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## OVERVIEW

Vascular embolization procedures allow blockage of blood vessels without invasive surgery. Vascular embolization can be used to stop arterial bleeding and can also be used to block blood vessels for other reasons, such as to treat tumors, shrink vascular malformations, or re-direct flow.

This policy does not address vascular embolization for the liver or uterine fibroids. Please refer to the Prior Authorization via Web-Based Tool for Procedures policy, listed in the Related Policies section.

## MEDICAL CRITERIA

The following procedures are considered medically necessary for both Medicare Advantage Plans and Commercial Products:

1. Coil embolization in the treatment of arterio-venous malformations (AVMs)/aneurysm, congenital aorto-azygous fistula, and splenic artery aneurysm
2. Coil embolization of gastric varices
3. Embolization for the treatment of lower gastro-intestinal bleeding
4. Embolization (coil, microsphere, glue, or other agents) for the treatment of renal angiomyolipoma (AML) if there is active bleeding, or the size of the renal AML is greater than 6 cm
5. Endovascular embolization for an extracranial AVM or fistula
6. Geniculate artery embolization for knee hemarthrosis following total knee arthroplasty if member has failed conservative therapies (e.g., ice, immobilization, compression, saline lavage, corticosteroid instillation, and selective COX-2 inhibitors); and demonstrated synovial hyper-vascularity on angiography
7. Onyx embolization for the treatment of cerebrospinal fluid (CSF) vertebral vein fistula
8. Portal vein embolization before surgical resection of cholangiocarcinoma
9. Splenic artery embolization for the treatment of hyper-splenism secondary to hepatic cirrhosis as an alternative to splenectomy
10. Transcatheter arterial embolization for non-variceal upper gastrointestinal bleeding
11. Transcatheter embolization (embolotherapy) in the treatment of intractable or recurrent severe posterior epistaxis when conservative measures have failed
12. Transcatheter embolization for the treatment of lower gastrointestinal bleeding (GIB) in persons for whom a bleeding scan has identified the lower gastrointestinal tract as the source of GIB and ANY of the following criteria are met:
  - a. For a hemodynamically unstable person with active lower GIB or a person who has required greater than 4units of blood within 24 hours; or
  - b. For a person with ongoing or recurrent lower GIB where colonoscopy has localized the bleeding site and treatment was attempted; or
  - c. In a hemodynamically stable person with obscure (nonlocalized) recurrent lower GIB, assuming a prior negative adequate colonoscopy and upper gastrointestinal endoscopy
13. Vascular embolization for the treatment of type I/type II endovascular leak.
14. Pre-operative embolization of skull base meningiomas
15. Renal artery embolization/angioinfarction, as a pre-operative adjunct to nephrectomy, in the treatment of persons with large, hypervascular renal cell carcinomas
16. Selective arterial embolization for the treatment of giant cell tumor

17. Tumor embolization or pre-operative tumor embolization to reduce intra-operative bleeding prior to surgical resection in the treatment of hypervascular tumors or metastases from hypervascular tumors
18. TACE or TAE as therapeutic interventions for actively bleeding malignant or nonmalignant lesions.
19. Persistent gross hematuria originating from the prostate

For procedures or conditions not addressed in this policy, please refer to the Medical Necessity policy, listed in the Related Policies section.

### **PRIOR AUTHORIZATION**

Prior authorization is required for Medicare Advantage Plans and is recommended for Commercial Products via the web-based tool for participating providers. Refer to the Related Policies section, below.

### **POLICY STATEMENT**

#### **Medicare Advantage Plans and Commercial Products**

Vascular embolization procedures are considered medically necessary when the medical criteria, above, are met.

Because the CPT codes used to represent embolization procedures are not specific to any one particular body-region or medical condition, medical necessity review is needed to determine specifically what procedure is being performed and for what condition. During the medical necessity review process, the following procedures are considered not covered for Medicare Advantage Plans and not medically necessary for Commercial Products as the evidence is insufficient to determine the effects of the technology on outcomes:

1. Coil embolization for treatment of left ventricular outflow tract (LVOT) pseudoaneurysm
2. Embolization for locoregional treatment of metastatic pancreatic cancer
3. Embolization for the treatment of asymptomatic persistent sciatic artery
4. Endovascular embolization in the treatment of spinal dural arteriovenous fistula
5. Genicular artery embolization for the treatment of osteoarthritis related knee pain
6. Hemorrhoidal embolization (HydroPearl microspheres)
7. HydroPearl microspheres for the treatment of AVMs in the lower extremity
8. Bariatric arterial embolization (BAE)
9. Middle meningeal artery embolization for chronic subdural hematoma
10. Paraumbilical vein coil embolization for the treatment of hepatic encephalopathy
11. Pre-operative embolization for carotid body tumor resection
12. Pre-operative embolization of the inferior mesenteric artery to reduce the rate of type II endoleak following endovascular abdominal aortic aneurysm repair.
13. Prostatic arterial embolization for benign prostatic hyperplasia.

For procedures or conditions not addressed in this policy, please refer to the Medical Necessity policy, listed in the Related Policies section.

### **COVERAGE**

Benefits may vary between groups/contracts. Please refer to the Evidence of Coverage or Subscriber Agreement for applicable not medically necessary/not covered benefits/coverage

### **BACKGROUND**

Vascular embolization procedures allow blockage of blood vessels without invasive surgery. Vascular embolization can be used to stop arterial bleeding and can also be used to block blood vessels for other reasons, such as to treat tumors, shrink vascular malformations, or re-direct flow.

#### **Coil Embolization for the Treatment of Arterio-Venous Malformations (AVMs) / Aneurysm**

Jiang and colleagues (2021) stated that whether the use of endovascular embolization could provide additional benefits in patients treated with stereotactic radiosurgery (SRS) for intracranial arterio-venous malformations (IAVMs) remains controversial. In a meta-analysis, these researchers examined the safety and efficacy of SRS with and without prior endovascular embolization in patients with IAVMs. The authors stated that this study

had several drawbacks. First, most included studies (17/19) had a retrospective, observational design, and the conclusions of this study were based on lower evidence level, which should be interpreted cautiously. Second, the disease status and experience of the clinician were different across included studies, which could affect the prognosis of IAVMs. Third, the heterogeneity across included studies was not fully explained using sensitivity and subgroup analyses, which restricted the reliability of pooled conclusions. Fourth, the background therapeutic options and rehabilitation strategies were not addressed, which could affect the treatment effects between groups for the mid-term and long-term outcomes. Finally, the inherent limitations of the meta-analysis based on published articles included publication bias and analysis based on pooled data. Thompson et al, 2015 support treatment of intra-cranial aneurysms if they are enlarging. The guidelines note that endovascular coiling is an effective treatment for select unruptured intracranial aneurysms (UIAs) that are considered for treatment (Class IIa; Level of Evidence B); endovascular coiling is associated with a reduction in procedural morbidity and mortality over surgical clipping in selected cases but has an overall higher risk of recurrence (Class IIb; Level of Evidence B). The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Coil Embolization for the Treatment of Congenital Aorto-Azygous Fistula**

Recto and Elbl (2001) concluded that transcatheter coil embolization therapy was safe and should be considered as a therapeutic option for patients who have moderate-to-large systemic AV fistulas. Ishii et al (2003) concluded that a vein-to-vein shunt is an important cause of protein-losing enteropathy, and when it is recognized, coil embolization should be selected as an effective treatment. Romero et al (2006) concluded that available data in the literature suggested that coil embolization of aorto-azygous fistulas was usually successful. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Gastric Variceal Embolization**

Bazarbashi et al (2020) noted that gastric variceal (GV) bleeding is a feared complication of cirrhosis. Traditional endoscopic treatment with cyanoacrylate (CYA) injection can be challenging. Alternatively, endoscopic ultrasound (EUS)-guided delivery of hemostatic coils has shown high therapeutic success without the complications profile of CYA alone. These researchers compared the clinical outcomes of EUS-guided coil embolization with endoscopic CYA injection for the treatment of GV. Technical success was 100 % for EUS coil therapy versus 96.7 % for CYA injection ( $p = 1.0$ ). Complication rates were 10 % in the EUS coil group versus 20% in the CYA group ( $p = 0.65$ ). At 9 months, no EUS coil patient had rebled compared with 38 % of the CYA group. The authors concluded that compared with CYA, EUS-guided coil injection appeared superior for the treatment of GV and should be considered initial endoscopic treatment of choice in centers with interventional EUS expertise. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Endovascular embolization for an extracranial AVM or fistula**

Kirkwood (2015) states that “Options for endovascular repair include bare metal stent placement with or without trans-stent coil embolization of the aneurysm sac, exclusion of the aneurysm using a stent-graft, or endovascular occlusion of the carotid artery. Features favoring an endovascular approach include pseudoaneurysm related to trauma, aneurysm of the distal internal carotid artery, and hostile neck anatomy”. Furthermore, guidelines on “The management of patients with unruptured intracranial aneurysms” from the American Heart Association/American Stroke Association (Thompson et al, 2015) support treatment of intracranial aneurysms if they are enlarging. The guidelines note that endovascular coiling is an effective treatment for select unruptured intracranial aneurysms (UIAs) that are considered for treatment (Class IIa; Level of Evidence B); endovascular coiling is associated with a reduction in procedural morbidity and mortality over surgical clipping in selected cases but has an overall higher risk of recurrence (Class IIb; Level of Evidence B). Based on the clinical evidence, endovascular embolization is an acceptable treatment modality for an extracranial AVM or fistula. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Geniculate Artery Embolization for Knee Hemarthrosis Following Total Knee Arthroplasty (TKA)**

van Baardewijk et al (2018) conducted a study and concluded that embolization of the geniculate arteries in was a safe and effective treatment of recurrent spontaneous hemarthrosis following TKA. Although these

researchers had performed a substantial number of re-interventions, results of this study showed that this procedure could be safely repeated without adverse events. They stated that these findings indicated that embolization could possibly be the treatment of choice when conservative measures failed and can be repeated in the event of recurrent or persistent symptoms. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Splenic Artery Embolization for the Treatment of Hyper-Splenism Secondary to Hepatic Cirrhosis**

Although the individual study numbers are small, the total studied over several years is significant and the evidence has demonstrated that coil embolization in the treatment of splenic artery aneurysms is safe and effective and may induce less morbidity than open surgery, in particular by preserving the spleen. In a meta-analysis, Wang and colleagues (2017) examined the effectiveness of partial spleen arterial embolization (PSAE) in the treatment of hypersplenism due to hepatic cirrhosis. Authors concluded that PSAE is a mini-invasive therapy, which can be applied to treat hypersplenism secondary to hepatic cirrhosis effectively, particularly for patients with a poor overall condition. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Transcatheter Arterial Embolization for Non-Variceal Upper Gastro-Intestinal Bleeding**

Tarasconi and colleagues (2019) noted that very few patients with nonvariceal upper gastro-intestinal (GI) bleeding fail endoscopic hemostasis (refractory NVUGIB). This subset of patients poses a clinical dilemma: should they be operated on or referred to transcatheter arterial embolization (TAE)? These researchers performed a systematic review of the literature and carried out a meta-analysis of studies that directly compared TAE and surgery in patients with refractory NVUGIB. The authors concluded that the findings of this study showed that TAE was a safe and effective procedure; when compared to surgery; TAE exhibited a higher re-bleeding rate, but this tendency did not affect the clinical outcome as shown by the comparison of mortality rates (slight drift toward lower mortality for patients undergoing TAE). The present study suggested that TAE could be a viable option for the 1st-line therapy of refractory NVUGIB and set the foundation for the design of future randomized clinical trials (RCTs). Another issue that needs to be addressed in the future is the best therapeutic option for refractory NVUGIB in hemodynamically unstable patients. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Embolization for the Treatment of Renal Angiomyolipoma (rAML)**

Torres and Pei (2024) states that “Patients with a renal angiomyolipoma (AML) who develop flank pain or tenderness, or gross hematuria should undergo prompt imaging with computed tomography (CT) or magnetic resonance imaging (MRI) to assess for hemorrhage. Patients who develop active bleeding should receive resuscitative measures (if hemodynamically unstable) and, if feasible, undergo prompt angiography and selective artery embolization (SAE) to stop the bleeding. Patients who cannot have SAE, or who continue to have life-threatening hemorrhage from a renal AML after an attempt at SAE, should undergo a partial or complete nephrectomy... Imaging and other features that are associated with a higher risk of bleeding include: AML diameter > 6 cm”. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Embolization for the Treatment of Lower Gastro-Intestinal Bleeding**

Strate (2024) states that “Transcatheter embolization is a means of controlling hemorrhage and has largely replaced other temporizing interventions such as vasopressin infusion. Super-selective embolization of distal vessels using coaxial catheters decreases the risk of bowel infarction. A meta-analysis found that in patients with active bleeding, super-selective embolization is feasible in 98 %, and complications occur in 4.6 %, most commonly bowel infarction or ulceration”. Kruskal and Collares (2024) states that “Angiographic therapies include the infusion of vasoconstricting medications or the delivery of agents to mechanically occlude the vascular supply of the bleeding lesion (embolization). Agents used for embolization include biodegradable gelatin sponge, polyvinyl alcohol particles, liquid agents such as glue and ethylene-vinyl alcohol copolymer, and metallic coils. Super-selective transcatheter embolization with microcoils is the primary endovascular treatment option for lower GI bleeding. Endovascular treatment of upper GI bleeding is usually performed with a combination of coils, gelatin sponge, and/or particles”. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Transcatheter Embolization for Lower Gastrointestinal Bleeding (GIB)**

Kruskal and Collares (2024) concluded that "Angiographic control of nonvariceal gastrointestinal bleeding in adults" include massive lower gastrointestinal (GI) bleeding (transfusion requirement of 4 units of blood or more in 24 hours) as indication for embolization. Furthermore, the authors assert that embolization should be considered a primary method for treating lower GI bleeding although vasopressin infusion has a fairly comparable efficacy to embolization. The authors also state that super-selective transcatheter embolization with micro-coils is the main endovascular treatment option for lower GI bleeding. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Portal Vein Embolization (PVE) Before Surgical Resection of Cholangiocarcinoma**

Kumar (2021) states that "Preoperative PVE is primarily indicated when a marginal FLR precludes an otherwise potentially curative hepatectomy in selected patients with primary or metastatic liver tumors... In properly selected patients, preoperative PVE increases resectability rates and reduces the incidence of post-hepatectomy liver failure. Approximately 70 to 80 % of patients who undergo preoperative PVE eventually undergo successful liver resection. Although the timing of hepatic resection varies, hepatic surgeons generally wait 3 to 6 weeks post-PVE before undertaking resection". The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Transcatheter Embolization in the Treatment of Intractable or Recurrent Severe Posterior Epistaxis**

Based on the clinical evidence, transcatheter embolization (embolotherapy) is an acceptable alternative in the treatment of intractable or recurrent severe posterior epistaxis when conservative measures have failed. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Prostatic Arterial Embolization (PAE) for Hematuria**

Tian et al (2019) concluded that PAE is safe and effective and is a reasonable choice of treatment for gross BPH induced gross hematuria refractory to medical management for at least 3 months in patients who are not candidates for surgery or refuse surgery. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Vascular Embolization for the Treatment of Type I/Type II Endovascular Leak.**

Clinical evidence shows that fibrin glue sac embolization to eliminate type I endoleak after endovascular aneurysm repair (EVAR) yielded excellent results, effectively and durably resolving the leaks. In a systematic review and meta-analysis, Zhang and colleagues (2022) examined the effect of preventive collateral arteries embolization before endovascular aneurysm repair (EVAR) to reduce type II endoleaks, aneurysm enlargement, and re-interventions. These researchers carried out a comprehensive search to identify articles related to preventive collateral arteries embolization before EVAR. A total of 12 relevant studies, including 11 retrospective studies and 1 RCT, were identified and fulfilled the specified inclusion criteria. A total of 1,706 patients in 11 studies were involved in the meta-analysis. The authors concluded that collateral arteries embolization is a promising approach to prevent the occurrence of type II endoleaks, sac enlargement, and re-intervention. Moreover, these researchers stated that high-quality studies are needed to provide stronger evidence-based medical suggestions regarding the effectiveness of this approach. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **Pre-Operative Embolization of Skull Base Meningiomas**

Ilyas and colleagues (2019) stated that neoadjuvant endovascular embolization of skull base meningiomas may facilitate surgical resection, thus, potentially decreasing operative morbidity. However, due to variation in the reported efficacy and complication rates, the utility of embolization remains incompletely defined. The authors concluded that future comparative analyses are needed to determine the benefits of pre-operative EMB of skull base meningiomas with respect to extent of resection, operative duration, operative blood loss, and surgical morbidity. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Renal Artery Embolization**

Based on the clinical evidence, renal artery embolization/angioinfarction, as a pre-operative adjunct to nephrectomy, is an acceptable alternative in the treatment of patients with large, hypervascular renal cell carcinomas. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Selective Arterial Embolization for the Treatment of Giant Cell Tumor**

Guidelines on giant cell tumor of the bone from the National Comprehensive Cancer Network (2018) state that "[s]erial arterial embolizations have been shown to be effective in the management of patients with giant cell tumors of the extremities, especially for tumors with large cortical defects and joint involvement and for those with large giant cell tumors of the sacrum." The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Tumor Embolization of Hypervascular Tumors**

A hypervascular tumor is a tumor characterized by an abnormal increase in blood vessel growth in the area. These vessels feed the tumor cells, and may be characterized by abnormal connections between veins and arteries. Hypervascular tumors may be benign (meningiomas, osteoblastomas, chondromas), malignant (renal cell carcinoma, thyroid carcinoma, hepatocellular carcinoma, glomus tumor) or metastatic tumors from these primary sites (list is not all-inclusive). Tumor embolization or pre-operative tumor embolization to reduce intraoperative bleeding prior to surgical resection may be considered medically necessary in the treatment of hypervascular tumors or metastases from hypervascular tumors. The evidence is sufficient to determine the effects of the technology on health outcomes.

### **Embolization for Locoregional Treatment of Metastatic Pancreatic Cancer**

Timmer and colleagues (2021) stated that the prognosis of metastatic pancreatic ductal adenocarcinoma (mPDAC) remains universally poor, requiring new and innovative therapeutic approaches. In a subset of oligometastatic PDAC patients, locoregional therapy, in addition to systemic chemotherapy, may improve survival. In a systematic review, these researchers examined available evidence on locoregional treatments for mPDAC. They carried out a systematic literature search on locoregional techniques, including resection, ablation and embolization, for mPDAC with a focus on hepatic and pulmonary metastases. A total of 59 studies were identified, including 63,453 patients. The authors concluded that although the exact additive value of locoregional treatments for mPDAC patients could not be distilled from the results, locoregional primary pancreatic and metastatic treatment appeared beneficial for a highly selected group of oligometastatic PDAC patients. Moreover, these researchers stated that for definite recommendations, large, prospective, well-designed RCTs with strict inclusion and exclusion criteria are needed to validate these findings; locoregional treatment for mPDAC should not be provided outside the context of an experimental trial. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **Coil Embolization for Treatment of Left Ventricular Outflow Tract (LVOT) Pseudoaneurysm**

Kumar et al (2012) noted that cardiac and aortic pseudoaneurysms are rare complications following myocardial infarction (MI) or cardiac surgery. They are characterized by a contained cardiac or aortic rupture within surrounding tissue and have a high mortality rate if left untreated. Percutaneous treatment of cardiac pseudoaneurysms might be a feasible therapeutic option in patients who are at high-risk of re-operative surgery. There is limited literature on the outcomes and the approaches to percutaneous treatment of these pseudoaneurysms. The authors reviewed the technical approaches, device selection strategies, outcomes, and complications with these percutaneous therapeutic options. The size of the pseudoaneurysm dimensions of its neck and relative anatomy, especially to the coronaries and valves, were critical issues to be addressed before percutaneous treatment of these pseudoaneurysms. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **Embolization for the Treatment of Asymptomatic Persistent Sciatic Artery**

Persistent sciatic artery (PSA) is a relatively rare congenital variant of the lower limb vasculature and can have highly variable clinical presentations. Muniz et al (2024) reported a case of a patient with bilateral PSAs and an infra-renal aortic aneurysm. The aneurysm was successfully treated by the endovascular approach. An ultra-low profile endograft associated with access incisions slightly above the usual position was used to

overcome this challenging access. The authors stated that the therapeutic options for PSA aneurysms are open ligation and bypass, coil embolization, or endograft deployment. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **Paraumbilical Vein Coil Embolization for the Treatment of Hepatic Encephalopathy**

Cho et al (2014) examined the feasibility of percutaneous access via the re-canalized paraumbilical vein for varix embolization and stated that this study had 2 main drawbacks. First, the study population was too small (n = 1 for umbilical varix embolization); further study with a larger population is needed to confirm the safety of percutaneous access via the paraumbilical vein. Second, the study lacked a comparison with other access methods such as the trans-splenic and trans-hepatic approaches; however, the paraumbilical vein is superficially located in the abdominal wall, and the authors believed that access via the paraumbilical vein is much easier for inexperienced operators. Further studies in 2021 (Ferenci, Chalela, Goldberg and Chopra) related to the treatment of hepatic encephalopathy did not mention paraumbilical vein coil embolization as a management or therapeutic option. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **Endovascular Embolization in the Treatment of Spinal Dural Arteriovenous Fistula**

In a meta-analysis, Yuan et al (2022) compared the effectiveness of microsurgery and endovascular embolization in the treatment of spinal dural arteriovenous fistula (SDAVF). These researchers carried out a systematic review to retrieve all relevant studies regarding surgical treatment or endovascular embolization of SDAVF. A total of 46 studies involving 1,958 cases of SDAVF were included, in which 935 cases were treated by microsurgery and 1,023 cases were treated by endovascular embolization. The results of meta-analysis showed that the incidence of early surgical failure was lower than that of endovascular embolization and the long term recurrence was also lower than that of endovascular embolization. The improvement of neurological function in the surgical patients was significantly higher than that in the patients treated with endovascular embolization. There was no significant difference in the occurrence of complications between the 2 groups. In the cases of endovascular embolization, the risk of treatment failure or recurrence was higher with Onyx glue than with n-butyl 2-cyanoacrylate (NBCA), and the difference was statistically significant. The authors concluded that although the treatment of dural arteriovenous fistulas by intra-vascular embolization has been widely used, the clinical effect of microsurgery was still better than that of endovascular embolization. Moreover, these researchers stated that large scale and high-quality RCTs are needed to validate the safety and effectiveness of endovascular treatment in SDAVF patients. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **Genicular Artery Embolization for the Treatment of Osteoarthritis Related Knee Pain**

Torkian and colleagues (2021) noted that genicular artery embolization (GAE) is an innovative technique that has been examined as a supplementary therapy for chronic pain secondary to knee osteoarthritis (OA). In a systematic review and meta-analysis, researchers examined the available evidence on the safety and effectiveness of GAE for OA-related knee pain. They carried out a systematic literature search to identify studies related to knee OA treated with GAE. Therapeutic agents were categorized as embolene, imipenem/cilastatin, resorbable microspheres, and polyvinyl alcohol. Of 379 initially inspected studies, 11 (n = 225 patients; 268 knees) were included in the final review. The quality of the studies was fair in 8 and poor in 3-categorized according to the National Institutes of Health quality assessment tool. No significant difference between embolic agents was observed with regard to post-GAE pain reduction. No severe or life-threatening complications were reported. The authors concluded that this systematic review revealed that mild-to-moderate OA treated by GAE using different embolic particles could generally be considered safe, with no reported serious complications. The procedure resulted in significant and sustained pain improvement as well as better functional status in the studies reviewed. However, because of the paucity of high-quality trials, further investigation is needed to examine GAE's long-term outcomes, its comparative efficacy with other treatment modalities, and its role in the therapeutic approach. These researchers stated that as far as the general drawbacks of the study were concerned, available studies lacked a control group (other treatment modalities). Furthermore, the studies had been reported from a limited number of geographical regions; therefore, further patient-centered investigations of the GAE safety and effectiveness in other geographical regions, with a larger sample size from different ethnic groups and longer duration of

follow-up, is needed to improve the quality of evidence in terms of safety, durability, and efficacy of this treatment. In a systematic review, Casadaban and associates (2021) stated that future studies should be standardized to facilitate comparison and control for placebo effect. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **HydroPearl Microspheres for the Treatment of AVMs in the Lower Extremity**

Stone (2022) states that “For symptomatic AVFs that fail compression-based therapy, we recommend surgical repair (Grade 1B). Endovascular repair with a covered stent or coil embolization are alternative treatments for patients who may not tolerate trivial bleeding, have a hostile groin (e.g., prior surgery), or have a prohibitive risk for general anesthesia”. Microsphere is not mentioned as a therapeutic option in this review. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **Bariatric Arterial Embolization (BAE)**

BAE is a minimally invasive procedure which is the percutaneous, catheter-directed, trans-arterial embolization of the left gastric artery (LGA). The procedure is performed by an interventional radiologist and targets the fundus that produces the majority of the hunger-controlling hormone ghrelin. Beads placed inside the vessels purportedly help decrease blood flow and limit the secretion of ghrelin to minimize feelings of hunger to initiate weight loss. Reddy et al. (2020) conducted a single-center, sham controlled, masked RCT to evaluate the efficacy of transcatheter bariatric embolization (TBE) for weight reduction in obesity. Limitations included small sample size, single center, no control group after 6 months, and possibility that the efficacy of TBE was related to subject participation in weight management counseling as it is unknown if TBE alone would have an impact on obesity without lifestyle counseling. Additionally, four subjects withdrew consent after randomization and another three prior to the 6-month visit. Furthermore, the clinical significance of the effect, its long-term sustainability, and safety are unclear. There is insufficient evidence for bariatric artery embolization and its outcomes for weight loss; additional robust RCTs are warranted for safety and efficacy along with long-term follow up. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **Middle Meningeal Artery Embolization for Chronic Subdural Hematoma**

Goncalves et al (2025) stated that middle meningeal artery embolization (MMAE) has been studied as an adjunct to surgical evacuation for chronic subdural hematoma (cSDH). Previous meta-analyses comparing MMAE with conventional treatment for cSDH included both observational and randomized studies. To provide a more robust assessment, these investigators carried out a meta-analysis of RCTs to evaluate the outcomes of adjunct MMAE compared to surgical treatment alone. The authors concluded that the findings of this meta-analysis confirmed that MMAE significantly reduced recurrence and re-operation rates compared to surgery alone, with low AE rates; however, the impact on functional outcomes and mortality remains uncertain, warranting further studies to clarify its long-term benefits. Gillespie et al (2025) noted that MMAE has been proposed as adjunct and stand-alone treatment for cSDH. The investigators meta-analyzed 3 recently published RCTs to estimate the effect of MMAE. In addition, they performed a systematic review of ongoing trials and their key outcomes. A PRISMA-compliant meta-analysis was conducted. Three published RCTs (MAGIC-MT, EMBOLISE, and STEM) assessing MMAE in cSDH were included. The authors concluded that in this meta-analysis of 3 RCTs, the use of MMAE in patients undergoing surgery did not appear to significantly reduce recurrence or improve functional outcomes, but did reduce progression in non-surgical cohorts. These researchers stated that further studies evaluating these cohorts are ongoing. Wach et al (2025) noted that cSDH is a common neurological condition, with high recurrence rates after surgical evacuation, posing significant challenges for patient outcomes; MMAE has emerged as a potential adjunctive therapy to reduce recurrence and re-operation rates. In a meta-analysis, these investigators examined the impact of MMAE on recurrence and re-operation rates in surgically treated unilateral subdural hematoma patients. The authors concluded that the findings of this pooled analysis from 965 randomized patients suggested that MMAE, as an adjunct to surgery, could be considered for patients with unilateral symptomatic sub-acute or chronic SDH. Moreover, these investigators stated that rigorous standardization of surgical and embolization protocols in future research will be pivotal in enhancing outcome predictability and patient safety. Maroufi et al (2025) stated that cSDH often recurs following surgical evacuation, with rates ranging from 2 % to 37 %; MMAE has emerged as a potential adjunct to surgery to reduce recurrence. The

authors concluded that MMAE combined with surgery effectively reduced CSDH recurrence and improved radiological outcomes without increasing complications. These researchers stated that these findings support MMAE as a valuable adjunct to surgical treatment, warranting further research to optimize its clinical application. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **Pre-Operative Embolization for Carotid Body Tumor Resection**

Texakalidis and associates (2019) stated that there is evidence suggesting that pre-operative selective embolization could reduce blood loss during surgery and decrease the risk of peri-operative complications; however, recent reports have questioned the benefits that pre-operative embolization provides. These investigators examined the impact of pre-operative embolization on CBT surgical resection utilizing Systematic Reviews and Meta-Analyses guidelines. Eligible studies were identified and a total of 25 studies comprising 1,326 patients were included. Patients who received pre-operative embolization had statistically significant lower intra-operative blood loss. Duration of the procedure was statistically significantly shorter in the pre-embolization group than the non-embolization group. There were no differences in the rates of cranial nerve (CN) injuries, stroke, transient ischemic attacks (TIAs) or length of stay between the 2 groups. The authors concluded that patients who received embolization prior to CBT resection had statistically significant lower blood loss and shorter duration of operation; the clinical significance of these differences were unclear. Furthermore, the rates of CN palsy, stroke, TIA, and LOS were similar between patients who had preoperative embolization and those who did not. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **Prostatic Arterial Embolization for Benign Prostatic Hyperplasia**

Prostate arterial embolization (PAE) has been investigated as a minimally invasive alternative to transurethral resection of the prostate (TURP), considered the traditional standard treatment for benign prostatic hyperplasia (BPH). PAE differs from other minimally invasive surgical therapies in treatment approach (endovascular vs transurethral) and mechanism (embolic), and thus requires different considerations. An interventional radiologist injects microspheres through a catheter to the blood vessels around the prostate, reducing the blood supply to multiple different areas. No surgical intervention is required for this procedure and recovery times are often less than that of TURP.

For individuals who have benign prostatic hyperplasia (BPH) and lower urinary tract symptoms (LUTS) who receive prostate artery embolization (PAE), the evidence includes systematic reviews, randomized controlled trials (RCTs) and noncomparative studies. The outcomes of interest are symptoms, functional outcomes, quality of life, and procedure-related morbidity. A Cochrane meta-analysis of 7 RCTs comparing PAE with transurethral resection of the prostate (TURP) or a sham procedure in men with LUTS due to BPH reported similar improvements in symptom scores and quality of life across procedures over both short-term ( $\leq 12$  months) and long-term (13-24 months) follow-up. There remained significant uncertainty about major adverse events (very low-certainty evidence), but PAE was associated with a higher likelihood of retreatment (moderate-certainty evidence). The long-term effect on erectile function was minimal (low-certainty evidence), and PAE may continue to lower the incidence of ejaculatory disorders (low-certainty evidence). A qualitative systematic review of 5 RCTs and two observational studies found that PAE and TURP resulted in comparable symptom and quality of life improvements at 12 months. TURP offered greater increases in urine flow and prostate volume reduction, while PAE had shorter hospital stays and fewer complications. Three RCTs, published following the systematic reviews, have assessed the efficacy of PAE relative to conventional therapies for BPH. One RCT conducted in Switzerland (2024) reported that TURP demonstrated superior efficacy to PAE in improving LUTS and urinary flow rates at 5-years of follow-up, although erectile function outcomes favored PAE. Another RCT from Australia (2024) indicated that PAE, when utilized as a first-line therapy, resulted in greater reductions in prostate volume, improved symptom scores, and enhanced quality of life relative to medical therapy, with a lower incidence of adverse events. The third RCT, performed in France (2023), found that PAE was more effective than combined medical therapy for patients with moderate LUTS, yielding greater improvements in both symptoms and erectile function, with no major adverse events and a decreased need for retreatment. All three trials were open-label and characterized by high loss to follow-up and significant patient crossover between study arms. A retrospective, single-center study of 317 men with moderate to severe BPH found bilateral PAE had lower recurrence rates than a unilateral approach

at over 2-years of follow-up. There is a paucity of direct comparative data between PAE and other minimally invasive therapies for BPH, such as transurethral water vapor thermal therapy, water jet ablation, prostatic urethral lift, and temporarily implanted nitinol devices; these modalities are addressed in separate evidence reviews. Future studies should specifically assess outcomes related to repeat interventions and unilateral PAE procedures. The evidence is insufficient to determine that the technology results in an improvement in the net health outcome.

### **Hemorrhoidal Embolization**

De Gregorio et al (2023) stated that catheter-directed hemorrhoidal embolization (CDHE) has provided encouraging outcomes in patients with hemorrhoids and mild prolapse Goligher grade-I to grade-III with persistent rectal bleeding. These preliminary findings need to be validated by well-designed studies. The evidence is insufficient to determine the effects of the technology on health outcomes.

### **Onyx Embolization for the Treatment of Cerebrospinal Fluid (CSF) Vertebral Vein Fistula**

Brinjikji et al (2024) stated that cerebrospinal fluid-venous fistulas (CSFVF) are a common cause of spontaneous intracranial hypotension (SIH); and trans-venous embolization has emerged as a reliable therapeutic option. These investigators reviewed the clinical presentation, imaging, and clinical outcomes of 100 consecutive CSFVF patients who underwent embolization over 2 years. The authors concluded that trans-venous embolization of CSFVF in SIH patients was safe and effective with a 95% treatment response, significant improvement in imaging outcomes, and a very low rate of complications. Cagnazzo et al (2024) stated that trans-venous embolization is a recent treatment strategy for CSFVF, which are associated with SIH. In this trial, subjects were selected from a prospective database on patients with CSFVF who received trans-venous Onyx embolization. All subjects underwent a brain MRI before and after embolization with MRI follow-up performed at least 3 months after treatment. Clinical and MRI results after treatment were described. The authors stated that this study had several drawbacks. First, the sample size precluded the possibility of sub-group analysis. Second, the analysis was carried out retrospectively; however, as the database was maintained prospectively, all patients received a standardized pre- and post-treatment clinical and MRI follow-up. Third, results were collected over a medium-term follow-up, and these investigators could not conclude about the long-term durability of the treatment. Park and Salama, 2025, “Cranial cerebrospinal fluid leaks” does not mention embolization as a management / therapeutic option / tool. The evidence is insufficient to determine the effects of the technology on health outcomes.

## **CODING**

### **Medicare Advantage Plans and Commercial Products**

The following CPT codes are considered medically necessary when the medical criteria, above, are met:

- 37242** Vascular embolization or occlusion, inclusive of all radiological supervision and interpretation, intraprocedural roadmapping, and imaging guidance necessary to complete the intervention; arterial, other than hemorrhage or tumor (eg, congenital or acquired arterial malformations, arteriovenous malformations, arteriovenous fistulas, aneurysms, pseudoaneurysms)
- 37243** Vascular embolization or occlusion, inclusive of all radiological supervision and interpretation, intraprocedural roadmapping, and imaging guidance necessary to complete the intervention; for tumors, organ ischemia, or infarction

## **RELATED POLICIES**

Centers for Medicare and Medicaid Services (CMS) National and Local Coverage Determinations  
Medical Necessity  
Prior Authorization of Services, Treatments or Procedures

## **PUBLISHED**

Provider Update, June 2026  
Provider Update, December 2025  
Provider Update, June 2024  
Provider Update, August 2023

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