Endovascular Therapies for Extracranial Vertebral Artery Disease

Policy Number: 7.01.148
Origination: 8/2015
Last Review: 8/2017
Next Review: 8/2018

Policy
Blue Cross and Blue Shield of Kansas City (Blue KC) will not provide coverage for Endovascular Therapies for Extracranial Vertebral Artery Disease. This is considered investigational.

When Policy Topic is covered
n/a

When Policy Topic is not covered
Endovascular therapy, including percutaneous transluminal angioplasty with or without stenting, is considered investigational for the management of extracranial vertebral artery disease.

Considerations
The extracranial vertebral artery is considered to be segments V1-V3 of the vertebral artery from its origin at the subclavian artery until it crosses the dura mater.

Description of Procedure or Service

<table>
<thead>
<tr>
<th>Populations</th>
<th>Interventions</th>
<th>Comparators</th>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individuals: • With extracranial vertebral artery stenosis</td>
<td>Interventions of interest are: • Percutaneous transluminal angioplasty with or without stent implantation</td>
<td>Comparators of interest are: • Medical management</td>
<td>Relevant outcomes include: • Overall survival • Symptoms • Morbid events • Treatment-related mortality • Treatment-related morbidity</td>
</tr>
<tr>
<td>Individuals: • With extracranial vertebral artery aneurysm(s)</td>
<td>Interventions of interest are: • Percutaneous transluminal angioplasty with stent implantation</td>
<td>Comparators of interest are: • Observation • Surgical treatment</td>
<td>Relevant outcomes include: • Overall survival • Symptoms • Morbid events • Treatment-related mortality • Treatment-related morbidity</td>
</tr>
</tbody>
</table>
Vertebral artery diseases, including atherosclerotic stenosis, dissections, and aneurysms, can lead to ischemia of the posterior cerebral circulation. Conventional management of extracranial vertebral artery diseases may include medical therapy, including antiplatelet or anticoagulant medications and medications to reduce atherosclerotic disease risk (eg, statins), and/or surgical revascularization. Endovascular therapies have been investigated as an alternative to conventional management.

### Angioplasty With or Without Stenting

For individuals who have extracranial vertebral artery stenosis who receive percutaneous transluminal angioplasty with or without stent implantation, the evidence includes a phase 2 randomized controlled trial (RCT). Relevant outcomes are overall survival, symptoms, morbid events, and treatment-related mortality and morbidity. The phase 2 RCT, the Vertebral Artery Stenting Trial (VAST), found no advantage for endovascular intervention compared to best medical therapy alone, with a periprocedural adverse event rate of 5% for the invasive procedures. A larger phase 3 trial comparing endovascular therapy to medical therapy for vertebral artery stenosis is ongoing, although the lack of benefit of endovascular therapy demonstrated in VAST raises questions about the need for a phase 3 trial. Evidence from noncomparative studies indicates that vertebral artery stenting can be performed with high rates of technical success and low periprocedural morbidity and mortality, and that vessel patency can be achieved in a high percentage of cases. However, long-term follow-up has demonstrated high rates of in-stent stenosis. The evidence is insufficient to determine the effects of the technology on health outcomes.

### Angioplasty With Stenting

For individuals who have extracranial vertebral artery aneurysm(s), dissection(s), and arteriovenous (AV) fistula(e) who receive percutaneous transluminal angioplasty with stent implantation, the evidence includes small case series and case reports. Relevant outcomes are overall survival, symptoms, morbid events, and treatment-related mortality and morbidity. The available evidence indicates...
that endovascular therapy for extracranial vertebral artery disorders other than stenosis is feasible and may be associated with favorable outcomes. However, given the lack of data comparing endovascular therapies to alternatives, the evidence is insufficient to determine whether endovascular therapy for extracranial vertebral artery aneurysms, dissections, and AV fistulae improves the net health outcome. The evidence is insufficient to determine the effects of the technology on health outcomes.

**Background**

**Vertebrobasilar Circulation Ischemia**

Ischemia of the vertebrobasilar or posterior circulation accounts for about 20% of all strokes. Posterior circulation strokes may arise from occlusion of the innominate and subclavian arteries, the extracranial vertebral arteries, or the intracranial vertebral, basilar, or posterior cerebral arteries. Compared with carotid artery disease, relatively little is known about the true prevalence of specific causes of posterior circulation strokes, particularly the prevalence of vertebral artery disease. Reports from 1 stroke registry have estimated that, in 9% of cases, posterior circulation strokes are due to stenosis of the proximal vertebral artery.\(^1\) Patients who experience strokes or transient ischemic attacks of the vertebrobasilar circulation face a 25% to 35% risk of stroke within the subsequent 5 years. In particular, the presence of vertebral artery stenosis increases the 90-day risk of recurrent stroke by about 4-fold.

**Relevant Clinical Anatomy and Pathophysiology**

Large artery disease of the posterior circulation may be due to atherosclerosis (stenosis), embolism, dissection, or aneurysms. In about a third of cases, posterior circulation strokes are due to stenosis of the extracranial vertebral arteries or the intracranial vertebral, basilar, and posterior cerebral arteries. The proximal portion of the vertebral artery in the neck is the most common location of atherosclerotic stenosis in the posterior circulation. Dissection of the extracranial or intracranial vertebral arteries may also cause posterior circulation ischemia. By contrast, posterior cerebral artery ischemic events are more likely to be secondary to embolism from more proximal vessels.

The vertebral artery is divided into 4 segments, V1 though V4, of which segments V1, V2, and V3 are extracranial. V1 originates at the subclavian artery and extends to the C5 or C6 vertebrae; V2 crosses the bony canal of the transverse foramina from C2 to C5; V3 starts as the artery exits the transverse foramina at C2 and ends as the vessel crosses the dura mater and becomes an intracranial vessel. The most proximal segment (V1) is the most common location for atherosclerotic occlusive disease to occur, while arterial dissections are most likely to involve the extracranial vertebral artery just before the vessel crosses the dura mater. Compared with the carotid circulation, the vertebral artery system is more likely to be associated with anatomic variants, including a unilateral artery.

Atherosclerotic disease of the vertebral artery is associated with conventional risk factors for cerebrovascular disease. However, risk factors and the underlying pathophysiology of vertebral artery dissection and aneurysms differ. Extracranial
vertebral artery aneurysms and dissections are most often secondary to trauma, particularly those with excessive rotation, distraction, or flexion/extension, or iatrogenic injury, such as during cervical spine surgeries. Spontaneous vertebral artery dissections are rare, and in many cases are associated with connective tissue disorders, including Ehlers-Danlos syndrome type IV, Marfan syndrome, autosomal dominant polycystic kidney disease, and osteogenesis imperfecta type I.2

Management of Extracranial Vertebral Artery Disease
The optimal management of occlusive extracranial vertebral artery disease is not well-defined. Medical treatment with antiplatelet or anticoagulant medications is a mainstay of therapy to reduce stroke risk. Medical therapy also typically involves risk reduction for classical cardiovascular risk factors. However, no randomized trials have compared specific antiplatelet or anticoagulant regiments.

Surgical revascularization may be used for vertebral artery atherosclerotic disease, but open surgical repair is considered technically challenging due to poor access to the vessel origin. Surgical repair may involve vertebral endarterectomy, bypass grafting, or transposition of the vertebral artery, usually to the common or internal carotid artery. Moderately sized, single-center case series of surgical vertebral artery repair from 2012 and 2013 have reported overall survival rates of 91% and 77% at 3 and 6 years postoperatively, and arterial patency rates of 80% after 1 year of follow-up.3,4 Surgical revascularization may be used when symptomatic vertebral artery stenosis is not responsive to medical therapy, particularly when bilateral vertebral artery stenosis is present or when unilateral stenosis is present in the presence of an occluded or hypoplastic contralateral vertebral artery. Surgical revascularization may also be considered in patients with concomitant symptomatic carotid and vertebral disease who do not have relief from vertebrobasilar ischemia after carotid revascularization.

The management of extracranial vertebral artery aneurysms or dissections is controversial due to uncertainty about the risk of thromboembolic events associated with aneurysms and dissections. Antiplatelet therapy is typically used; surgical repair, which may include vertebral bypass, external carotid autograft, and vertebral artery transposition to the internal carotid artery, or endovascular treatment with stent placement or coil embolization, may also be used.

Given the technical difficulties related to surgically accessing the extracranial vertebral artery, endovascular therapies have been investigated for extracranial vertebral artery disease. Endovascular therapy may consist of percutaneous transluminal angioplasty, with or without stent implantation.

Regulatory Status
Currently, no endovascular therapies have been approved by the U.S. Food and Drug Administration (FDA) specifically for treatment of extracranial vertebral artery disease.
Various stents, approved for use in the carotid or coronary circulation, have been used for extracranial vertebral artery disease. These stents may be self- or balloon-expandable.

Two devices have been approved by FDA through the humanitarian device exemption process for intracranial atherosclerotic disease. This form of FDA approval is available for devices used to treat conditions with an incidence of 4000 or less per year; FDA only requires data showing “probable safety and effectiveness.” Devices with their labeled indications are as follows:

1. Neurolink System® (Guidant, Santa Clara, CA). “The Neurolink system is indicated for the treatment of patients with recurrent intracranial stroke attributable to atherosclerotic disease refractory to medical therapy in intracranial vessels ranging from 2.5 to 4.5 mm in diameter with ≥50% stenosis and that are accessible to the stent system.”
2. Wingspan™ Stent System (Boston Scientific, Fremont, CA). “The Wingspan Stent System with Gateway PTA Balloon Catheter is indicated for use in improving cerebral artery lumen diameter in patients with intracranial atherosclerotic disease, refractory to medical therapy, in intracranial vessels with ≥50% stenosis that are accessible to the system.”

**Rationale**

This evidence review was originally created in February 2015 and has been updated regularly with searches of the MEDLINE database. The most recent literature review was performed through March 23, 2017.

Assessment of efficacy for therapeutic interventions involves a determination of whether an intervention improves health outcomes. The optimal study design for this purpose is a randomized controlled trial (RCT) that includes clinically relevant measures of health outcomes. Improvements in intermediate outcome measures may also be adequate to determine efficacy if there is an established link between the intermediate outcome and true health outcomes. Nonrandomized comparative studies and uncontrolled studies can sometimes provide useful information on health outcomes, but are prone to biases such as noncomparability of treatment groups, placebo effect, and variable natural history of the condition.

Appropriate comparators for studies evaluating vertebral artery stenting for vertebral artery stenosis include surgical repair and/or medical management.

**Angioplasty and Stenting for Extracranial Vertebral Artery Stenosis**

The evidence base for the efficacy of endovascular interventions for vertebral artery stenosis consists of a large number of case series, most of which are small and retrospective. A small number of controlled trials have been published. The emphasis for this review is on controlled trials.
Systematic Reviews
Several systematic reviews of published studies were identified. Two systematic reviews included all the published studies, while the third selected only RCTs. These systematic reviews were published prior to the Vertebral Artery Stenting Trial (VAST), which is described in the Randomized Controlled Trials subsection.

In 2012, Antoniou et al reported results of a systematic review of studies evaluating percutaneous transluminal angioplasty (PTA), stenting, or both for proximal vertebral artery stenosis. Reviewers included randomized and nonrandomized trials comparing endovascular treatment with open surgical repair or endovascular treatment to best medical care for proximal vertebral artery stenosis, along with prospective and retrospective case series with at least 5 patients receiving endovascular treatment for proximal vertebral artery stenosis. Reviewers included 42 publications reporting on unique data sets, 40 of which were retrospective case studies or retrospective reviews of prospectively collected data, and 2 of which were comparative studies (1 RCT by Coward et al [2007], 1 nonrandomized study by Karameshev et al [2010]) evaluating vertebral artery angioplasty and stenting with medical treatment. The selected studies reported outcomes for endovascular treatment (PTA, stenting, or both) of 1117 vertebral arteries in 1099 patients, with a mean of 26 patients (range, 5-117 patients) per study. Indications for treatment differed across studies, but most required vertebral artery stenosis, ranging from at least 50% to at least 70% occlusion, in conjunction with symptoms of posterior circulation disease. Most studies defined “technical success” as less than 20% residual stenosis of the treated segment of the vertebral artery at the end of the procedure. Overall, the literature was of poor quality, and demonstrated heterogeneity in the selection of patients for revascularization, the characteristics of the populations used, and revascularization techniques.

Reported technical success rates were 36% to 100% among the studies, with a weighted mean value of 97%. Thirty-seven studies reported follow-up outcomes at a mean follow-up time of 6 to 54 months. During follow-up, recurrent symptoms of vertebrobasilar insufficiency developed in 65 (8%) patients. Twenty-one patients died (mean late mortality rate, 2%), with 1 death only reported to be associated with insufficiency of the posterior cerebral circulation. Restenosis in the previously treated segment of the vertebral artery occurred in 183 of the 789 patients who underwent follow-up imaging, for an accumulated restenosis rate of 23% (range, 0%-58%). However, restenosis was defined inconsistently in these studies.

A 2011 systematic review had a smaller evidence base but reported no differences in conclusions. These 2 systematic reviews included all of the published evidence available at the time. Reviewers’ conclusions were limited largely due to the poor quality of the underlying evidence base.

A third systematic review, published by Cochrane in 2005, included only studies that randomized patients with vertebral artery stenosis to endovascular treatment or to best medical therapy. Reviewers identified 1 RCT that met the inclusion
criteria, the Carotid and Vertebral Artery Transluminal Angioplasty Study (CAVATAS). The vertebral artery arm of this trial randomized 16 subjects with symptomatic vertebral artery stenosis to endovascular therapy with best medical care or to best medical care alone. CAVATAS is detailed in the Randomized Controlled Trials subsection.

Randomized Controlled Trials
VAST is the largest RCT published to date on stenting versus medical therapy in patients with symptomatic vertebral artery disease. This multicenter phase 2 trial included 115 patients who had transient ischemic attack (TIA) or minor stroke attributed to vertebral artery stenosis. Randomization to stenting or medical therapy was stratified by center and level of stenosis; 83.5% of patients had extracranial lesions and the rest had intracranial lesions. The median interval between symptoms and randomization was 25 days, with a median interval between randomization and stenting of 7 days. Stent selection was by surgeon preference. All patients received best medical therapy and were followed yearly by telephone. The primary outcome was the composite of vascular death, stroke, or myocardial infarction (MI) within 30 days. Secondary outcomes were stroke in the territory of the symptomatic artery, the composite outcome measure during follow-up, and the degree of restenosis. Median follow-up was 3.0 years (range, 1.3-4.1 years).

Endovascular therapy plus best medical therapy was not superior to best medical therapy alone in this trial. The primary outcome occurred in 3 (5%) of 57 patients (95% confidence interval [CI], 0% to 11%) in the stenting group and 1 (2%) of 58 patients (95% CI, 0% to 5%) in the medical treatment group. Of these 4 patients, all had a vertebrobasilar stroke and 2 of the 4 occurred in the group of 9 patients with intracranial stenosis who received endovascular therapy. One of the strokes in the stenting group was fatal. During follow-up, the composite primary outcome occurred in 11 (19%) patients in the stenting group and in 10 (17%) patients in the medical therapy group. The periprocedural risk of a major vascular event in the stenting group was 5%. The trialists questioned the need and feasibility of a phase 3 trial, given the low risk of recurrent stroke with best medical therapy. However, recruitment of 540 patients for the phase 3 Vertebral artery Ischaemia Stenting Trial (VIST) is still ongoing. Enrollment was originally planned for 1302 patients. In VIST, patients with symptomatic extracranial or intracranial vertebral artery stenosis and vertebrobasilar TIAs or stroke in the previous 3 months were to be randomized to vertebral artery stenting or best medical therapy alone.

CAVATAS incorporated data from 3 separate randomized trials, 2 of which compared endovascular treatment to carotid endarterectomy or medical treatment alone for patients with carotid stenosis who were considered surgical candidates or who were not suitable for endarterectomy, respectively. In the third trial (discussed here), 17 patients with symptomatic vertebral artery stenosis were randomized to endovascular treatment or best medical management alone. The mean interval between symptom onset and randomization was 92 days (range, 5-376 days). Analysis included 8 patients allocated to endovascular treatment and 8 patients allocated to best medical treatment alone. Endovascular treatment was
technically successful in all 8 patients on the first attempt. Severity of vessel stenosis was reduced immediately after angioplasty or stenting, from a median of 73% to a median of 25% (interquartile range, 0%-50%; p=0.003). During the 30-day postprocedure period or postrandomization period, 2 subjects in the endovascular group experienced symptomatic posterior circulation TIAs, compared with no subjects in the control group (p=0.47). There were no periprocedural strokes or deaths in either group and no patient experienced the primary outcome (vertebrobasilar territory stroke). Six endovascular patients had follow-up catheter angiography, and 3 of them had restenosis greater than 50%. Two of the 6 patients had additional posterior circulation TIAs during follow-up, and 4 had no further TIAs (median stenosis severity, 59%; p=0.64). Over a mean follow-up of 4.7 years, 3 patients in each treatment arm died of MI, vascular death, or carotid territory stroke, and 1 endovascular patient had a nonfatal carotid territory stroke. This study failed to demonstrate a benefit for the endovascular intervention, although it was underpowered to detect all but a very large treatment benefit.

**Nonrandomized Comparative Studies**

One other nonrandomized study compared patients with symptomatic vertebral ostial stenosis treated with medical therapy alone or vertebral artery stenting.8 It was included in the Antoniou systematic review. The study included 39 consecutive patients at a single institution who were treated for vertebral ostial stenosis from 2000 to 2008, 10 with stenting and 29 with best medical therapy. Treatment decisions were left to the treating physicians. All patients had a history of posterior circulation stroke or TIA, with no alternative causes of stroke identified. Patients in the medical therapy group received therapies including aspirin (n=20), clopidogrel (n=1), vitamin K antagonists (n=5), combination of aspirin and clopidogrel (n=3), statins (n=20), and antihypertensive drugs (n=18). All patients receiving vertebral artery stenting received aspirin and clopidogrel for 12 months, with aspirin continued indefinitely. Patients treated medically were older (68 years vs 60 years; p=0.04), had less severe neurologic deficits on admission (National Institutes of Health Stroke Scale score, 1 vs 2.5; p=0.03), and were less often current smokers (10% vs 60%; p=0.03). In the medical group, 1 patient died from basilar artery thrombosis 22 days after the index event. In the stenting group, 1 patient experienced a TIA 1 day after the procedure. There were no hemorrhagic strokes, strokes in the anterior circulation, MI, or reinterventions within 30 days after the index event. At 4-year follow-up, stented patients had a nonstatistically significant lower risk of the combined end point of TIA and nonfatal and fatal posterior circulation strokes (10% vs 45%; relative risk, 0.25; 95% CI, 0.03 to 1.85; p=0.095).

**Noncomparative Studies**

A large number of noncomparative studies, most often enrolling few patients, have described outcomes for patients treated with endovascular therapies for extracranial vertebral artery disease. Some cohort studies reporting prospectively collected complication and restenosis rates are shown in Table 1.
Section Summary: Angioplasty With or Without Stenting for Extracranial Vertebral Artery Stenosis

The evidence on the overall efficacy of endovascular therapies for extracranial vertebral artery stenosis includes a phase 2 RCT (115 patients) that compared endovascular therapy to best medical therapy alone for vertebral artery stenosis. This trial found no advantage of endovascular intervention over best medical therapy alone, with a periprocedural adverse event rate of 5% for the invasive procedures. A larger phase 3 trial comparing endovascular therapy to medical therapy for vertebral artery stenosis is ongoing, although the lack of benefit of endovascular therapy demonstrated in VAST raises questions about the need for a phase 3 trial. Evidence from noncomparative studies has indicated that vertebral artery stenting can be performed with high rates of technical success and low periprocedural morbidity and mortality, and that vessel patency can be achieved in a high percentage of cases. However, long-term follow-up has demonstrated high rates of in-stent stenosis.

Table 1: Cohort Studies of Endovascular Treatment of Extracranial Vertebral Artery Stenosis

<table>
<thead>
<tr>
<th>Study</th>
<th>Study Type</th>
<th>Population</th>
<th>FU Period</th>
<th>Main Results</th>
<th>In-Stent Restenosis Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kikuchi et al (2014)¹¹</td>
<td>Retrospective review of prospectively collected data</td>
<td>404 patients from a registry treated with endovascular therapy</td>
<td>30 d</td>
<td>• Postprocedural morbidity: 2.0%</td>
<td>Not reported</td>
</tr>
<tr>
<td>Sun et al (2015)¹²</td>
<td>Retrospective review of prospectively collected data</td>
<td>188 patients with posterior circulation TIA or stroke and mRS score ≤2</td>
<td>16.5 mo²</td>
<td>• Technical success rate: 100%</td>
<td>21.2%</td>
</tr>
<tr>
<td>Mohammadian et al (2013)¹³</td>
<td>Prospective interventional study</td>
<td>206 patients with clinical signs/symptoms of vertebral occlusion (239 treated lesions, 202 extracranial)</td>
<td>13.15 mo²</td>
<td>• Technical success rate: 100%.</td>
<td>15.9%</td>
</tr>
<tr>
<td>Hatano et al (2011)¹⁴</td>
<td>Retrospective review of prospectively collected data</td>
<td>117 patients (108 symptomatic, 9 asymptomatic)</td>
<td>48 mo³</td>
<td>• Technical success rate: 99%</td>
<td>9.6% at 6 mo</td>
</tr>
</tbody>
</table>

FU = follow-up, mRS = modified Rankin Scale, ISR = intrastent restenosis.
FU: follow-up; ISR: in-stent restenosis; mRS: modified Rankin Scale; NR: TIA: transient ischemic attack.

a Mean value

Angioplasty WITH Stenting for Extracranial Vertebral Artery Aneurysms, Dissections, and Arteriovenous Fistula(e)
A smaller body of literature has addressed the use of endovascular procedures for extracranial vertebral artery aneurysms, dissections, and arteriovenous (AV) fistula(e). These lesions most commonly occur after trauma or iatrogenic injury. Because aneurysms, dissections, and AV fistulae may coexist in the same vessel, studies reporting outcomes for endovascular treatment of these conditions are discussed together. The available literature consists entirely of case reports, case series, and a systematic review of case series.

Systematic Reviews
In 2011, Pham et al conducted a systematic review of studies evaluating endovascular stenting for extracranial carotid and vertebral artery dissections. Eight studies of extracranial vertebral artery stenting with 10 patients (12 vessels) were included. Of the 10 patients included, 70% had associated pseudoaneurysms and 20% had bilateral lesions. Most dissections (60%) were traumatic in etiology, while 20% were spontaneous and 20% were iatrogenic. The indications for stenting were failure of medical management in 40% (defined as a new ischemic event, progression of initial symptoms, or demonstration of an enlarging pseudoaneurysm despite adequate anticoagulation or antiplatelet treatment), contraindication to anticoagulation in 20%, and/or severity of dissection hemodynamics in 60%. No stent-related complications or mortalities were reported in any study. One dissection-related death was reported, although stenting was considered technically successful.

Case Series and Reports
Since the publication of the 2011 Pham systematic review, additional case series on the use of endovascular therapies for extracranial vertebral artery dissections have been published.

In 2014, Badve et al retrospectively compared the clinical characteristics of patients with vertebrobasilar dissections with and without aneurysmal dissection treated at a single institution from 2002 to 2010. Thirty patients were identified, 7 with aneurysmal dissections (1 of which was 1 extracranial) and 23 with nonaneurysmal dissections (10 of which were extracranial, 12 of which were combined intracranial/extracranial). Patients were treated with antiplatelet agents (aspirin or clopidogrel; n=8), anticoagulation with warfarin (n=13), or neurointerventional procedures (n=6). One patient in the nonaneurysmal dissection group treated with aspirin died.

The use of endovascular therapy for extracranial vertebral artery aneurysms and AV fistulae is similarly limited to small case series and reports. In an early report, Horowitz et al (1996) described a left-sided vertebral artery pseudoaneurysm with dissection between the vessel media and adventitia at the C7 vertebra that was
treated with a balloon-expandable stent. Follow-up angiography 3 months postprocedure showed no filling of the pseudoaneurysm and normal patency of the parent artery. In 2004, Felber et al reported outcomes from endovascular treatment with stent grafts of 11 patients with aneurysms or AV fistulae of craniocervical arteries, 2 of whom were treated for extracranial vertebral artery disorders with coronary stents (1 aneurysm, 1 traumatic AV fistula). The procedure was technically successful in both subjects, without complications. At follow-up (5 years and 14 months postprocedure in the aneurysm and fistula patients, respectively), the target vessel was patent without stenosis. In 2008, Herrera et al reported outcomes for a single-center series of 18 traumatic vertebral artery injuries, including 16 AV fistulae (7 of which had an associated pseudoaneurysm) and 2 isolated pseudoaneurysms, treated with endovascular therapy. Endovascular therapy consisted of balloon occlusion of the parent vessel and AV fistula in 12 (66.6%) patients, coil embolization in 2 (11.1%) patients, and detachable balloon and coil embolization, balloon occlusion, and stent delivery with coil and n-butyl cyanoacrylate embolization of a AV fistulae each in 1 (5.5% each) patient. Angiography immediately after endovascular treatment demonstrated complete occlusion in 16 (88.9%) patients and partial occlusion in 2 (11.1%) patients. Seventeen (94.5%) patients had complete resolution of symptoms.

Other case reports have described successful use of endovascular treatment with stenting for iatrogenic vertebral artery pseudoaneurysms, iatrogenic vertebral artery AV fistula, extracranial vertebral artery aneurysm with an unknown cause, and extracranial vertebral artery aneurysm with a cervical vertebral AV fistula.

Section Summary: Angioplasty With Stenting for Extracranial Vertebral Artery Aneurysms, Dissections, and Arteriovenous Fistula(e)
The evidence on use of endovascular therapies for the treatment of extracranial vertebral artery dissections, aneurysms, and AV fistula(e) consists of small case series and case reports. The available reports and series have indicated that endovascular therapy for extracranial vertebral artery disorders other than stenosis is feasible and may be associated with favorable outcomes. However, given the lack of evidence comparing endovascular therapies to alternatives, the evidence is insufficient to determine whether endovascular therapy for extracranial vertebral artery dissections, aneurysms, and AV fistula(e) improves the net health outcome better than existing alternative therapies.

Summary of Evidence

Angioplasty With or Without Stenting
For individuals who have extracranial vertebral artery stenosis who receive percutaneous transluminal angioplasty with or without stent implantation, the evidence includes a phase 2 randomized controlled trial (RCT). Relevant outcomes are overall survival, symptoms, morbid events, and treatment-related mortality and morbidity. The phase 2 RCT, the Vertebral Artery Stenting Trial (VAST), found no advantage for endovascular intervention compared to best medical therapy alone, with a periprocedural adverse event rate of 5% for the invasive procedures.
A larger phase 3 trial comparing endovascular therapy to medical therapy for vertebral artery stenosis is ongoing, although the lack of benefit of endovascular therapy demonstrated in VAST raises questions about the need for a phase 3 trial. Evidence from noncomparative studies has shown that vertebral artery stenting can be performed with high rates of technical success and low periprocedural morbidity and mortality, and that vessel patency can be achieved in a high percentage of cases. However, long-term follow-up has demonstrated high rates of in-stent stenosis. The evidence is insufficient to determine the effects of the technology on health outcomes.

**Angioplasty With Stenting**

For individuals who have extracranial vertebral artery aneurysm(s), dissection(s), or arteriovenous (AV) fistula(e) who receive percutaneous transluminal angioplasty with stent implantation, the evidence includes small case series and reports. Relevant outcomes are overall survival, symptoms, morbid events, and treatment-related mortality and morbidity. The available evidence has indicated that endovascular therapy for extracranial vertebral artery disorders other than stenosis is feasible and may be associated with favorable outcomes. However, given the lack of data comparing endovascular therapies to alternatives, the evidence is insufficient to determine whether endovascular therapy for extracranial vertebral artery aneurysms, dissections, or AV fistulae improves the net health outcome. The evidence is insufficient to determine the effects of the technology on health outcomes.

**Supplemental Information**

**Practice Guidelines and Position Statements**

**American Heart Association and American Stroke Association**

In 2014, the American Heart Association and American Stroke Association issued joint guidelines on prevention of stroke in patients with stroke and transient ischemic attack, which made the following recommendations about treatment of extracranial vertebrobasilar disease (see Table 2).24

**Table 2. Guidelines on Stroke Prevention in Patients With Stroke and Transient Ischemic Attack**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>COR</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>“Routine preventive therapy with emphasis on anti-thrombotic therapy, lipid lowering, BP control, and lifestyle optimization is recommended for all patients with recently symptomatic extracranial vertebral artery stenosis”</td>
<td>I</td>
<td>C</td>
</tr>
<tr>
<td>“Endovascular stenting of patients with extracranial vertebral stenosis may be considered when patients are having symptoms despite optimal medical treatment.”</td>
<td>IIb</td>
<td>C</td>
</tr>
<tr>
<td>“Open surgical procedures, including vertebral endarterectomy and vertebral artery transposition, may be considered when patients are having symptoms despite optimal medical treatment.”</td>
<td>IIb</td>
<td>C</td>
</tr>
</tbody>
</table>

BP: blood pressure; COR: class of recommendation; LOE: level of evidence.
American Stroke Association et al
In 2011, a multisociety task force issued guidelines on the management of extracranial vertebral and carotid artery disease, which made the following statements about catheter-based revascularization of extracranial vertebral artery disease: “Although angioplasty and stenting of the vertebral vessels are technically feasible, as for high-risk patients with carotid disease, there is insufficient evidence from randomized trials to demonstrate that endovascular management is superior to best medical management.” No specific recommendations were made about endovascular therapies.

European Society of Cardiology
In 2011, the European Society of Cardiology issued guidelines on the management of peripheral artery disease, including extracranial vertebral artery disease, and made the following recommendations about revascularization for vertebral artery stenosis (see Table 3).26

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>COR</th>
<th>LOE</th>
</tr>
</thead>
<tbody>
<tr>
<td>“In patients with symptomatic extracranial VA stenosis, endovascular treatment may be considered for lesions ≥50% in the case of recurrent ischaemic events despite optimal medical management.”</td>
<td>IIb</td>
<td>C</td>
</tr>
<tr>
<td>“Revascularization of an asymptomatic VA stenosis is not indicated, irrespective of the degree of severity.”</td>
<td>III</td>
<td>C</td>
</tr>
</tbody>
</table>

Table 3. Guidelines on Management of Peripheral Artery Disease
COR: class of recommendation; LOE: level of evidence; VA: vertebral artery.

U.S. Preventive Services Task Force Recommendations
Not applicable.

Medicare National Coverage
Centers for Medicare and Medicaid Services has a national coverage determination (NCD) addressing the use of percutaneous transluminal angioplasty (PTA) in the treatment of atherosclerotic obstructive lesions of the lower or the upper extremities (not including the head or neck vessels), of a single coronary artery, of renal arteries, and of arteriovenous dialysis fistulas and grafts. It also addresses the use of PTA concurrent with carotid stent placement in Food and Drug Administration (FDA) investigational device exemption clinical trials, in FDA-approved postapproval studies, and in patients at high risk for carotid endarterectomy.

The NCD states that all other indications for PTA, with or without stenting, to treat obstructive lesions of the vertebral and cerebral arteries remain noncovered.

Ongoing and Unpublished Clinical Trials
Some currently unpublished trials that might influence this review are listed in Table 4.
<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
<th>Planned Enrollment</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Ongoing</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCT02328781</td>
<td>Prospective Multi-center Single-arm Target Value Clinical Trial for</td>
<td>150</td>
<td>Dec 2016 (ongoing)</td>
</tr>
<tr>
<td></td>
<td>Evaluating Clinical Use Safety and Efficacy of the Firehorus Vertebral</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Artery Rapamycin-target-eluting Stent System</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISRCTN95212240</td>
<td>Vertebral artery Ischaemia Stenting Trial (VIST)</td>
<td>540</td>
<td>Nov 2017</td>
</tr>
<tr>
<td><strong>Unpublished</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCT02197559</td>
<td>A Prospective Cohort Study of Bare-Metal Stents and Drug-eluting Stents</td>
<td>168</td>
<td>Jun 2016 (completed)</td>
</tr>
<tr>
<td></td>
<td>in the Treatment of Patients With Vertebral Artery Ostium Stenosis</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NCT: national clinical trial.

References

**Billing Coding/Physician Documentation Information**

**0075T** Transcatheter placement of extracranial vertebral artery stent(s), including radiologic supervision and interpretation, open or percutaneous; initial vessel

**0076T** Transcatheter placement of extracranial vertebral artery stent(s), including radiologic supervision and interpretation, open or percutaneous; each additional vessel (List separately in addition to code for primary procedure)
ICD-10 Codes

I65.01- I65.09 Occlusion and stenosis of vertebral artery code range
I72.6 Aneurysm of vertebral artery
I77.74 Dissection of vertebral artery

There are CPT category III codes for the stenting procedure:

0075T Transcatheter placement of extracranial vertebral artery stent(s), including radiologic supervision and interpretation, open or percutaneous; initial vessel
0076T ; each additional vessel (List separately in addition to code for primary procedure)

CPT also instructs that when the ipsilateral extracranial vertebral arteriogram (including imaging and selective catheterization) confirms the need for stenting, then 0075T and 0076T include all ipsilateral extracranial vertebral catheterization, all diagnostic imaging for ipsilateral extracranial vertebral artery stenting, and all related radiologic supervision and interpretation. If stenting is not indicated, then the appropriate codes for selective catheterization and imaging should be reported in lieu of 0075T and 0076T (eg, 36226, 36228).

Additional Policy Key Words
N/A

Policy Implementation/Update Information
8/1/15 New Policy. Considered Investigational.
8/1/16 No policy statement changes.
8/1/17 No policy statement changes.

State and Federal mandates and health plan contract language, including specific provisions/exclusions, take precedence over Medical Policy and must be considered first in determining eligibility for coverage. The medical policies contained herein are for informational purposes. The medical policies do not constitute medical advice or medical care. Treating health care providers are independent contractors and are neither employees nor agents Blue KC and are solely responsible for diagnosis, treatment and medical advice. No part of this publication may be reproduced, stored in a retrieval system or transmitted, in any form or by any means, electronic, photocopying, or otherwise, without permission from Blue KC.