Vascular Embolization: Select Procedures

Policy Number: 2026T0669A
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➲ Instructions for Use

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Related Commercial/Individual Exchange Policies

- Abnormal Uterine Bleeding and Uterine Fibroids
- Outpatient Surgical Procedures – Site of Service
- Prostate Surgeries and Interventions
- Transarterial Radioembolization (TARE)/ Selective Internal Radiation Therapy (SIRT) for the Treatment of Malignant Cancers of the Liver

Community Plan Policy

- Vascular Embolization: Select Procedures

Medicare Advantage Policy

- Radiation and Oncologic Procedures

Application

UnitedHealthcare Commercial

This Medical Policy applies to UnitedHealthcare Commercial benefit plans.

UnitedHealthcare Individual Exchange

This Medical Policy applies to Individual Exchange benefit plans.

Coverage Rationale

Notes:

- This policy does not apply to members aged < 18 years.
- This policy does not apply to indications involving acute/active bleeding (e.g., gastrointestinal bleed, hemoptysis, bleeding secondary to trauma, and other emergent causes resulting in hemodynamic instability).
- For transarterial radioembolization/selective internal radiation therapy for treating malignancies involving the liver, refer to the Medical Policy titled Transarterial Radioembolization (TARE)/Selective Internal Radiation Therapy (SIRT) for the Treatment of Malignant Cancers of the Liver.

Transarterial bland embolization or transarterial chemoembolization is proven and medically necessary for treating malignancies involving the liver when certain criteria are met. For medical necessity clinical coverage criteria, refer to the InterQual® CP: Procedures, Ablative or Transarterial Therapy, Liver.

Click here to view the InterQual® criteria.

Renal embolization is proven and medically necessary for any of the following indications:

- Preoperative treatment of renal cell carcinoma
- Palliation of symptomatic renal cell carcinoma
- Treatment (as an alternative to surgery) of nonruptured angiomyolipomas that are considered to be at elevated risk for bleeding (e.g., large in size or with rapid growth, large intratumoral aneurysms, hypervascular tumors, female individual of reproductive age or pregnant)

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For vascular embolization for all other oncological indications, refer to the relevant NCCN Clinical Practice Guidelines in Oncology (NCCN Guidelines®) for clinical criteria.

Arterial embolization is unproven and not medically necessary for the following indications due to insufficient evidence of efficacy:

- Hemorrhoids (hemorrhoidal/rectal arteries)
- Musculoskeletal pain, including but not limited to the following:
  - Knee osteoarthritis (genicular artery)
  - Shoulder osteoarthritis
  - Adhesive capsulitis
  - Tendinitis
  - Plantar fasciitis

Medical Records Documentation Used for Reviews

Benefit coverage for health services is determined by the member specific benefit plan document and applicable laws that may require coverage for a specific service. Medical records documentation may be required to assess whether the member meets the clinical criteria for coverage but does not guarantee coverage of the service requested; refer to the guidelines titled Medical Records Documentation Used for Reviews.

Applicable Codes

The following list(s) of procedure and/or diagnosis codes is provided for reference purposes only and may not be all inclusive. Listing of a code in this policy does not imply that the service described by the code is a covered or non-covered health service. Benefit coverage for health services is determined by the member specific benefit plan document and applicable laws that may require coverage for a specific service. The inclusion of a code does not imply any right to reimbursement or guarantee claim payment. Other policies and guidelines may apply.

Coding Clarification: CPT code 37242 is not an appropriate code for reporting embolization of benign or malignant tumors. Examples of these tumors include but are not limited to the following:

- Prostate, including benign prostatic hyperplasia
- Uterus, including uterine fibroids
- Liver
- Other organs

CPT Code	Description
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 (e.g., 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

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Description of Services

Vascular embolization procedures place synthetic materials called embolic agents (with or without medications) into a blood vessel to block blood flow to an area of the body. The procedures may be used to control or prevent abnormal bleeding, close off vessels supplying blood to a tumor, eliminate abnormal connections between arteries and veins, or treat aneurysms. Examples of embolic agents include coils, particles, gels, glues, or beads (American College of Radiology, 2024).

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Clinical Evidence

Renal Cell Carcinoma

Rooseno et al. (2023) conducted a systematic review and meta-analysis that investigated the efficacy of preoperative renal artery embolization (RAE) before radical nephrectomy for renal cell carcinoma (RCC). Comparative studies that reported intraoperative blood loss, transfusion rate, intensive care unit stay, hospitalization length, and operation time were included. Eight studies that comprised 921 individuals, with a mean age of 66 years, were analyzed. Embolic agents such as ethanol, gelatin sponge, and metal spirals were used in the procedures. Quantitative and qualitative analyses assessed intraoperative blood loss, transfusion rate, surgical time, intensive care unit stay, and hospital stay. The primary outcome, intraoperative blood loss, was significantly lower in the embolization group [$p < 0.00001$; standardized mean difference (MD), -0.20; 95% CI, -0.29 to -0.12]. No statistically significant differences were found between groups in transfusion rate, operative time, hospital stay, or intensive care unit stay. The authors concluded that preoperative RAE before radical nephrectomy significantly reduces blood loss in individuals with RCC but shows no difference in surgical time, transfusion rate, hospital stay, or intensive care unit stay. There were variation and lack of consensus on the timing of RAE before nephrectomy.

Wright et al. (2022) conducted a systematic review and meta-analysis that evaluated transarterial embolization (TAE) monotherapy of the primary tumor in individuals with RCC. Eligible studies included randomized and nonrandomized prospective trials, case series, and retrospective chart reviews, with at least 25 individuals per arm for trials and at least two individuals for other designs. Nine studies met the inclusion criteria: eight case series and one nonrandomized prospective trial, with a total of 237 individuals (mean age, 69.4 years; mean tumor diameter, 9.3 cm) across stages I to IV. The primary outcomes were improvements in pain and hematuria, with pooled event rates of 0.952 (95% CI, 0.788-0.990; $p < 0.001$) and 0.920 (95% CI, 0.803-0.970; $p < 0.001$), respectively. Median overall survival ranged from 1 to 39 months, with one study showing a statistically significant improvement in overall survival ($p = 0.02$). The authors concluded that TAE monotherapy in individuals with RCC improved symptomatology such as pain and hematuria, with an acceptable safety profile. Key limitations include the reliance on case series, both retrospective and prospective, which represent weaker levels of evidence than randomized controlled trials (RCTs).

Shanmugasundaram et al. (2021) conducted a systematic review and meta-analysis that evaluated the safety and efficacy of preoperative RAE in individuals with RCC who were undergoing partial nephrectomy. Overall, 21 studies were included in the systematic review and four in the meta-analysis. A total of 270 individuals (173 male; 97 female) underwent partial nephrectomy for RCC. Of those individuals, 222 received preoperative embolization, while the remaining 48 underwent the procedure without preoperative embolization. A random-effects model was used to calculate estimated blood loss, with heterogeneity assessed using Cochrane Q and I^2 statistics and publication bias evaluated by funnel plots and Egger regression. The primary outcome, estimated intraoperative blood loss, was significantly lower in the embolization group (154.0 ±22.6 mL) than the nonembolization group (353.4 ±69.6 mL; 95% CI, 82.13-225.96 mL; $p < 0.0001$). Major complications occurred in 4.9% vs 10.9% ($p = 0.01$), and minor complications occurred in 5.8% vs 19.0% ($p < 0.0001$) in the embolization and nonembolization groups, respectively. The authors concluded that RAE prior to partial nephrectomy significantly reduced intraoperative blood loss, without increasing complication rates, compared with surgery alone. The key limitation is the reliance on retrospective cohort and case series data, which provided mixed results and limited the strength of the evidence. Additional limitations relate to study design, including nonstandardized techniques, variable selection of individuals, and inconsistent follow-up across studies. Measurement limitations include the lack of specification of operative technique, inclusion of open partial nephrectomy cases, and uncontrolled variation in embolic agents, with most procedures using polyvinyl alcohol microspheres of varying sizes.

Clinical Practice Guidelines

European Association of Urology (EAU)

EAU clinical guidelines provide evidence-based information and recommendations for the management of RCC. The guidelines address preoperative and palliative care (EAU, 2026).

Angiomyolipomas

Duffy et al. (2025) conducted a systematic review and meta-analysis that evaluated the efficacy and safety of selective arterial embolization (SAE) for renal angiomyolipomas (AMLs) in the elective setting. Overall, 13 studies that were published between 1997 and 2023 were included, encompassing 478 individuals with 542 treated lesions; all met the inclusion criteria of at least 6 months of follow-up and less than 20% lost to follow-up. Bleeding AMLs were excluded, and all procedures used transfemoral access, with various embolic agents such as ethanol, polyvinyl alcohol, coils, and gelatin sponge. The primary outcomes were technical, clinical, and radiological success, defined, respectively, as successful embolic occlusion, symptom improvement, and computed tomography–measured tumor shrinkage. Pooled technical

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success was 86.2% (95% CI, 80.0%-89.1%), radiological success was 94.0% (95% CI, 91.2%-97.3%), and clinical success ranged from 83% to 94%, with substantial heterogeneity. The authors concluded that SAE is an effective and safe first-line treatment for renal AMLs and achieved high technical and radiological success, with low major complication and surgical intervention rates. Ethanol-based regimens showed the most favorable results. Noted limitations include high heterogeneity in clinical success and reintervention rates due to variable definitions, techniques, and follow-up protocols.

Miangul et al. (2025) conducted a systematic review and meta-analysis that evaluated the safety and efficacy of TAE for renal AML, including 32 studies that comprised 1,087 adults (772 female; 315 male). The primary outcomes were technical success and tumor reduction. Technical success was defined as complete vascular occlusion of the tumor, and tumor size reduction was measured by changes in centimeters, volume, and percentage between pre- and postprocedure imaging. The pooled analysis applied a random-effects model using the DerSimonian and Laird method, with heterogeneity assessed by the Q statistic and I^2 index. The pooled mean preoperative tumor size was 8.79 cm (95% CI, 7.64-9.93 cm), and the postoperative size was 6.47 cm (95% CI, 5.44-7.50 cm), corresponding to a mean reduction of 1.85 cm (95% CI, 1.69-2.00 cm) and a 43.30% decrease (95% CI, 34.30%-52.30%). The pooled technical success rate was 95.7% (95% CI, 0.94%-0.97%; $p = 0.008$). The authors concluded that TAE is a safe and effective intervention for renal AMLs and demonstrates high technical success, significant tumor size reduction, and minimal complications. The study designs were predominantly retrospective in design. Measurement limitations include inconsistent reporting of tumor outcomes, absence of standardized follow-up intervals, and limited patient-level data. Statistical limitations arose from the wide selection and variable combinations of embolic agents used. Generalizability was constrained by heterogeneous study populations and differences across centers in protocols, equipment, operator experience, and follow-up imaging methods.

Lin et al. (2019) conducted a meta-analysis of studies that evaluated TAE in individuals with renal AMLs. Overall, 30 observational cohort studies, comprising 653 individuals (mean age, 45.8 years; 79.9% women), were analyzed using a random-effects model. The end points of interest included estimated glomerular filtration rate, serum creatinine levels, blood urea nitrogen levels, complications, and changes in tumor size. The analysis showed no significant change in estimated glomerular filtration rate and a mean creatinine decrease of 7.83 μmol/L after embolization. The pooled rate of postembolization syndrome was 54.0% (95% CI, 36.6%-70.4%; $p < 0.001$), and major complications occurred in 4.4% of individuals. Tumor diameter decreased by a mean of 2.09 cm (95% CI, 0.73-3.45 cm) in sporadic AMLs and 2.12 cm (95% CI, 1.48-2.75 cm) in tuberous sclerosis complex–related cases, corresponding to 30.0% and 20.0% reductions, respectively. The authors concluded that TAE preserved renal function, with a low complication rate; was effective for both sporadic and tuberous sclerosis complex–related AMLs; and serves as a potential alternative to surgery, particularly in individuals with poor renal function or physical condition. Key limitations include the absence of prospective, comparative studies.

Ryan et al. (2018) provided recommendations regarding indications for prophylactic embolization of renal AMLs that consider an individual's clinical context. The authors included information on timing based on tumor size but acknowledged the lack of high-level evidence on this topic.

Clinical Practice Guidelines

Canadian Urological Association (CUA)

A CUA report (Guo et al., 2020) on the diagnosis and management of sporadic AMLs states that the vast majority of AMLs are asymptomatic, have a low risk of hemorrhage, and can be monitored. There does appear to be an increased risk of symptoms and hemorrhage in lesions that are larger than 4 cm, but this is not based on high-level evidence. Symptomatic AMLs should be treated to ameliorate symptoms. Treatment for asymptomatic AMLs of > 4 cm should be discussed, with the understanding that the absolute risks of hemorrhage are lower than previously thought. Other factors that may influence the desire to treat include access to health care, women of childbearing age, and patient preferences. Both surgery and embolization are acceptable first-line management options for AML treatment. Surgery should be minimally invasive and nephron sparing when possible. Re-treatment rates may be lower for surgery. Embolization is safe and may allow for a less invasive, nephron-sparing approach in select cases; however, it appears to have a slightly higher recurrence rate.

European Association of Urology (EAU)

EAU guidelines (EAU, 2026, and Fernandez-Pello S et al., 2020) on the management of AMLs recommend treatment with SAE or nephron-sparing surgery in any of the following circumstances (strength of rating: weak):

- Large tumors (a recommended threshold of intervention does not exist)
- Female patients of childbearing age
- Patients in whom follow-up or access to emergency care may be inadequate
- Persistent pain or acute or repeated bleeding episodes

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Hemorrhoids

Interpretation of outcomes that are associated with arterial embolization is limited by the absence of uniform protocols and direct, high-quality comparisons with standard treatments, including rubber band ligation, injection sclerotherapy, and surgical approaches.

Al Jnainati et al. (2025) conducted a systematic review of clinical studies that evaluated superior rectal artery embolization using the emborrhoid technique for treating grade I to III internal hemorrhoids. Overall, 22 studies published between 2014 and 2024, encompassing 810 procedures, were included. Studies were eligible for inclusion if they involved adult individuals who were treated with embolization as the primary intervention; included comparators with rubber band ligation, sclerotherapy, or surgery; and reported at least one clinical or patient-related outcome. The review followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) 2020 and Cochrane Handbook guidelines, with two independent reviewers performing screening, data extraction, and quality assessment using RoB 2, ROBINS-I (Risk of Bias in Non-Randomized Studies of Interventions), or an adapted Newcastle-Ottawa Scale. The prespecified primary outcomes were technical success, clinical success (≥ 2-point fall in bleeding score or equivalent), adverse events, and recurrence. Technical success ranged from 93% to 100% and clinical success from 63% to 94%, with recurrence in 8% to 20% of individuals. Minor complications included low-grade fever, nausea, pelvic pain, and vomiting. No major complications were reported. Comparative effectiveness could not be assessed because most studies were prospective, single-arm case series without a control group. The authors concluded that the emborrhoid technique is a safe and effective bridge between office procedures and surgery and is particularly valuable for frail or anticoagulated individuals or when other procedures are contraindicated. Well-designed, multicenter, randomized trials that compare embolization directly with standard office-based therapies are needed. There are limitations, including pronounced heterogeneity in study design and reporting that made data pooling or reliable qualitative ranking misleading. This substantial heterogeneity precluded meta-analysis. There was a persistent lack of standardization across approaches, methods, and materials. Sample sizes were small, and most research was conducted in European populations, which may restrict generalizability to other populations.

Falsarella et al. (2023) conducted a prospective RCT that compared superior rectal artery embolization with closed hemorrhoidectomy in adults with grades II to III symptomatic internal hemorrhoids. Overall, 33 participants who had persistent or recurrent bleeding for more than 3 months or other hemorrhoidal symptoms were randomized to superior rectal artery embolization (n = 16) or closed hemorrhoidectomy (n = 17). In total, 29 participants received the intervention due to some loss to follow-up. The primary outcome was postprocedural pain, which was measured three times daily for 7 days using the visual analog scale (VAS) and use of analgesics. After the initial 30-day follow-up, participants were followed up through telephone calls at 3, 6, and 12 months. Mean pain during the first bowel movement after the procedure was significantly lower in the embolization group (6.08 ±4.41 in the surgery group and 0 in the embolization group; $p = 0.001$). The mean total medication use was 2.4 ±5.2 medication doses in the embolization group vs 28.9 ±15.8 doses in the surgery group ($p < 0.001$). The authors concluded that rectal artery embolization offered similar clinical outcomes, with reduced pain, compared with surgical hemorrhoidectomy. Study limitations include a small sample size, short-term follow-up, and lack of blinding due to the nature of the treatments.

Nguyenhuy et al. (2022) conducted a systematic review and meta-analysis in accordance with PRISMA guidelines to evaluate the clinical efficacy and safety of rectal artery embolization for internal hemorrhoids. Studies were eligible if they specified rectal artery embolization for hemorrhoidal disease, included at least five individuals, used observational or randomized designs, and excluded acute rectal bleeding from other causes. Overall, 14 studies that comprised 381 individuals, with mean ages between 38.6 and 72.2 years and mostly grade II to III hemorrhoids, were analyzed. A random-effects meta-analysis summarized MDs and pooled proportions, with heterogeneity and sensitivity analyses performed. The primary outcomes were the French Bleeding Score (FBS), VAS for pain, quality-of-life score, and Goligher Prolapse Score. Rectal artery embolization was associated with improvements in the FBS (MD, 2.66; 95% CI, 2.10-3.23), VAS (MD, 1.92; 95% CI, 1.58-2.27), and quality of life (MD, 1.41; 95% CI, 1.20-1.62), while the prolapse grade increased slightly (MD, 0.30; 95% CI, 0.23-0.36). The authors concluded that rectal artery embolization is a safe and effective treatment for grade I to III internal hemorrhoids and demonstrated early clinical efficacy, with low morbidity and no major complications. Key limitations, including the small sample sizes, variable follow-up intervals, lack of evidence on long-term outcomes, absence of standardized outcome reporting, and use of heterogeneous scoring systems, hinder the development of clear treatment guidelines. Follow-up was limited to a maximum of 1 year, leaving ongoing uncertainty about long-term efficacy.

Makris et al. (2021) conducted a systematic review and meta-analysis that followed PRISMA guidelines to evaluate the efficacy and safety of catheter-directed hemorrhoidal dearterialization for rectal bleeding. Eight prospective studies and six retrospective case series, including 362 individuals with chronic bleeding due to grade II to III hemorrhoids, were analyzed. Technical success was defined as angiographic occlusion of target superior rectal artery branches, while clinical success was defined as resolution of hemorrhoid symptoms, as measured by bleeding scores such as the FBS.

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The pooled mean technical success was 97.8% (SD, 3.5%), and mean clinical success was 78.9% (SD, 10.6%), with a significant reduction in FBS from 6.8 to 3.9 (p = 0.004). Minor complications, including pain, fever, and tenesmus, were self-resolving, and no bowel ischemia or necrosis occurred. Preliminary evidence suggests that catheter-directed hemorrhoidal dearterialization is a safe and effective treatment for chronic rectal bleeding from hemorrhoids. There are limitations, including a small sample size, short and variable follow-up periods, and predominance of nonrandomized, nonblinded case series. Many studies lacked quantitative assessment of bleeding change and did not include validated quality-of-life questionnaires. Additional limitations include heterogeneity in embolization techniques and agents and the potential for publication bias due to underreporting of negative results.

Clinical Practice Guidelines

American College of Gastroenterology (ACG)

The ACG guidelines do not address rectal artery embolization in the recommendations for managing benign anorectal disorders (Wald et al., 2021).

American Society of Colon and Rectal Surgeons (ASCRS)

The ASCRS guidelines do not address rectal artery embolization in the recommendations for managing hemorrhoids (Hawkins et al., 2024).

National Institute for Health and Care Excellence (NICE)

NICE guidelines (2018) state that current evidence on the safety and efficacy of superior rectal artery embolization for treating hemorrhoids is inadequate in quality and quantity. Therefore, this procedure should only be used in the context of research.

Musculoskeletal Conditions

Arterial embolization has demonstrated early signals of safety and short-term symptom improvement in certain musculoskeletal conditions; however, the available evidence is limited and does not yet establish long-term outcomes, durability of benefit, or comparative effectiveness relative to established treatments.

Epelboym et al. (2024) conducted a systematic review and meta-analysis that evaluated the efficacy of TAE for treating tendinopathy-related pain. Five cohort studies, with 97 embolization procedures in 74 individuals, were included. All five studies were classified as level II evidence and included individuals with Achilles, rotator cuff, and patellar tendinopathy as well as medial and lateral epicondylitis. A random-effects meta-analysis using the ratio of means assessed changes in VAS pain scores compared with baseline. At 6 months, the ratio of means values ranged from 0.12 to 0.23, and the pooled range of motion (ROM) was 0.18 (95% CI, 0.13-0.26), indicating significant pain reduction. Minor complications occurred in 9.3% of cases, with no severe adverse events reported. The authors concluded that TAE is a safe and effective short-term treatment for refractory tendinopathy-related pain. There are limitations, including the small number of studies that met the inclusion criteria, limited sample sizes, and absence of comparator groups. Further studies are needed to assess the long-term durability of TAE for treating tendinopathies.

Kim et al. (2022) conducted a systematic review and meta-analysis that evaluated the efficacy and safety of TAE for chronic inflammatory joint pain. Eligible studies included individuals with adhesive capsulitis, lateral epicondylitis, knee osteoarthritis (KOA), tendinopathy, or enthesopathy who were treated with TAE and reported pain or ROM outcomes. Overall, 14 observational studies (10 prospective; four retrospective), comprising 346 individuals, were analyzed using DerSimonian-Laird random-effects modeling with inverse variance weighting. The primary outcomes were pain and ROM changes measured by the VAS and shoulder motion angles, respectively. The pooled mean pain score decreases were 3.1 at 1 week, 4.0 at 1 month, 4.2 at 3 months, 5.1 at 6 months, and 5.5 at 1 year (95% CI, 3.5-7.6; I^2 = 96.7%), and shoulder ROM increased by 55.6° (95% CI, 39.8°-71.3°) for anterior elevation and 64.7° (95% CI, 46.8°-82.5°) for abduction at 6 months. The pooled technical success rate was 95.8% (95% CI, 91.7%-97.9%), with no major adverse events and a minor adverse event rate of 20.9% (95% CI, 13.3%-31.4%). The authors concluded that TAE was an effective and safe therapeutic option for chronic inflammatory joint pain and showed high technical success and significant pain reduction. Key limitations include the observational design of all included studies, which may have introduced selection bias, and heterogeneity in the populations of individuals and selection criteria. There are also limitations related to measurement and data quality, as technical aspects such as embolic volume and access route were not analyzed due to insufficient detail and the small number of available studies.

Kishore et al. (2022) conducted a systematic review to evaluate the safety and efficacy of TAE for chronic musculoskeletal pain that was not responsive to standard conservative therapy. Eligible studies included adult individuals who had musculoskeletal conditions such as KOA, adhesive capsulitis, lateral epicondylitis, tendinopathy, enthesopathy, and

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cervical myalgia. Seven studies and four abstracts were included. Due to high heterogeneity in indications and outcomes, results were qualitatively summarized. The primary outcomes were pain reduction and adverse events, with all studies reporting 100% technical success, significant pain and functional improvement, and no major complications or serious adverse events, with improvements durable up to 24 months post procedure. The authors concluded that TAE appears to be a safe and effective treatment for some types of chronic refractory musculoskeletal pain. There are limitations, including reliance on open-label case series and cohort studies without control groups, that introduce selection bias and placebo effects. The small sample sizes limit detection of uncommon or serious adverse events, and many conditions may improve spontaneously, making regression to the mean difficult to exclude. Heterogeneity in individuals, conditions, and outcome measures prevented quantitative synthesis, and data comparing different embolic agents used in TAE remain limited. The absence of randomized, placebo-controlled trials and the concentration of studies in a few centers with homogeneous populations restrict the generalizability and confirmatory strength of the evidence.

Knee Osteoarthritis

Milhem et al. (2025) conducted a systematic review that evaluated the efficacy and safety of genicular artery embolization (GAE) compared with those of sham procedures in adults with symptomatic, mild to moderate KOA. Three sham-controlled RCTs, including 138 individuals (mean age, 60 ±8.2 years; 65.2% female), were analyzed. The studies used various embolic agents and sham angiography comparators. The primary outcome was change in pain measured by the Knee Injury and Osteoarthritis Outcome Score (KOOS) and VAS. One trial showed a significant VAS pain reduction at 1 month (-50.8 vs -0.5; $p < 0.01$) that favored GAE, while others found nonsignificant differences in KOOS pain ($p = 0.31$) and the VAS ($p = 0.17$). Functional outcomes were mixed. No serious adverse events occurred, and minor complications were infrequent. The authors concluded that GAE appears to be a safe and minimally invasive treatment that can provide short-term pain and functional improvement in KOA, although differences from sham procedures were not statistically significant in most studies. Study limitations include a small total sample size, heterogeneity in the embolic agents used, methodological variability, and short follow-up durations. Larger studies that include longer follow-up and standardized protocols are necessary to confirm long-term efficacy and maximize the selection of individuals and the technique.

Ashraf et al. (2025) conducted a systematic review that evaluated the effectiveness, safety, and long-term outcomes of GAE for KOA pain. Eligible studies included adults with KOA of any Kellgren-Lawrence grade who were treated with GAE. Overall, 23 studies, comprising 657 individuals and 704 knees, were analyzed. The analysis included three RCTs, but most studies were single-center prospective or retrospective designs. The mean age was 61.3 years, and the mean body mass index was 28.6 kg/m^2. The intervention involved embolization of one to seven genicular branches using agents such as imipenem/cilastatin sodium, microspheres, polyvinyl alcohol, or gelatin sponge particles. The outcomes included technical and clinical success, adverse events, and comparison of baseline and posttreatment subjective knee pain scores according to the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), KOOS, and VAS. The results showed significant reductions in WOMAC and VAS scores sustained up to 24 months, with mild to moderate osteoarthritis responding better than severe disease. Technical success was reported at 100% in nearly all studies, and clinical success ranged from 30% to 100% depending on follow-up and osteoarthritis severity. Adverse events were minor, including skin discoloration (15.6%) and transient knee pain (10.2%). The authors concluded that GAE appears to be a promising and viable option for KOA pain, particularly in individuals who are unresponsive to conservative treatments or ineligible for surgery. Study limitations include the lack of inconsistency in outcome measures across studies and lack of standardization in reporting clinical success and adverse events. The overall quality of the studies that were included significantly affects the strength of these conclusions due to the higher risk of bias. The two RCTs included in the analysis showed mixed results, with a large placebo effect demonstrated in one.

Berreta et al. (2024) conducted a systematic review that followed PRISMA 2020 guidelines and included level I to IV human clinical studies that reported patient-reported outcomes after GAE for KOA. Overall, 17 studies that were published from 2015 to 2023 and comprised 533 individuals and 620 knees met the inclusion criteria. Mean ages ranged from 50.2 to 73.1 years, with follow-up durations of 6 to 24 months. The primary outcomes were changes in patient-reported pain and function scores at 12 months, as measured by the VAS, WOMAC, and KOOS instruments. Pooled MDs in VAS pain were -54.00 (-64.34, -43.66) at 4 to 6 weeks, -56.30 (-63.56, -49.04) at 3 to 4 months, -17.47 (-21.72, -13.22) at 6 months, -54.60 (-63.84, -45.36) at 12 months, and -58.00 (-62.75, -53.25) at 24 months ($p < 0.00001$ for all time points, except 12 months, $p = 0.0002$). The overall pooled MD in WOMAC pain scores was -33.38 (-34.49, -32.26; $p < 0.00001$). Transient adverse events occurred in up to 80% of individuals, most commonly skin discoloration and access site hematomas. The authors concluded that GAE results in short-term improvements in pain and function. They noted decreasing minimal clinically important difference achievement after 3 to 6 months, lower rates of achievement in severe osteoarthritis, and variable durability beyond 6 months, emphasizing the importance of precise selection of individuals for favorable outcomes. There are limitations, including significant procedural and protocol heterogeneity that contributed to variable outcomes and discordant findings among the included trials. Most of the evidence included single-arm studies, and the absence of control groups limited the ability to draw definitive conclusions regarding the efficacy of GAE. There were also measurement limitations due to inconsistent reporting and heterogeneity in outcome measures. The evidence base

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remains limited by the predominance of noncomparative, low-level studies as well as a paucity of high-level evidence comparing the outcomes of GAE with those of controls.

Chlorogiannis et al. (2024) conducted a systematic review and meta-analysis that evaluated the safety and efficacy of GAE for pain reduction in KOA. Eligible studies included adults who were over 18 years of age and underwent GAE with any embolic material and reported pain outcomes using the VAS, WOMAC, and KOOS scales and adverse events. Overall, 21 studies, comprising 633 individuals and 758 knees, were analyzed using random-effects models with inverse variance weighting. The primary end point was change in VAS score at 1 month, showing a weighted MD of -38.5 (95% CI, -44.9 to -32.0; $p < 0.05$) with high heterogeneity ($I^2 = 87\%$). Significant improvements were also observed at 3, 6, and 12 months, with MDs of -36.2 (95% CI, -43.0 to -29.5), -40.3 (95% CI, -49.0 to -31.7), and -40.5 (95% CI, -54.5 to -26.6), respectively. The authors concluded that GAE is safe and effective for pain relief in individuals with KOA, and the result was not affected by the type of embolic material used. Key limitations include considerable variability in study designs, procedural techniques, time points, and included populations with differing KOA severity, leading to high heterogeneity and making generalization of the comparisons challenging. Additionally, there is a lack of mid- and long-term outcome data because individuals were unblinded at 1 month when the sham group underwent GAE. Randomized studies that compare GAE with standard-of-care evidenced-based practices are still needed to confirm these findings.

A Hayes (2025a) review of seven clinical studies, two systematic reviews, and one clinical practice guideline found minimal or no/unclear support for using GAE as a treatment for KOA.

Plantar Fasciitis

Kumar et al. (2026) conducted a single-center retrospective study that evaluated the feasibility, safety, and effectiveness of superselective TAE for treating chronic plantar fasciitis that was refractory to conservative management. Overall, 12 adults (50% men; mean age, 36 years) with pain on palpation along the proximal plantar fascia and thickened fascia greater than 4 mm on magnetic resonance imaging were included. Patients with infection, coagulopathy, renal dysfunction, or prior foot surgery were excluded. Branches of the posterior tibial artery that were supplying the area of maximal pain were superselectively embolized using imipenem/cilastatin sodium. Pain was measured using the VAS at baseline and multiple follow-up points up to 12 months. Clinical success, which was defined as a 50% or greater reduction in the VAS score at 6 months, was achieved in eight of 11 patients (72.73%) and was sustained through 12 months of follow-up. The mean VAS score decreased from 7.36 ±0.92 at baseline to 2.27 ±1.19 on day 1 ($p < 0.0001$) and remained low at 12 months (2.64 ±1.50). Technical success was achieved in 11 of 12 patients (91.7%). There were no adverse events reported. The authors concluded that superselective TAE using imipenem/cilastatin sodium results in significant and sustained pain relief in chronic plantar fasciitis that is refractory to conservative management. They also noted that randomized trials that directly compare superselective with nonselective embolization are needed to establish the optimal TAE technique for chronic plantar fasciitis. Study limitations include the lack of a control group, small sample size, and short-term follow-up.

Tonkaz et al. (2026) conducted a single-center prospective study that evaluated the efficacy and safety of superselective embolization of the medial calcaneal artery in participants with chronic, treatment-resistant plantar fasciitis. Overall, 32 participants (17 female; 15 male; mean age, 47.3 ±9.1 years) were included. Participants with peripheral arterial disease, infection, neuropathy, or coagulopathy were excluded. All participants underwent superselective embolization of the medial calcaneal artery using imipenem/cilastatin, which was performed by two experienced interventional radiologists. Pain severity was assessed using the VAS, functional status with the Foot Function Index, and plantar fascia thickness using ultrasound. Measurements were taken at baseline and up to 6 months post procedure. The procedure provided rapid pain relief, improved foot function, reduced plantar fascia thickness, and no complications. The mean VAS score decreased from 7.3 ±0.7 to 1.3 ±0.5, functional status improved from 55.5 ±4.9 to 20.4 ±6.3, and plantar fascia thickness decreased from 5.2 ±0.6 mm to 3.7 ±0.3 mm at 6 months (all $p < 0.001$). The authors concluded that superselective embolization of the medial calcaneal artery using imipenem/cilastatin is a safe and effective minimally invasive option for chronic plantar fasciitis that is unresponsive to conservative treatments. Large, multicenter, prospective trials that include longer follow-up durations are needed to confirm these promising results and to establish standardized protocols for the use of embolization in treating plantar fasciitis. Key study limitations include the lack of a control group, small sample size, and short-term follow-up.

A Hayes (2025b) review of abstracts found very little published, peer-reviewed literature to evaluate the evidence of plantar fascia embolization for the treatment of plantar fasciitis. No systematic reviews, RCTs, or comparative studies were found.

Sasaki et al. (2024) conducted a retrospective, multicenter, single-arm study that evaluated ultrasound-guided intra-arterial embolization using temporary embolic material in patients with refractory unilateral plantar fasciitis. Eligible patients had local tenderness at the calcaneal attachment, plantar fascia thickness greater than 4 mm on ultrasound, and

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poor response to at least 2 months of conservative therapy. Overall, 72 patients were treated between January 2020 and February 2022, with six excluded for loss to follow-up, leaving 66 for analysis (56% women; mean age, 53 years). The mean follow-up period was 30.9 ±5.5 months (range, 24-49 months). The intervention involved percutaneous infusion of imipenem/cilastatin sodium into the posterior tibial artery, with technical success achieved in all cases and no major complications. Pain and function were assessed using the numeric rating scale and the American Orthopaedic Foot and Ankle Society score. The mean numeric rating scale pain score improved from 7.9 ±1.3 at baseline to 0.7 ±1.2 at the final follow-up ($p < 0.001$), and mean American Orthopaedic Foot and Ankle Society score increased from 65.8 ±13.9 to 96.1 ±5.8 ($p < 0.001$), with effects maintained for a mean of 30.9 months. The authors concluded that ultrasound-guided intra-arterial embolization can be a safe alternative to existing treatment options for recalcitrant plantar fasciitis. Study limitations include the retrospective design, lack of a control group, and small cohort size.

Gandhi et al. (2024) conducted a small case series that evaluated TAE using imipenem/cilastatin in participants with chronic plantar fasciitis that was refractory to conservative therapy. Ten participants, three of whom underwent bilateral procedures, for a total of 13 embolizations, were included after confirmation of plantar fasciitis by clinical examination, ultrasonography, and x-ray imaging. Eligibility required at least 3 months of failed conservative management, and exclusion criteria included local infection, coagulopathy, and recent trauma. The procedure involved ultrasound-guided femoral artery access, heparin administration, and digital subtraction angiography followed by embolization until hypervascular blush disappeared. Pain was assessed using the VAS at 1, 3, 6, and 12 months. The mean VAS score decreased from 8.5 ±0.52 at baseline to 1.0 ±0.00 at 12 months ($p = 0.001$). Technical success was achieved in 100% of procedures, and no complications were reported. The authors concluded that TAE is a minimally invasive technique, with benefits in individuals with plantar fasciitis whose pain is refractory to conservative and traditional therapies. Study limitations include the lack of a control group, very small sample size, and short-term follow-up. The authors acknowledged that this report does not constitute a properly designed clinical study.

Shoulder/Elbow

Allaw et al. (2026) conducted a systematic review and meta-analysis of cohort studies that evaluated TAE for adhesive capsulitis and related shoulder tendinopathies. The analysis included 12 single-arm studies that evaluated adults with refractory shoulder pain and restricted ROM after failed conservative therapy. The pooled sample included 329 shoulders (mean age, 54 years; 67% women) with adhesive capsulitis, which comprised 84% of cases. Pain reduction was the primary outcome, measured by validated scales (VAS, numeric rating scale, and Shoulder36) and analyzed using standardized mean change with random-effects models. Results showed pooled decreases in pain of -1.48 (95% CI, -2.00 to -0.97; $p < 0.0001$) at 15 to 30 days, -2.51 (95% CI, -3.16 to -1.87; $p < 0.0001$) at 31 to 90 days, and -2.59 (95% CI, -3.62 to -1.57; $p < 0.0001$) at 91 to 180 days. Technical success was 100%, with 94 adverse events (30%), which were mostly mild; 2.2% were moderate, and no severe events occurred. The authors concluded that TAE confers clinically significant, early, and sustained improvements in pain, shoulder mobility, and function for refractory adhesive capsulitis and related tendinopathies, with a favorable safety profile and no major adverse events. Key limitations include the predominance of single-arm designs that had small study populations and lacked control groups; short-term follow-up; and substantial clinical heterogeneity across individuals and treatment characteristics. Randomized trials are needed to confirm durability and comparative effectiveness.

Aly et al. (2023) conducted a systematic review that followed PRISMA guidelines to evaluate the efficacy and safety of TAE for chronic shoulder and elbow joint pain that was refractory to conventional treatment. Seven cohort studies (four prospective and three retrospective) that included 143 individuals and 149 cases were included, with considerable overlap with those that were included in Allaw et al. (2026), which is noted above. The authors came to similar conclusions and noted similar limitations.

Clinical Practice Guidelines

American Academy of Orthopaedic Surgeons (AAOS)

AAOS guidelines do not address arterial embolization in the recommendations for managing KOA (AAOS, 2021) or glenohumeral joint osteoarthritis (AAOS, 2020).

American College of Foot and Ankle Surgeons (ACFAS)

An ACFAS consensus statement on the diagnosis and treatment of adult acquired infracalcaneal heel pain does not address embolization as a treatment option for plantar fasciitis (Schneider et al., 2018).

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National Institute for Health and Care Excellence (NICE)

NICE guidelines (2021) state that evidence on the safety of GAE for pain from KOA shows no major safety concerns in the short term. Evidence on its efficacy and long-term safety is inadequate in quality and quantity. Therefore, this procedure should only be used in the context of research.

Society of Interventional Radiology (SIR)

A SIR position paper (Ahmed et al., 2026) on GAE for symptomatic KOA states that clinical studies support safety and technical feasibility, with consistent improvements in pain, function, and quality of life; however, further studies are needed to define long-term durability, optimal embolic selection, and comparative effectiveness of GAE.

- GAE is supported by a growing body of evidence that demonstrates clinically meaningful reductions in pain and improvements in function in appropriately selected patients with symptomatic KOA.
- GAE has a favorable safety profile when performed by interventional specialists with formal training and advanced experience in microcatheter work and embolotherapies.
- GAE should be offered as a minimally invasive treatment option for patients with symptomatic KOA who have experienced failure of conservative therapy and/or are either ineligible for, unwilling to undergo, or seeking to delay total knee arthroplasty.
- Ongoing RCTs aim to quantify potential placebo effects and further define the long-term durability, optimal embolic selection, and comparative effectiveness of GAE.
- GAE should be performed in multidisciplinary care pathways and reported using standardized outcome measures that are consistent with the SIR Research Reporting Standards.

SIR also published a consensus document that suggests reporting standards for future research (Ahmed et al., 2024).

U.S. Food and Drug Administration (FDA)

This section is to be used for informational purposes only. FDA approval alone is not a basis for coverage.

Vascular embolization is a procedure and therefore not subject to FDA regulation. However, the devices and embolic agents used are subject to FDA oversight. Search the following website for additional information: https://www.accessdata.fda.gov/scripts/cdrh/cfdocs/cfPMN/pmn.cfm. (Accessed May 13, 2026)

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Policy History/Revision Information

Date	Summary of Changes
12/01/2026	• New Medical Policy

Instructions for Use

This Medical Policy provides assistance in interpreting UnitedHealthcare standard benefit plans. When deciding coverage, the member specific benefit plan document must be referenced as the terms of the member specific benefit plan may differ from the standard plan. In the event of a conflict, the member specific benefit plan document governs. Before using this policy, check the member specific benefit plan document and any applicable federal or state mandates. UnitedHealthcare reserves the right to modify its policies and guidelines as necessary. This Medical Policy is provided for informational purposes. It does not constitute medical advice.

This Medical Policy may also be applied to Medicare Advantage plans in certain instances. In the absence of a Medicare National Coverage Determination (NCD), Local Coverage Determination (LCD), or other Medicare coverage guidance, CMS allows a Medicare Advantage Organization (MAO) to create its own coverage determinations, using objective evidence-based rationale relying on authoritative evidence (Medicare IOM Pub. No. 100-16, Ch. 4, §90.5).

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