benefit.

Table 2. Mortality Following EVAR or Open Repair in the Individual Patient Data Meta-Analysis of the OVER, DREAM, EVAR 1, and ACE Trials

<table>
<thead>
<tr>
<th>Time of Follow-Up</th>
<th>EVAR n/N (%)</th>
<th>Open n/N (%)</th>
<th>HR</th>
<th>95% CI</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cumulative total deaths</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-30 days</td>
<td>16/1373 (1.2%)</td>
<td>40/1351 (3.0%)</td>
<td>0.40</td>
<td>0.22 to 0.74</td>
<td></td>
</tr>
<tr>
<td>0-6 months</td>
<td>46/1393 (3.3%)</td>
<td>73/1397 (5.5%)</td>
<td>0.61</td>
<td>0.42 to 0.89</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>6 months to 4 years</td>
<td>244/1345 (18.1%)</td>
<td>229/1315 (17.4%)</td>
<td>1.04</td>
<td>0.87 to 1.25</td>
<td>NS</td>
</tr>
<tr>
<td>&gt;4 years</td>
<td>191/987 (19.4%)</td>
<td>180/958 (26.4%)</td>
<td>1.07</td>
<td>0.88 to 1.32</td>
<td>NS</td>
</tr>
<tr>
<td><strong>Aneurysm-related deaths</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-30 days</td>
<td>16/1373 (1.2%)</td>
<td>40/1351 (3.0%)</td>
<td>0.41</td>
<td>0.22 to 0.74</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>31 days to 3 years</td>
<td>18/1357 (1.3%)</td>
<td>33/1311 (2.5%)</td>
<td>1.07</td>
<td>0.49 to 2.36</td>
<td>NS</td>
</tr>
<tr>
<td>After 3 years</td>
<td>19/1118 (1.7%)</td>
<td>3/1054 (0.3%)</td>
<td>5.16</td>
<td>1.49 to 17.89</td>
<td>0.01</td>
</tr>
</tbody>
</table>

CI: confidence interval; EVAR: endovascular aneurysm repair; HR: hazard ratio.

Numerous nonrandomized studies have been performed, including the studies originally used as the basis for FDA approval. A systematic review of nonrandomized studies that compared EVAR with open surgery in elderly patients, 80 years or older, was published in 2011. This analysis included observational studies of elderly patients who had undergone EVAR and compared results with observational studies of elderly patients who had open repair. Results of pooled analysis revealed that operative mortality was lower in the EVAR group (2.3%) than in the open surgery group (8.6%) and that EVAR also had lower rates of postoperative cardiac, pulmonary, and renal complications. Survival at 3 years did not differ between patients undergoing EVAR and open repair (relative risk, 1.10; 95% CI, 0.77 to 1.57).

Randomized Controlled Trials
The major RCTs that were included in the patient-level meta-analysis described above are OVER, DREAM, EVAR 1, and ACE. These are detailed next.

Open versus Endovascular Repair (OVER) Trial
Long-term results of the OVER trial were published by Lederle et al. in 2012. In this trial, 881 patients with asymptomatic AAAs from multiple Veterans Administration medical centers were randomized to EVAR versus open repair and followed up for a mean of 5.2 years. An early survival advantage was reported for EVAR of up to 3 years, but at final follow-up, mortality was similar between groups (hazard ratio [HR]: 0.97, 95% confidence interval [CI]: 0.77-1.22, p=0.81). On subgroup analysis, differences in mortality were noted...
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according to age. For patients younger than 70 years, mortality was increased in the EVAR group (HR: 1.31, 95% CI: 0.99-1.73), while for patients older than 70 years, mortality was reduced in the EVAR group (HR: 0.65, 95% CI: 0.43-0.98).

Dutch Randomized Endovascular Aneurysm Management (DREAM) Trial
The Dutch Randomized Endovascular Aneurysm Management (DREAM) trial enrolled 351 patients who were randomized to either endovascular or open repair. The incidence of aneurysm-related death (i.e., within 30 days) was 4.6% in the open repair group and 1.2% in the endovascular repair group. However, after 2 years, the cumulative survival rates were 89.6% for open repair and 89.7% for endovascular repair, due to a higher incidence of late death in the endovascular group. The trialists suggested that an open approach may precipitate the mortality of frail patients who were most likely to die in the coming year and that the advantage of an endovascular approach may primarily be to delay death. Alternatively, the late mortality of endovascular repair may relate to its inferior ability to prevent rupture or prevent additional complications, compared to an open approach.

Longer term follow-up from this study was reported in 2010. After 6 years of follow-up, the survival rates were similar between the EVAR and open repair groups (68.9% vs. 69.9%, respectively; 95% CI: -8.8 to 10.8; p=0.97). Re-interventions were more common in the EVAR group. Freedom from reinterventions was 70.4% for EVAR compared to 81.9% for open repair (95% CI: 2.0 to 21.0; p=0.03).

Endovascular Aneurysm Repair versus Open Repair in Patients with AAA (EVAR 1) Trial
A larger trial, EVAR 1, enrolled 1,082 patients 60 years or older with abdominal aneurysms at least 5.5 cm in diameter and randomized them to either elective open or endovascular repair. Similar to the DREAM trial, endovascular repair was associated with an improvement in aneurysm-related survival (4.7% open vs. 1.7% at 30 days), but no advantage with respect to all-cause mortality and quality-of-life measures. For example, within 4 years of follow-up, endoscopic repair was associated with a complication rate of 41% compared to only 9% in the surgically treated group.

Longer term follow-up from this trial was reported by the EVAR Investigators in 2010. This publication included a total of 1,252 patients with aneurysms 5.5 cm or larger randomized to EVAR or open repair. After 8 years of follow-up, there was no difference in survival between the groups (HR: 1.03; 95% CI: 0.86-1.23). This evidence suggests that the early survival advantage of EVAR is lost over time due to late endograft ruptures, some of which are fatal.

Another follow-up publication from the EVAR-1 trial focused on cardiovascular morbidity and mortality at 5 years post-treatment. The EVAR group had a lower total cardiovascular event rate at all follow-up time points, but the difference over the course of the study did not reach statistical significance (HR: 0.83, 95% CI: 0.62-1.10). During the period of 6-24 months post-surgery, the EVAR group had a higher rate of cardiovascular events (HR: 1.44, 95% CI: 0.79-2.62), which attenuated the early benefit of EVAR and led to convergence of events between the two procedures. Cardiovascular mortality over the course of the trial was similar between the groups (HR: 1.06, 95% CI: 0.83-1.36).
Anevrisme de l’aorte abdominale: Chirurgie versus Endoprothese Trial

The Anevrisme de l’aorte abdominale: Chirurgie versus Endoprothese (ACE) trial compared EVAR to open surgical repair in patients who were low-to-moderate surgical risk. A total of 306 patients were randomized from 25 clinical centers in France. Inclusion criteria included a Society of Vascular Surgery comorbidity score of 0-2 and suitable anatomy for EVAR without high-risk features. There were 17 crossovers from open surgery to EVAR (11%) and 4 crossovers from EVAR to open surgery (3%). Median follow-up was 3 years.

Perioperative mortality was 1.3% for the EVAR group and 0.6% for the open surgery group (p=0.12). Survival at one year was 95.2% for EVAR and 96.5% for open surgery (p=0.24). At 3 years, survival remained similar at 86.3% for EVAR and 86.7% for open surgery. Major adverse cardiovascular events were present in 6.7% of EVAR patients compared to 4.0% of open surgery, a difference that was also not significant. Re-interventions were more common in the EVAR group compared to open surgery (16% vs. 2.7%, p<0.0001). Endoleaks were identified on follow-up computed tomography (CT) scanning in 27% of EVAR patients (41/150). There were a total of 10 types I endoleaks; 5 were treated by endoluminal procedures, 2 were treated with open surgery, and 3 were treated by observation. There were a total of 31 type II endoleaks; 8 of these were treated with coil embolization and 23 were left untreated.

Nonrandomized Comparative Studies

In 2015, Schermerhorn et al published a propensity-matched study comparing EVAR with open repair in 79,932 Medicare patients. Matching was based on demographic and clinical variables available for the 2 years prior to the index procedure. Analysis of Medicare data showed that patients treated with EVAR had lower perioperative mortality (1.6% vs 5.2% p<0.001) and improved survival through the first 3 years of follow-up compared to patients treated with open repair. Survival rates between 3 and 8 years of follow-up did not differ between groups. Reasons for interventions through 8 years of follow-up differed, and were related to the management of the aneurysm after EVAR versus laparotomy after open repair. Aneurysm rupture occurred in a significantly greater proportion of patients after endovascular repair (5.4%) than in patients who had open repair (1.4%) through the 8-year follow-up (p<0.001). Interpretation of these data is limited by the potential for selection bias. While this study used propensity matching to reduce selection bias, the potential for bias in selecting patients for EVAR remains.

Section Summary: Endovascular Aneurysm Repair as an Alternative to Open Repair for Treatment of AAAs

Evidence from several RCTs and meta-analyses of the RCTs supports EVAR as a reasonable alternative to open surgical repair for aneurysms greater than 5.5 cm, and for aneurysms that have high-risk features such as rapid growth. In unselected patients with AAAs appropriate for surgery, EVAR is associated with lower perioperative morbidity and mortality. However, EVAR is associated with a higher rate of longer term complications, including endoleaks and the need for reinterventions. Longer term mortality is similar for EVAR and open surgery at 5 to 8 years of follow-up. For patients at low risk for open surgery, 1 RCT has reported low perioperative morbidity and mortality rates for both EVAR and open surgery, with no differences between the 2 procedures. Thus, the advantage for EVAR in reduced perioperative morbidity and mortality may not be present for patients who are low risk for surgery.
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EVAR as an Alternative to Open Repair for Ruptured Aneurysms

Emergency EVAR (eEVAR) for ruptured AAAs is being studied as a potential method to decrease the high mortality rate associated with open surgical repair. RCTs are difficult in this area due to the emergent or semi-emergent nature of treatment for ruptured aneurysms. As a result, until 2013, the most relevant evidence on this question is from nonrandomized, comparative studies of EVAR versus open surgery. However, there is a high risk for selection bias in uncontrolled studies. Aneurysms that meet the anatomic criteria for EVAR tend to be smaller and less complex than aneurysms that do not meet criteria for EVAR, resulting in the highest risk patients being preferentially treated with open surgery. Some studies have attempted to identify the degree to which selection bias may contribute to apparent favorable outcomes in endovascular EVAR repair by comparing outcomes for patients who underwent open repair in patients who met eligibility for EVAR compared with those who did not. In a study by Krenzien et al, those who were suitable for EVAR had a significantly lower prevalence of in-hospital deaths compared with patients unsuitable for EVAR (25% vs 53%, p=0.02). In contrast, in an observational cohort of 279 patients who underwent open repair of suspected ruptured AAA who were enrolled in parallel to the Amsterdam Acute Aneurysm Trial previously described, 30-day morbidity was not lower among the 71 patients who met criteria for EVAR compared with the 208 patients who did not meet criteria for EVAR (38% vs 30%, p=0.23). Because of the possibility of selection bias, several nonrandomized studies have used patient matching or other methods to reduce selection bias.

Two RCTs, published in 2013 and 2014, have compared short-term results following endovascular with open repair for ruptured aneurysms. One-year follow-up from the Immediate Management of Patients with Rupture: Open Versus Endovascular Repair (IMPROVE) trial (described next) was published in 2015. Thirty-day and 1-year follow-up for a pseudo-randomized trial that compared EVAR with open surgical repair in patients who qualified for EVAR was published in 2015.

Systematic Reviews

In 2015, Sweeting et al published a patient-level meta-analysis of 3 RCTs (total N=836 patients) that compared EVAR with open repair for ruptured AAAs. To have a more uniform comparison, 90-day data from only the patients who were anatomically suitable for EVAR from the IMPROVE trial were analyzed along with patient-level data from the AAA and ECAR trials (described below). There was no survival benefit from EVAR in pooled analysis at 90 days (OR=0.85; 95% CI, 0.64 to 1.13). However, pooled analysis confirmed findings from IMPROVE that women benefited more than men from an endovascular strategy (ratio of OR=0.49; 95% CI, 0.24 to 0.99). Pooled analysis also confirmed the individual findings of the 3 trials that hospital length of stay was shorter after EVAR than after open repair (HR=1.24; 95% CI, 1.04 to 1.47).

In a 2014 updated Cochrane review, Badger et al reviewed RCTs comparing emergency EVAR with surgical repair for clinically or radiologically diagnosed ruptured AAAs. Reviewers included 3 RCTs (n=761 patients), which consisted of the IMPROVE and AAA trials, along with a small 2006 pilot RCT (N=32 patients). The overall risk of bias was low, but 1 trial did not adequately report random sequence generation, putting it at risk of selection bias, 2 studies did not report on outcomes identified in their protocols, indicating reporting bias, and 1 study was underpowered. For the primary outcome of short-term
(30-day or in-hospital) mortality, there was no significant difference between open repair and EVAR (OR=0.91; 95% CI, 0.67 to 1.22; p=0.52).

Randomized Controlled Trials
Immediate Management of Patients With Rupture: Open vs Endovascular Repair Trial
The IMPROVE trial randomized 623 patients at 30 centers (29 in the U.K., 1 in Canada) with a clinical diagnosis of a ruptured AAA to either an endovascular strategy of immediate CT and emergency EVAR, with open repair for patients anatomically unsuitable for EVAR (endovascular strategy group), or to the standard treatment of emergency open repair (open repair group). Patients were excluded if they had had an aneurysm repair, rupture of an isolated internal iliac aneurysm, aorto-caval or aorto-enteric fistulae, recent anatomic assessment of the aorta (e.g., awaiting elective EVAR), a diagnosis of connective tissue disorder, or if the intervention was considered futile. The trial protocol permitted inclusion of hemodynamically unstable patients. Ten randomized patients were excluded from data analysis due to breach of inclusion criteria. Three hundred sixteen patients were randomized to EVAR, 275 (87%) of whom had a confirmed diagnosis of ruptured AAA and 174 (64%) were considered anatomically suitable for EVAR. EVAR was attempted in 154 patients, 4 of whom were converted to open repair. Open repair was attempted in 112 other patients (84 anatomically unsuitable for EVAR, 28 crossovers). Sixteen patients died before repair, and 1 patient refused repair and was discharged. Two hundred seventy-nine patients were randomized to open repair, 261 (88%) of whom had a confirmed diagnosis of ruptured AAA. In the open repair randomization group, open repair was attempted in 220 (80%) patients, EVAR was attempted in 36 (13%) patients, and 19 patients died before repair.

For the trial's primary outcome, overall 30-day mortality was 35.4% (112/316) in the EVAR group and 37.4% (111/297) in the open repair group (unadjusted OR=0.92; 95% CI, 0.66 to 1.28; p=0.62). After adjustment for age, sex, and Hardman index, a prognostic score for mortality after ruptured AAA, there were no significant differences between groups for overall 30-day mortality (adjusted odds ratio [AOR], 0.94; 95% CI, 0.67 to 1.33; p=0.73). Compared with men (AOR=0.44), women demonstrated a greater benefit from EVAR (AOR=1.18; p=0.019 for interaction). There was a trend for lower mortality in the EVAR group for patients with higher Hardman index and age. Patients in the EVAR group (94%) were more likely to be discharged directly to home than those in the open repair group (77%; p<0.001).

One-year outcomes were reported in 2015. For the trial's primary 1-year outcome, survival data were available for 611 of 613 patients randomized. All-cause mortality did not differ significantly between the EVAR (41.1%) and the open repair groups (45.1%; OR=0.85; 95% CI, 0.62 to 1.17; p=0.325), with similar reintervention rates in both groups. The EVAR group (17 days) had shorter hospital stays than the open repair group (26 days; p<0.001). QOL, measured with the EuroQoL questionnaire, was higher in the EVAR group than in the open group, with a mean difference of 0.087 (95% CI, 0.017 to 0.158) at 3 months and 0.068 (95% CI, -0.004 to 0.140) at 12 months. The EuroQoL outcome difference exceeded the minimally clinically important difference of 0.03.

Amsterdam Acute Aneurysm Trial
In 2013, Reimerink et al reported on results from the Amsterdam Acute Aneurysm (AAA) trial, a regional multicenter randomized trial that compared EVAR with open repair in the treatment of ruptured AAA. In this trial, 807 patients were randomized to EVAR (n=402) or open repair (n=405). The primary outcome was overall mortality at 30 days, defined as death from any cause within 30 days of randomization. The rate of overall 30-day mortality was 39.7% (158/398) in the EVAR group and 41.3% (167/405) in the open repair group (unadjusted OR=0.95; 95% CI, 0.74 to 1.22; p=0.7). After adjustment for age, sex, and initial emergency intervention, overall 30-day mortality was 34.5% (139/401) in the EVAR group and 36.2% (147/406) in the open repair group (adjusted OR=0.94; 95% CI, 0.72 to 1.24; p=0.7). The difference in mortality between the two groups was not statistically significant.

Amsterdam Acute Aneurysm Trial
In 2013, Reimerink et al reported on results from the Amsterdam Acute Aneurysm (AAA) trial, a regional multicenter randomized trial that compared EVAR with open repair in the treatment of ruptured AAA. In this trial, 807 patients were randomized to EVAR (n=402) or open repair (n=405). The primary outcome was overall mortality at 30 days, defined as death from any cause within 30 days of randomization. The rate of overall 30-day mortality was 39.7% (158/398) in the EVAR group and 41.3% (167/405) in the open repair group (unadjusted OR=0.95; 95% CI, 0.74 to 1.22; p=0.7). After adjustment for age, sex, and initial emergency intervention, overall 30-day mortality was 34.5% (139/401) in the EVAR group and 36.2% (147/406) in the open repair group (adjusted OR=0.94; 95% CI, 0.72 to 1.24; p=0.7). The difference in mortality between the two groups was not statistically significant.
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trial, patients were recruited from the set of all patients who presented with suspected ruptured AAA at 1 of 3 trial centers. The other 7 regional hospitals agreed to transfer patients with suspected ruptured AAA to one of the trial centers, if possible. After initial resuscitation, the diagnosis of a ruptured aneurysm was confirmed or rejected based on abdominal ultrasound and/or computed tomography angiography (CTA). Patients who were considered suitable for both EVAR and open repair by the treating vascular surgeon were randomized to EVAR or to open repair. Five hundred twenty patients were diagnosed with ruptured AAA in the trial region; of those, 365 patients were excluded (240 for unfavorable anatomy, 71 for lack of evaluation by CTA, 54 who were not referred to a trial center). One hundred fifty-five patients were considered to have favorable anatomy; 39 of them were excluded (16 were considered unfit for open repair, 11 for “logistics,” 7 with severe hemodynamic instability after CTA, 5 refused surgery). One hundred sixteen patients were randomized, 57 of whom were allocated to the EVAR group and 59 to the open repair group. Ten patients in the EVAR group underwent open repair, and there was 1 perioperative death. In the open repair group, there were 3 diagnoses other than ruptured AAA during surgery and 4 perioperative deaths. For the trial’s primary outcome, rates of a composite end point (death and severe complications at 30 days) were 42% (24/57) in the EVAR group compared with 47% (28/59) in the open repair group (absolute risk reduction [ARR], 5.4%; 95% CI, -13% to 23%). The 30-day mortality was 21% (12/57) in the EVAR group compared with 25% (15/59) in the open repair group (ARR=4.4%; 95% CI, -11% to 20%). The 2 groups had similar median hospital stay and likelihood of intensive care unit admission. The trialists noted that patients in the open repair group had a much lower 30-day mortality rate than was anticipated in the trial’s design (25% vs results from a prior meta-analysis demonstrating a mortality rate of 48.5% in subjects undergoing open repair of ruptured AAA). As such, the trial may have been underpowered to detect a difference between the groups. In addition, the trial had a high rate of exclusion of patients with ruptured aortic aneurysm, most commonly because of unfavorable infrarenal aortic neck anatomy with absent or very short necks and very wide necks.

Endovasculaire ou Chirurgie dan les Aneuvysmes aorto-iliaques Rompus

In 2015, Desgranges et al reported on the 30-day and 1-year results of the multicenter Endovasculaire ou Chirurgie dan les Aneuvysmes aorto-iliaques Rompus (ECAR) pseudorandomized trial. A total of 107 patients were assigned by alternating weeks to EVAR (n=56) or open repair (n=51). Power analysis indicated that 80 patients per group would be required to detect a 20% reduction in mortality, however, trial enrollment was terminated after 5 years. Patients were included if they had a ruptured aortic, aorto-iliac, or iliac aneurysm, met clinical and anatomic criteria for both EVAR and open repair, and were hemodynamically stable. Assignment also included the availability of a qualified surgeon (≥15 EVAR procedures) and facilities. During the study period, 417 patients were treated for ruptured aorto-iliac aneurysms, of which 32% qualified for EVAR (56 included, 116 not included). Baseline characteristic were similar between the EVAR and open repair study groups. There was no significant difference between the EVAR and open repair group for the primary outcome of mortality at 30 days (18% vs 24%, p=0.239) or at 1 year (30% vs 35%, p=0.296), although the trial was underpowered to detect a difference of this magnitude. The lower than expected mortality rate in the open repair group may have been due to the exclusion of patients with hemodynamic instability or unfavorable anatomic criteria. Despite a longer delay to repair with EVAR compared to open surgery (2.9 hours vs 1.3 hours, p<0.005), EVAR resulted in a reduction in respiratory support time (59.3 hours vs 180.3 hours, p=0.007), pulmonary complications (15.4% vs 41.5%,
Nonrandomized Comparative Studies
In 2014, Edwards et al published an evaluation of outcomes after EVAR or open repair for ruptured AAAs among traditional Medicare beneficiaries discharged from a U.S. hospital from 2001 to 2008. Overall, 10,998 patients underwent ruptured AAA repair, 1126 by EVAR and 9872 by open repair. The population analyzed in this study included 1099 patient pairs who were propensity-score matched based for baseline demographics, comorbid conditions, admission source, and hospital volume of ruptured AAA repair. Short-term mortality was significantly better in the EVAR group (33.8% vs 47.7%, p<0.001). The survival benefit persisted until 4 years before surgery. However, at 36 months before surgery, EVAR patients were more likely to have had AAA-related reinterventions than open repair patients (10.9% vs 1.5%, p<0.001). Strengths of this study include a large sample size, the availability of longer-term follow up data, and the use of propensity-score matching to reduce biased based on observed variables. However, the study is subject to bias if unobserved variables are associated with the decision to perform open repair.

Section Summary: EVAR as an Alternative to Open Repair for Ruptured AAAs
For patients with ruptured AAAs to be candidates for endovascular repair, the lesions need to be suitable for the endovascular devices and patients need to be sufficiently stable to undergo CT evaluation. Three RCTs have published outcomes comparing EVAR with open surgery for patients with ruptured AAA and reported that the 30-day and 1-year mortality rates for EVAR did not differ significantly from those for open surgery. Longer term outcomes comparing EVAR with open surgery for ruptured aneurysms have not been reported.

EVAR VS NONSURGICAL TREATMENT FOR SMALLER ANEURYSMS NOT MEETING CURRENT SIZE CRITERIA FOR SURGERY OR FOR PATIENTS INELIGIBLE FOR OPEN SURGERY
Few randomized trials have addressed patients with aneurysms that cannot be treated by open surgery. This population includes patients with smaller aneurysms that do not meet the size threshold for open surgery and patients who cannot undergo open surgery due to prohibitive operative risk.

EVAR for Smaller Aneurysms

Systematic Reviews
A 2012 Cochrane Review summarized the evidence on interventions for small aneurysms, 4.0 to 5.5 cm in size, either by open surgery or EVAR.32 Four RCTs were identified, including 2 RCTs on EVAR (discussed below) and 2 others on open surgical repair. Combined analysis of the 2 EVAR trials revealed no difference in mortality at 1 year (OR=1.15; 95% CI, 0.59 to 2.25). There was also no survival benefit for the trials of open surgery, nor was there any benefit apparent when all 4 trials were combined.

Randomized Controlled Trials
The Caesar trial compared the use of EVAR for small AAAs, which did not meet the current thresholds recommended for intervention, with active surveillance. The study enrolled 360 patients, 50-79-years-old, with aneurysms of 4.1-5.4 cm. Patients was randomized to early EVAR treatment or surveillance by...
ultrasound and/or CT. In the surveillance group, surgery was performed only after the AAA met current recommendations for intervention (≥5.5 cm, growth 1 cm/year, or symptomatic). If repair was indicated, EVAR was performed unless the anatomy of the AAA was unsuitable for EVAR, in which case open repair was performed. Patients were followed for a median of 32.4 months for the primary outcome of all-cause mortality.

The primary outcome occurred at a lower rate than anticipated, thus limiting the power to detect a difference. At final follow-up, there was no significant difference in the main endpoint. Kaplan-Meier estimates of all-cause mortality were 10.1% for the surveillance group compared with 14.5% for the EVAR group (HR: 0.76; 95% CI: 0.30-1.93). Aneurysm-related mortality, aneurysm rupture, and major morbidity rates were also similar between groups. For patients in the surveillance group, the Kaplan-Meier estimate of undergoing aneurysm repair was 59.7% at 36 months and 84.5% at 54 months.

A follow-up publication from the Caesar trial reported on quality-of-life (QOL) outcomes. Patients were assessed with the SF-36 short-form at baseline, 6 months, 12 months, and yearly after that with a mean follow-up of 31.8 months. Following EVAR, QOL scores in the EVAR arm rose while those in the observation arm declined. At 6 months’ follow-up, QOL scores in the EVAR group were significantly higher than in the observation group, with significant differences found for overall score (mean difference 5.4, p=0.002), physical domain score (mean difference 3.8, p=0.02), and mental domain score (mean difference 6.0, p=0.001). Over longer periods of time, scores in both the EVAR and observation group declined, and the differences were not significantly different at time periods of one year or longer.

The PIVOTAL (Positive Impact of Endovascular Options for Treating Aneurysms Early) trial randomly assigned 728 patients with AAAs of 4-5 cm to early EVAR or ultrasound surveillance. Patients were followed for a mean 20 +/- 12 months for the primary outcomes of aneurysm rupture, aneurysm-related death, and overall mortality. At the final follow-up, overall mortality was the same in both groups at a rate of 4.1%. Aneurysm rupture or aneurysm-related death occurred at a low rate and was also the same between groups at a rate of 0.6%. The HR for the primary outcome measures was 0.99 (95% CI: 0.14-7.06).

EVAR for Patients at Prohibitive Surgical Risk

A single RCT has compared endovascular repair for AAAs with no surgical intervention in patients who are unsuitable for open surgery. The U.K. EVAR Investigators published an RCT of EVAR versus no treatment of AAAs 5.5 cm or larger, but in whom surgery was not an option due to prohibitive surgical risk or patient preference. EVAR 2 randomized 338 patients to either endovascular repair or medical management. Endovascular repair had a considerable 30-day operative mortality and did not improve survival over no intervention. However, the results of this trial are limited, since 20% of patients assigned to medical management underwent elective aneurysm repair in violation of the protocol. In addition, endovascular repair was not performed until a median of 57 days after randomization; during this period, 9 aneurysms ruptured, contributing to the endovascular mortality calculation, biasing results against endovascular repair.

A follow-up publication for this trial reported on longer-term follow-up of 404 patients randomized to EVAR or no treatment. Perioperative mortality in the EVAR group was 7.3%. At the 8-year follow-up point, aneurysm-related mortality was lower in the EVAR group, but overall mortality did not differ (HR: 0.99; 95%
Endovascular Stent Grafts for Abdominal Aortic Aneurysms

Based solely on the EVAR 2 trial, a 2006 Agency for Healthcare Research and Quality (AHRQ) report comparing endovascular and open surgical repair for abdominal aortic aneurysm concluded that endovascular repair does not improve survival in patients who are medically unfit for open surgery. As previously discussed, the EVAR 2 trial, and thus the AHRQ assessment, is compromised by the high proportion of patients who crossed over from non-operative to endovascular repair, and by the number of patients who died in the interval between randomization and treatment with EVAR. Professional guidelines based on both randomized and nonrandomized trials suggest that endovascular repair of infrarenal aortic and/or common iliac aneurysms is reasonable in patients at high risk of complication from open operations.

A subsequent Cochrane Review (previously outlined) compared EVAR with best medical care for patients with AAA who were considered unfit for open repair. Only the EVAR 2 trial met the authors’ inclusion criteria; the authors concluded that “the results of a single trial found no overall short- or long-term benefits of EVAR over no intervention with regard to all-cause mortality.”

Lim et al retrospectively compared outcomes after EVAR for 75 patients considered high risk by the criteria used in the EVAR 2 trial with 75 considered normal risk. While high-risk patients had larger aneurysms on average and a higher prevalence of comorbid diseases, perioperative mortality (0% for high risk vs 1.2% for normal risk; p=1.0) and early complication rates (4% for high risk vs 6% for normal risk; p=0.08) were similar between groups. These findings suggest that EVAR may be feasible with reasonable outcomes in patients at high medical risk, but conclusions that may be drawn from this study are limited by its retrospective nature.

Section Summary: EVAR vs Nonsurgical Treatment for Smaller Aneurysms Not Meeting Current Size Criteria for Surgery or for Patients Ineligible for Open Surgery
The evidence does not indicate that EVAR improves outcomes for patients who are not suitable for open surgery, as judged by aneurysm size and or clinical factors that indicate prohibitive risk for open surgery. For small aneurysms, RCT evidence has suggested that morbidity and mortality outcomes from surveillance are as good as those from early intervention with EVAR. For patients at prohibitive operative risk, 1 RCT has reported that EVAR is associated with lower aneurysm mortality but no difference in overall mortality, and that there is a high rate of long-term complications and reinterventions with EVAR. This RCT evidence is biased by a high rate of crossovers, primarily from open surgery to EVAR, which would limit the ability to detect a difference between the 2 treatments.

Ongoing and Unpublished Clinical Trials
Some currently unpublished trials that might influence this policy are listed in Table 1.

Table 4. Summary of Key Trials

<table>
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<th>NCT No.</th>
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<td>Endovascular Exclusion of Abdominal Aortic Aneurysms in</td>
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High Risk Patients
NCT: national clinical trial.

Summary of Evidence
For individuals who have AAAs eligible for open repair who receive endovascular stent grafts, the evidence includes RCTs and systematic reviews of RCTs. Relevant outcomes are overall survival, morbid events, and treatment-related mortality and morbidity. Evidence from a patient-level meta-analysis of 4 RCTs comparing EVAR with open repair for elective treatment of AAAs has indicated that neither approach is clearly superior to the other. While EVAR is associated with an early reduction in mortality, outcomes at 5 years or longer have shown a greater endovascular mortality and comparable overall survival rates for EVAR and open repair. Thus, the early advantage of EVAR is balanced out by a higher rate of late complications over the long term. Based on these data, EVAR may be considered as an alternative to open surgery in patients who are candidates for both procedures. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

For individuals who have ruptured AAAs who receive endovascular stent grafts, the evidence includes RCTs and systematic reviews of RCTs. Relevant outcomes are overall survival, morbid events, and treatment-related mortality and morbidity. For patients with ruptured AAAs, evidence from 4 RCTs and a patient-level meta-analysis has indicated that short- and intermediate-term survival following EVAR is comparable with open repair. Evidence from RCTs and nonrandomized matched comparisons has shown that EVAR is associated with lower perioperative morbidity. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

For individuals who have AAAs ineligible for open repair who receive endovascular stent grafts, the evidence includes RCTs. Relevant outcomes are overall survival, morbid events, and treatment-related mortality and morbidity. At least 2 RCTs have compared EVAR to no surgical intervention in patients ineligible for open repair, either because of aneurysm size or prohibitive surgical risk. These trials did not report superior outcomes with EVAR and thus do not support use of EVAR in this population. The evidence is sufficient to determine that the technology is unlikely to improve the net health outcome.

References
2. Blue Cross and Blue Shield Association. Endovascular Stent-Grafts for Abdominal Aortic Aneurysm Repair. TEC Assessment Program. 2001:16(2).
Endovascular Stent Grafts for Abdominal Aortic Aneurysms

Policy # 00035
Original Effective Date: 01/27/2003
Current Effective Date: 06/21/2017


Endovascular Stent Grafts for Abdominal Aortic Aneurysms

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Policy History
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11/21/2002 Medical Policy Committee review
01/27/2003 Managed Care Advisory Council approval
01/26/2004 Managed Care Advisory Council approval
01/04/2005 Medical Director review
01/18/2005 Medical Policy Committee review. Format revision. Coverage eligibility unchanged
01/31/2005 Managed Care Advisory Council approval
05/17/2005 Medical Policy Committee review. Format revision. Policy statement changed from endoprostheses (i.e., endovascular grafts) as a treatment of abdominal aortic aneurysms (infrarenal abdominal or aortoiliac aneurysms) to: the use of FDA-approved endoprostheses as a treatment of abdominal aortic aneurysms. Patient selection criteria expanded to include; “The use of FDA-approved endoprostheses as a treatment of abdominal aortic aneurysms may be considered medically necessary as a treatment of abdominal aortic aneurysms in any of the following clinical situations, consistent with the FDA-labeled indications for the AneurRx device.” Investigational statement added to address non FDA-Approved devices and situations when patient selection criteria are not met.
05/23/2005 Managed Care Advisory Council approval
07/07/2006 Format revision; including, addition of FDA and or other governmental regulatory approval and rationale/source. Coverage eligibility unchanged.
08/02/2006 Medical Director Review
06/13/2007 Medical Director review
08/06/2009 Medical Policy Committee approval
Endovascular Stent Grafts for Abdominal Aortic Aneurysms

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08/26/2009 Medical Policy Implementation Committee approval. No change to coverage eligibility.
07/01/2010 Medical Policy Committee approval
07/21/2010 Medical Policy Implementation Committee approval. Changed coverage statement from investigational to eligible for coverage with criteria for ruptured abdominal aortic aneurysms.
07/07/2011 Medical Policy Committee review
07/20/2011 Medical Policy Implementation Committee approval. For clarification, added that the use of endoprostheses approved by the U.S. FDA as a treatment of abdominal aortic aneurysms is considered investigational for certain clinical situations.

06/28/2012 Medical Policy Committee review
07/27/2012 Medical Policy Implementation Committee approval. No change to coverage.
03/04/2013 Coding revised
06/27/2013 Medical Policy Committee review
07/17/2013 Medical Policy Implementation Committee approval. No change to coverage.
07/10/2014 Medical Policy Committee review
07/16/2014 Medical Policy Implementation Committee approval. Coverage eligibility unchanged.
06/04/2015 Medical Policy Committee review
06/17/2015 Medical Policy Implementation Committee approval. Coverage eligibility unchanged
08/03/2015 Coding update: ICD10 Diagnosis code section added; ICD9 Procedure code section removed.
06/02/2016 Medical Policy Committee review
06/20/2016 Medical Policy Implementation Committee approval. Coverage eligibility unchanged
01/01/2017 Coding update: Removing ICD-9 Diagnosis Codes
06/01/2017 Medical Policy Committee review
06/21/2017 Medical Policy Implementation Committee approval. Added “stent” to the title. Coverage eligibility unchanged.

Next Scheduled Review Date: 06/2018

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Endovascular Stent Grafts for Abdominal Aortic Aneurysms

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Current Effective Date: 06/21/2017

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*Investigational – A medical treatment, procedure, drug, device, or biological product is Investigational if the effectiveness has not been clearly tested and it has not been incorporated into standard medical practice. Any determination we make that a medical treatment, procedure, drug, device, or biological product is Investigational will be based on a consideration of the following:

A. Whether the medical treatment, procedure, drug, device, or biological product can be lawfully marketed without approval of the U.S. FDA and whether such approval has been granted at the time the medical treatment, procedure, drug, device, or biological product is sought to be furnished; or

B. Whether the medical treatment, procedure, drug, device, or biological product requires further studies or clinical trials to determine its maximum tolerated dose, toxicity, safety, effectiveness, or effectiveness as compared with the standard means of treatment or diagnosis, must improve health outcomes, according to the consensus of opinion among experts as shown by reliable evidence, including:
   1. Consultation with the Blue Cross and Blue Shield Association TEC or other nonaffiliated technology evaluation center(s);
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A. In accordance with nationally accepted standards of medical practice;

B. Clinically appropriate, in terms of type, frequency, extent, level of care, site and duration, and considered effective for the patient's illness, injury or disease; and

C. Not primarily for the personal comfort or convenience of the patient, physician or other health care provider, and not more costly than an alternative service or sequence of services at least as likely to produce equivalent therapeutic or diagnostic results as to the diagnosis or treatment of that patient's illness, injury or disease.

For these purposes, “nationally accepted standards of medical practice” means standards that are based on credible scientific evidence published in peer-reviewed medical literature generally recognized by the relevant medical community, Physician Specialty Society recommendations and the views of Physicians practicing in relevant clinical areas and any other relevant factors.

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