Endobronchial brachytherapy may be considered medically necessary in the following clinical situations:

- In patients with primary endobronchial tumors who are not otherwise candidates for surgical resection or external-beam radiotherapy due to comorbidities or location of the tumor.
- As a palliative therapy for airway obstruction or severe hemoptysis in patients with primary, metastatic, or recurrent endobronchial tumors.

Other applications of endobronchial brachytherapy are investigational including, but not limited to, its use as a radiation “boost” to curative external-beam radiotherapy, as a treatment for asymptomatic recurrences of non-small-cell lung cancer, or in the treatment of hyperplastic granulation tissue.

Endobronchial brachytherapy is a multistep procedure requiring a series of radiation oncology CPT codes for radiation treatment planning, radiation physics, treatment delivery, and clinical treatment management. CPT codes 77761-77787 describe various types of radiation source application; these codes are used to describe the brachytherapy delivery. Unlike other types of radiotherapy, endobronchial brachytherapy requires the services of a radiation oncologist, and a pulmonologist or other physician to perform the bronchoscopy and insert the catheter.

There is a CPT code that specifically identifies the catheter placement:

31643 Bronchoscopy (rigid or flexible); with placement of catheter(s) for intracavitary radioelement application.

BLUECARD/NATIONAL ACCOUNT ISSUES

State or federal mandates (eg, Federal Employee Program) may dictate that certain U.S. Food and Drug Administration–approved devices, drugs, or biologics may not be considered investigational, and thus these devices may be assessed only by their medical necessity.
BACKGROUND

ENDOBRONCHIAL LESIONS

Brachytherapy
Endobronchial brachytherapy has been primarily investigated as a palliative treatment of obstructing primary or metastatic tumors, particularly in non-small-cell lung cancer. Endobronchial brachytherapy has also been used as a tool in curative treatment for some primary bronchial and tracheal tumors. Two to 4 fractions delivered weekly is a typical schedule. Median overall survival of patients with obstructing endobronchial tumors is typically less than 9 months.

In the outpatient setting, the patient receives local anesthesia and monitored sedation. A flexible bronchoscope is passed transnasally; a separate port on the bronchoscope allows passage of the afterloading catheter to the target lesion. Once the catheter is placed, the radioisotope can be administered by the high-dose-rate radiotherapy afterloading machine. Patients with potential airway compromise due to bleeding may require treatment with a rigid bronchoscope, which requires general anesthesia and frequently an overnight stay.

Other Treatments
Endobronchial brachytherapy is an approach to the local treatment of endobronchial lesions. Other technologies include electrocoagulation, cryosurgery, laser resection, endosurgery, and endobronchial stent placement. In some instances, the therapies may be used together, such as laser therapy for initial debulking followed by brachytherapy.

REGULATORY STATUS
Several bronchoscopes (Food and Drug Administration product code: EOQ) and remote-controlled afterload/radionuclide applicator systems (Food and Drug Administration product code: JAQ) have been cleared for marketing by the Food and Drug Administration through the 510(k) process. Examples of both include the Video Sciences BRS-5000 Video Bronchoscopy with EndoSheath System (Vision-Sciences) and microSelectron (Nucletron), respectively.

RATIONALE
This evidence review was created in March 1999 and has been updated regularly with searches of MEDLINE database. The most recent literature update was performed through May 10, 2018

Evidence reviews assess the clinical evidence to determine whether the use of a technology improves the net health outcome. Broadly defined, health outcomes are length of life, quality of life, and ability to function—including benefits and harms. Every clinical condition has specific outcomes that are important to patients and to managing the course of that condition. Validated outcome measures are necessary to ascertain whether a condition improves or worsens; and whether the magnitude of that change is clinically significant. The net health outcome is balance of benefits and harms.

To assess whether the evidence is sufficient to draw conclusions about the net health outcome of a technology, 2 domains are examined: the relevance and the quality and credibility. To be relevant, studies must represent one or more intended clinical use of the technology in the intended population and compare an effective and appropriate alternative at a comparable intensity. For some conditions, the alternative will be supportive care or surveillance. The quality and credibility of the evidence depend on study design and conduct, minimizing bias and confounding that can generate incorrect findings. The randomized controlled trial (RCT) is preferred to assess efficacy; however, in some circumstances, nonrandomized studies may be adequate. RCTs are rarely large enough or long enough to capture less
common adverse events and long-term effects. Other types of studies can be used for these purposes and to assess generalizability to broader clinical populations and settings of clinical practice.

**ENDBRONCHIAL BRACHYTHERAPY AS PALLIATIVE TREATMENT**

**Clinical Context and Test Purpose**
The purpose of endobronchial brachytherapy for palliation of patients who have obstructive lesions is to provide a treatment option that is an alternative to or an improvement on existing therapies.

The question addressed in this evidence review is: Does the use of endobronchial brachytherapy in the treatment of non-small-cell lung cancer (NSCLC) improve the net health outcome?

The following PICOTS were used to select literature to inform this review.

**Patients**
The relevant population of interest is patients with recurrent or metastatic tumors of the bronchus who are experiencing obstructive symptoms such as dyspnea, cough, hemoptysis, and postobstructive pneumonia.

Many patients with NSCLC are initially treated with external-beam radiotherapy (EBRT) but ultimately experience local recurrence. Many are not candidates for additional EBRT due to limited tolerance of normal tissue.

**Interventions**
The test being considered is endobronchial brachytherapy.

**Comparators**
The following practices and treatments are currently being used to treat obstructive lesions of the bronchus: EBRT, laser resection, and surgical resection.

**Outcomes**
The general outcomes of interest are overall survival (OS), symptoms, morbid events, and treatment-related morbidity. Specific benefits include palliation of obstructive symptoms, avoidance of blood loss due to hemoptysis, and avoidance of adverse events associated with more invasive therapies. Specific harms may be early due to immediate procedure-related complications. Late-occurring and the most serious complications described for endobronchial brachytherapy are massive hemoptysis, the formation of tracheoesophageal fistulas, bronchospasm, bronchial stenosis, radiation bronchitis, and palliative care.

**Timing**
The duration of follow-up for advanced malignant lesions treated with endobronchial brachytherapy is weeks to months.

**Setting**
Endobronchial brachytherapy would be administered in an inpatient or outpatient hospital setting equipped for monitored anesthesia and handling of radionuclide products.

**Systematic Reviews**
The best available evidence consists of systematic reviews, several small prospective trials, and case series.
A comparative effectiveness review by Ratko et al (2013), prepared for the Agency for Healthcare Research and Quality, assessed local nonsurgical therapies for symptomatic obstructive NSCLC.² For patients with an obstruction due to inoperable NSCLC, 4 RCTs (n=268 patients) examined endobronchial brachytherapy alone or in combination with EBRT or Nd-YAG laser therapy for palliative or curative intent. All RCTs were determined to be of poor quality. Seven single-arm studies (n=740 patients) examined endobronchial brachytherapy alone or in combination with EBRT, stent placement, or chemotherapy plus photodynamic therapy for palliative or curative intent. The evidence was considered “insufficient to permit conclusions on the comparative effectiveness of local nonsurgical therapies for ... inoperable NSCLC patients with endoluminal tumor causing pulmonary symptoms.”

A 2008 Cochrane review (updated in 2012) assessing palliative endobronchial brachytherapy for NSCLC analyzed 13 RCTs but did not conduct meta-analyses because of heterogeneity in the doses of radiotherapy delivered, patient characteristics, and outcomes measured.¹³ Reviewers concluded that EBRT alone was more effective for palliation of symptoms than endobronchial brachytherapy alone. Findings did not provide conclusive evidence that endobronchial brachytherapy plus EBRT improved symptom relief, reduced complication rates, or extended survival compared with EBRT alone. Additionally, reviewers did not find sufficient evidence to recommend endobronchial brachytherapy as an add-on to first-line EBRT, chemotherapy, or Nd-YAG laser palliative treatment. For patients previously treated with EBRT who remain symptomatic, endobronchial brachytherapy was considered an option.

Ung et al (2006) conducted a systematic review of endobronchial brachytherapy for palliative treatment of NSCLC.⁴ Based on 29 studies, including 6 randomized trials, reviewers also concluded that EBRT alone was more effective than endobronchial brachytherapy alone for symptom palliation in previously untreated patients. Unlike the Cochrane reviews, however, the Ung review concluded that endobronchial brachytherapy plus EBRT seems to provide better symptom relief than EBRT alone, yet the final recommendation was to use endobronchial brachytherapy only for symptomatic recurrent endobronchial obstruction after EBRT.

Randomized Controlled Trials
Mallick et al (2006), in a prospective randomized trial from India (N=45), suggested that endobronchial brachytherapy alone and endobronchial brachytherapy plus EBRT have similar efficacy and safety profiles in the palliative management of NSCLC.⁵

Nonrandomized Studies
Goldberg et al (2015) reported on a prospective, observational cohort study evaluating the quality of life and symptom-related outcomes for 98 patients with locally advanced inoperable lung cancer receiving high-dose rate (HDR) endobronchial brachytherapy.⁶ Patients were followed every 3 months for 1 year. Most (78%) were treated for a newly diagnosed disease that was inoperable at diagnosis. The OS rate was 13.4% at 12 months. Endobronchial brachytherapy was not associated with longer OS or improved quality of life, compared with chemotherapy or EBRT, in multivariable analyses.

Ozkok et al (2008) published a case series from Turkey on the use of HDR endobronchial brachytherapy for palliation of symptoms in 158 patients with 3 lung cancer profiles.⁷ Group A comprised 43 patients with stage IIIA or IIIB NSCLC, who received endobronchial brachytherapy plus EBRT; group B comprised 74 previously untreated patients with incurable, locally advanced lung cancer; and group C comprised 41 patients with symptomatic endobronchial recurrences who had previously received full-dose radiotherapy. Participants in group A were from a previously reported prospective trial by Gejerman et al (2002)⁸; data from these participants were reanalyzed for symptom palliation in the Ozkok report. Not all patients received the intended number of fractions due to patient refusal or deterioration in performance status. A few patients required more than the prescribed doses due to repetitive...
obstructive symptoms. Response rates for a cough, dyspnea, and hemoptysis were measured using the Speiser Symptom Index scoring system. Response rates in group A were 58% for cough (30% complete response [CR]), 77% for dyspnea (76% CR), and 100% for hemoptysis (92% CR). Groups B and C had CR rates of 57% and 55% for a cough and 90% and 78% for dyspnea, respectively. Eighteen (11%) patients died of hemoptysis, with a median time to an event of 7 months. Significant prognostic factors for fatal hemoptysis were the use of brachytherapy intended as a treatment (as opposed to palliation, p<0.001), total radiobiologic equivalent dose (p<0.001), and the number of HDR endobronchial brachytherapy fractions (p<0.001). The authors concluded that HDR endobronchial brachytherapy was effective for palliation of symptoms related to inoperable lung cancer, either alone or in combination with EBRT. They cautioned that optimal dose, fractionation, and combination schedule with EBRT were unknown.

Although endobronchial brachytherapy is often used to palliate hemoptysis, historically, there has been concern about an observed association between treatment with endobronchial brachytherapy and fatal hemoptysis. The largest study retrospectively reviewed 938 patients treated with external irradiation and/or endobronchial brachytherapy for inoperable NSCLC. In this study, Langendijk et al (1998) reported that 101 (10.8%) patients died from massive hemoptysis; 78 (77%) of those who died had clinical or radiologic evidence of tumor progression while 23 (23%) did not. On multivariate analysis, intrabronchial tumor extension in the main bronchus, hemoptysis before radiotherapy, and tumor location in the upper bronchus were independently associated with massive hemoptysis. A dose-response relation between fraction dose and massive hemoptysis also was found; in all subgroups, higher incidence of massive hemoptysis was seen after fraction dose of 15 gray (Gy). These data were largely consistent with data from Hennequin et al (1998) who reported that hemoptysis was most likely due to disease progression, with brachytherapy facilitating bleeding, rather than directly causing bleeding. However, for tumors located in the upper lobes, brachytherapy may be causal. Tumor location was cited as the most important factor in predicting pulmonary hemoptysis in a case series reported by Bedwinek et al (1992), in which 32% of patients died of massive hemoptysis after brachytherapy.

Dagnault et al (2010) retrospectively reviewed 81 patients treated with brachytherapy for symptom palliation due to endobronchial primary lung tumors or metastases. Between 2002 and 2007, 81 patients who were not candidates for surgery or EBRT because of poor respiratory function, medical comorbidities, or previous treatment with thoracic radiation or surgery, were treated at a single institution. Mean patient age was 66 years (range, 39-87 years). Previous treatment included surgical resection of the primary tumor in 58% of patients, lung radiotherapy in 44%, and chemotherapy in 41%. After endobronchial brachytherapy, patients were followed until death or loss to follow-up. Patient characteristics included 59 (73%) with a lung primary and the remainder with metastatic disease, including primary colorectal cancer (13%), kidney, gynecologic, or head and neck cancers (4% each), and other cancers (2%). Presenting symptoms included dyspnea (66%), cough (47%), hemoptysis (28%), and no symptoms (6%). After brachytherapy, major symptomatic improvement was seen in most patients: dyspnea improved during or shortly after the end of treatment in 85% of patients; hemoptysis stopped in all 23 patients; a cough improved in 77% of patients, and 18% remained stable. At 6-week follow-up, 72% of tumors were evaluable for bronchoscopic response. A visible bronchoscopic response was evident in 77 patients; for 42 (52%) of 81 patients, the tumor shrank significantly during treatment. Median survival was 14.7 months; local progression-free survival (PFS) was 77% at 12 months and 64% at 24 months. For comparison, authors stated that OS estimates for most patients with inoperable endobronchial tumors or metastases were less than 6 months. The incidence of complications was low, and all complications resolved.
Guarnaschelli et al (2010) reviewed treatment outcomes of 52 patients with recurrent endobronchial tumors who underwent palliative HDR endobronchial brachytherapy between 1995 and 2005 at a single institution. Objective response was assessed by bronchoscopy and chest computed tomography, and subjective clinical response by patient reports. All patients had histologically confirmed bronchogenic carcinoma, recurrent or persistent symptoms (hemoptysis, cough, dyspnea, or postobstructive pneumonia), previous definitive EBRT, and bronchoscopic evidence of endobronchial obstruction. The mean patient age was 63 years (range, 41-83 years); 37% of patients were women. Tumor histology was non-small-cell in 77% of patients, small cell in 13%, adenoid cystic in 2%, and metastatic in 2%. Patient symptoms before brachytherapy included dyspnea on exertion (79%), cough (89%), hemoptysis (62%), wheezing (52%), dysphagia (8%), chest pain (15%), and shortness of breath (83%). Symptomatic improvement was defined as significant if there was an improvement in 2 or more symptoms and mild if only 1 symptom improved. Forty-eight (92%) patients showed symptom reductions. One patient had worsening hemoptysis, and 2 (4%) of 52 patients did not return for assessment. Median time to symptom relapse after the first fraction of brachytherapy was 6 months (range, 1 to >6 months). Complete or partial tumor regression was confirmed in 44 (85%) patients on repeat bronchoscopy. For the entire cohort, median follow-up was 31 months, and median actuarial OS from the first brachytherapy session was 7 months (range, 0-55 months). Fifty (96%) patients tolerated treatment without acute, treatment-related complications. Significant treatment-related complications (grade 3 or 4) were reported as possibly occurring in 2 (4%) patients: one developed a pneumothorax 6 weeks after brachytherapy, and another died from hemoptysis 48 hours after treatment (it was unknown whether hemoptysis was due to brachytherapy or to the erosion of tumor into a blood vessel).

Section Summary: Endobronchial Brachytherapy as Palliative Treatment
Single-arm series and RCTs summarized in systematic reviews comprise the evidence base for use of endobronchial brachytherapy with palliative intent for NSCLC. Overall, the RCTs were assessed as low-quality, and there is no evidence that endobronchial brachytherapy improved survival. However, the single-arm studies suggested that endobronchial brachytherapy reduced symptoms (pulmonary obstruction, hemoptysis), particularly in patients not candidates for EBRT.

ENDOBRONCHIAL BRACHYThERAPY AS PRIMARY TREATMENT

Clinical Context and Test Purpose
The purpose of endobronchial brachytherapy as primary treatment for patients who have NSCLC is to provide a treatment option that is an alternative to or an improvement on existing therapies.

The question addressed in this evidence review is: Does the use of endobronchial brachytherapy as primary treatment of NSCLC improve the net health outcome?

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest is patients with early-stage endobronchial tumors who are not candidates for surgical resection or EBRT due to comorbidities or tumor location. Most studies have been case series, which have reported CR rates of 50% to 80%.14-16

Interventions
The test being considered is endobronchial brachytherapy as first-line treatment.

There also have been investigations using brachytherapy to deliver a focused radiation boost to patients undergoing curative EBRT. Because patients usually present with surgically unresectable disease and
because NSCLC is unresponsive to chemotherapy, the primary treatment for most patients with NSCLC is typically EBRT.

Comparators
The following practices and treatments are currently being used to treat NSCLC: EBRT and surgical resection.

Outcomes
The general outcomes of interest are OS, symptoms, morbid events, and treatment-related morbidity. Specific benefits include avoidance of blood loss due to hemoptysis and avoidance of adverse events associated with more invasive therapies. Specific harms may be early due to immediate procedure-related complications. Late-occurring and the most serious complications described for endobronchial brachytherapy are massive hemoptysis, the formation of tracheoesophageal fistulas, bronchospasm, bronchial stenosis, radiation bronchitis, and palliative care.1

Timing
The duration of follow-up for early-stage lesions treated with endobronchial brachytherapy is 1 to 5 years.

Setting
Endobronchial brachytherapy would be administered in an inpatient or outpatient hospital setting equipped for monitored anesthesia and handling of radionuclide products.

Case Series
Aumont-le Guilcher et al (2011) reported on 226 patients with primary NSCLC (endobronchial only) who underwent HDR brachytherapy because of contraindications to surgery and EBRT.17 The patient sample comprised 223 men and 3 women from 9 institutions; mean age was 62 years (range, 40-84 years). Tumor histology was squamous cell carcinoma in 96%, adenocarcinoma in 2%, and other in 2%. Response to HDR brachytherapy at 2 to 3 months was classified as a complete histologic response (disappearance of the lesion by bronchoscopy and negative biopsy), complete macroscopic response (disappearance of the lesion but no biopsy), partial response (>50% decrease in endobronchial tumor volume), or progression (increase in endobronchial tumor volume or tumor visible on computed tomography scan). At 3 months, complete local response was observed in 213 (94%) patients, and in 137 patients with biopsies, 126 (91%) had a CR. Also, 7 patients had tumor progression, 5 had a partial response, and 1 had stable disease. The OS rate was 57% at 2 years and 29% at 5 years. Median survival was 28.6 months. The cancer-specific survival rate was 81% at 2 years and 56% at 5 years. Complications led to treatment interruption in 4.5% of patients. Fatal complications (most commonly fatal hemoptysis) occurred in 6% of patients.

Skowronek et al (2013) reported on a small cohort of 34 patients in Poland who had stage IB, II, or III lung cancer (74% squamous cell carcinoma histology; all distant metastasis-free) and had undergone lobar resection.18 Thirteen (38%) patients developed postoperative recurrence in the bronchial stump, and 21 (72%) patients had histopathologically positive margins after nonradical resection. All patients had dyspnea and cough, and 8 (24%) patients had hemoptysis. Median patient age was 57 years (range, 47-73 years). Median time to recurrence after surgery was 11 months. It was not specified whether patients were candidates for reoperation. Nine patients received HDR endobronchial brachytherapy (total dose, 12 Gy) in combination with EBRT (total dose, 50 Gy), and 25 patients received brachytherapy alone (total dose, 30 Gy). At 1 month, complete local and radiologic response was observed in 25 (74%) patients, with 100% CR in the nonradical surgery group. All partial responses occurred in the recurrent...
tumor group (9 [69%] of 13 patients). Median OS for the entire cohort was 19 months. With a median follow-up of 2 years, the 2-year OS rate was 15% in the group with recurrent tumor and 48% in the nonradical resection group (p=0.05). Adverse events were not reported.

Rochet et al (2013) reported on a cohort of 35 patients in Germany who had stage I, II, or III inoperable NSCLC (31% squamous cell carcinoma histology; all distant metastasis-free) and received primary treatment with HDR endobronchial brachytherapy (median total dose, 15 Gy) in combination with EBRT (median total dose, 50 Gy). Mean age was 64 years (range, 45-75 years). With a median follow-up of 26 months, median OS was 39 months. One-, 2-, and 5-year OS rates were 76%, 61%, and 28%, respectively. Median PFS and local PFS were 17 months and 42 months, respectively. In patients without mediastinal node involvement, the 5-year local PFS rate was 56% and 11% with positive mediastinal nodes (p=0.008). Grade 3 adverse events were hemoptysis in 2 patients and necrosis in 1 patient. Fatal hemoptysis in 1 patient resulted from tumor recurrence.

Hosni et al (2016) reported on a series of 10 patients with endobronchial tumors treated at a single center with endobronchial brachytherapy with curative intent, with (n=8) or without (n=2) EBRT. Among the 10 patients treated with curative intent, median follow-up was 17 months. For these patients, the 2-year local control rate was 89% (95% confidence interval, 79% to 99%) and the 2-year OS rate was 67% (95% confidence interval, 51% to 83%). Given the high rate of combination therapy, it is difficult to draw conclusions about brachytherapy alone.

Section Summary: Endobronchial Brachytherapy as Primary Treatment
For primary treatment (ie, with intent to improve survival outcomes), the effects of endobronchial brachytherapy on survival outcomes compared with alternative therapies are not well-defined. Additional comparative data are needed.

ENDOBRONCHIAL BRACHYTHERAPY TO TREAT HYPERPLASTIC GRANULATION TISSUE

Clinical Context and Test Purpose
The purpose of endobronchial brachytherapy in patients who have hyperplastic granulation tissue is to provide a treatment option that is an alternative to or an improvement on existing therapies.

The question addressed in this evidence review is: Does the use of endobronchial brachytherapy in the treatment of hyperplastic granulation tissue improve the net health outcome?

The following PICOTS were used to select literature to inform this review.

Patients
The relevant population of interest is patients with hyperplastic granulation tissue causing recurrent airway stenosis after lung transplantation or stent placement.

Interventions
The test being considered is endobronchial brachytherapy.

Comparators
The following practices and treatments are currently being used to treat obstructive lesions of the bronchus: surgical resection and other endobronchial therapies.

Outcomes
The general outcomes of interest are symptoms, morbid events (eg, recurrence of central airway obstructions), and treatment-related morbidity. Specific benefits include avoidance of blood loss due to
hemoptysis and avoidance of adverse events associated with more invasive therapies. Specific harms may be early due to immediate procedure-related complications.

**Timing**
The duration of follow-up for hyperplastic granulation tissue treated with endobronchial brachytherapy is weeks to months.

**Setting**
Endobronchial brachytherapy would be administered in an inpatient or outpatient hospital setting equipped for monitored anesthesia and handling of radionuclide products.

**Case Series**
Tendulkar et al (2008) reported on a case series assessing endobronchial brachytherapy in 8 patients after excision of obstructive granulation tissue; 6 (75%) patients showed a good or excellent subjective early response for the first 6 months. In another case series, Madu et al (2006) used endobronchial brachytherapy to treat 5 patients with benign, post–lung transplantation granulation tissue refractory to multiple other bronchoscopic interventions. After a median follow-up of 12 months, 3 (60%) of 5 patients had marked symptom improvement.

Rahman et al (2010) reported on long-term follow-up for 115 patients who underwent various flexible bronchoscopic therapeutic modalities for the management of benign tracheal stenosis between 2001 and 2009. HDR endobronchial brachytherapy was used in cases defined as requiring 3 or more interventions within 6 months due to refractory stent-related granulation tissue formation. All patients presented with signs and symptoms of upper airway obstruction, including shortness of breath, stridor, cough, dyspnea, and wheezing. Stents were placed in 33 patients to restore airway patency, and 28 of them underwent brachytherapy to prevent granulation tissue reformation. All 28 experienced a reduction in therapeutic bronchoscopic procedures after brachytherapy compared with the pretreatment period; no further details about response duration or other outcomes were reported. There were no treatment-related complications. Small sample size and concerns about outcomes reporting limit conclusions that can be drawn from this series.

**Section Summary: Endobronchial Brachytherapy to Treat Hyperplastic Granulation Tissue**
The evidence for endobronchial brachytherapy for hyperplastic granulation tissue is limited by sample sizes. The available case series also typically included endobronchial brachytherapy as part of multimodal management, making it difficult to assess the specific contribution of brachytherapy.

**SUMMARY OF EVIDENCE**
For individuals with NSCLC with airway obstruction or severe hemoptysis who receive endobronchial brachytherapy as palliative treatment, the evidence includes single-arm series and RCTs summarized in systematic reviews. Relevant outcomes are overall survival, symptoms, morbid events, and treatment-related morbidity. Overall, the RCTs were assessed as low-quality and provided no evidence that endobronchial brachytherapy improves survival. However, the single-arm studies have suggested that endobronchial brachytherapy reduces symptoms (pulmonary obstruction, hemoptysis), particularly in patients who are not candidates for EBRT. If symptoms persist after EBRT, endobronchial brachytherapy is well-accepted as short-term palliation for symptoms such as hemoptysis, cough and dyspnea, and resolution of obstructive atelectasis or pneumonitis. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

For individuals with non NSCLC who receive endobronchial brachytherapy as primary treatment, the evidence includes single-arm series. Relevant outcomes are overall survival, symptoms, morbid events,
and treatment-related morbidity. For primary treatment (ie, with intent to improve survival outcomes), the effects of endobronchial brachytherapy on survival outcomes compared with alternative therapies are not well-defined. Additional comparative data are needed. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals with endobronchial hyperplastic granulation tissue who receive endobronchial brachytherapy, the evidence includes case series. Relevant outcomes are symptoms, morbid events, and treatment-related morbidity. The evidence for endobronchial brachytherapy for hyperplastic granulation tissue is limited. The available case series typically include endobronchial brachytherapy as part of multimodal management, making it difficult to assess the specific contribution of brachytherapy. The evidence is insufficient to determine the effects of the technology on health outcomes.

SUPPLEMENTAL INFORMATION

PRACTICE GUIDELINES AND POSITION STATEMENTS

National Comprehensive Cancer Network Guidelines (v.4.2018) for non-small-cell lung cancer includes external-beam radiotherapy and brachytherapy as treatment options for severe hemoptysis in locoregional recurrent disease (category 2A).24

American College of Radiology et al

The American College of Radiology (ACR) made a number of recommendations in 2013 and 2014 on use of radiotherapy and nonsurgical treatments of lung cancer.

- For nonsurgical treatment of non-small-cell lung cancer in patients with poor performance status or for palliative intent, ACR considered endobronchial brachytherapy “useful for patients with symptomatic endobronchial tumors.”25
- For nonsurgical treatment of non-small-cell lung cancer in patients with good performance status or for definitive intent (no distant metastases), ACR considered endobronchial brachytherapy not appropriate.26 Endobronchial brachytherapy may be appropriate in combination with external-beam radiotherapy (EBRT) for patients who are symptomatic due to endoluminal obstruction (eg, postobstructive pneumonia).25
- Endobronchial brachytherapy was not included in appropriateness criteria for radiotherapy of small cell lung cancer.27

Practice guidelines published jointly by ACR and the American Brachytherapy Society in 2017 addressed the use of high-dose-rate brachytherapy (≥12 gray per hour) in the treatment of multiple medical conditions, including malignancies in the endobronchial region.28 The guidelines cited studies on the use of high-dose-rate brachytherapy as palliative care and as primary care and noted that brachytherapy might be combined with EBRT.

Both groups also published guidelines in 2017 on the use of low-dose-rate radionuclide brachytherapy, defined as treatment between 4 and 200 centigray per hour.29 The guidelines considered low-dose-rate brachytherapy an appropriate treatment for a number of malignancy types, including those found in the bronchus or trachea. Such treatment may be especially appropriate when used to augment EBRT, or when the target volume may be defined.

Both sets of joint guidelines provided a standard for procedural protocol, as well as a summary of the potential treatment sites of the respective types of brachytherapy.
American College of Chest Physicians
Guidelines on the treatment of a cough as a symptom of lung cancer from the American College of Chest Physicians were updated in 2017.\textsuperscript{30} The systematic review used to inform the guidelines included a number of low-quality studies and the strength of the recommendations was diminished, accordingly. Acknowledging a lack of studies about the effect of brachytherapy on specific lung cancer symptoms (eg, cough), the College recommended that endobronchial brachytherapy be used in patients who cannot receive surgery, chemotherapy, or EBRT (grade 2C evidence). Citing the accompanying risk of side effects such as hemoptysis, the College suggested that a pharmacologic therapy trial be considered initially, or, if endobronchial brachytherapy is used, that caregivers administer the lowest dose.

American Brachytherapy Society
The Society (2016) issued consensus guidelines on thoracic brachytherapy for lung cancer.\textsuperscript{31} The guidelines included the following recommendations:

- As palliative care for patients with central, obstructive lesions, particularly those who have previously received EBRT.
- Alone or in combination with “endobronchial resection, laser therapy, stenting, and photodynamic therapy.”
- As either “high dose rate or pulsed dose rate with the ability to optimize dose” (low dose rate not recommended).

U.S. PREVENTIVE SERVICES TASK FORCE RECOMMENDATIONS
Not applicable.

MEDICARE NATIONAL COVERAGE
There is no national coverage determination. In the absence of a national coverage determination, coverage decisions are left to the discretion of local Medicare carriers.

ONGOING AND UNPUBLISHED CLINICAL TRIALS
Some currently unpublished trials that might influence this review are listed in Table 1.

Table 1. Summary of Key Trials

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NCT: national clinical trial.
REFERENCES


**CODES**

<table>
<thead>
<tr>
<th>Codes</th>
<th>Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPT</td>
<td>31643</td>
<td>Bronchoscopy (rigid or flexible); with placement of catheter(s) for intracavitary radioelement application</td>
</tr>
</tbody>
</table>
### Endobronchial Brachytherapy

<table>
<thead>
<tr>
<th>Code Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>77316-77318</td>
<td>Brachytherapy isodose plan; code range</td>
</tr>
<tr>
<td>77761-77763</td>
<td>Intracavitary radiation source application; code range</td>
</tr>
<tr>
<td>77770-77772</td>
<td>Remote afterloading high dose rate radionuclide brachytherapy interstitial or intracavitary; code range</td>
</tr>
<tr>
<td>77790</td>
<td>Supervision, handling, loading of radiation source</td>
</tr>
</tbody>
</table>

**HCPCS**
- No code

**ICD-10-CM**
- C34.00-C34.92: Malignant neoplasm of bronchus lung, code range
- C78.00-C78.02: Secondary malignant neoplasm of lung, code range
- D02.20-D02.22: Carcinoma in situ of bronchus and lung, code range

**ICD-10-PCS**
- ICD-10-PCS codes are only used for inpatient services. There is no specific ICD-10-PCS code for this procedure.

<table>
<thead>
<tr>
<th>Code Range</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0BH01Z,</td>
<td>Surgical, respiratory system, insertion, tracheobronchial tree, radioactive element, code by approach (open, percutaneous, percutaneous endoscopic, via natural or artificial opening, or via natural or artificial opening endoscopic)</td>
</tr>
<tr>
<td>0BH031Z,</td>
<td></td>
</tr>
<tr>
<td>0BH041Z,</td>
<td></td>
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<tr>
<td>0BH071Z,</td>
<td></td>
</tr>
<tr>
<td>0BH081Z,</td>
<td></td>
</tr>
<tr>
<td>0BH01Z,</td>
<td>Surgical, respiratory system, insertion, radioactive element, code by body part (right lung or left lung) and approach (open, percutaneous, percutaneous endoscopic, via natural or artificial opening, or via natural or artificial opening endoscopic)</td>
</tr>
<tr>
<td>0BH031Z,</td>
<td></td>
</tr>
<tr>
<td>0BH041Z,</td>
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<td>0BH071Z,</td>
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<td></td>
</tr>
<tr>
<td>0BH081Z,</td>
<td></td>
</tr>
</tbody>
</table>

**Type of service**
- Radiation therapy

**Place of service**
- Inpatient/outpatient

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### POLICY HISTORY

<table>
<thead>
<tr>
<th>Date</th>
<th>Action</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02/13/14</td>
<td>Replace policy</td>
<td>Policy updated with literature search through January 20, 2014; references 15, 20-21, and 27-28 added; reference 25 updated. No changes to policy statements.</td>
</tr>
<tr>
<td>01/18/17</td>
<td>Replace policy</td>
<td>Policy updated with literature review through November 9, 2016; references 7, 22, and 31 added. Policy statements unchanged.</td>
</tr>
<tr>
<td>12/27/17</td>
<td>Replace policy</td>
<td>Blue Cross of Idaho adopted changes as noted. Policy updated with literature review through November 7, 2017; references 31-33 added; reference 26 updated. Policy statements unchanged.</td>
</tr>
<tr>
<td>07/25/18</td>
<td>Replace policy</td>
<td>Blue Cross of Idaho adopted changes as noted. Policy updated with literature review through May 10, 2018; no references added. Reference 24 updated. Policy statements unchanged.</td>
</tr>
</tbody>
</table>

Original Policy Date: March 1999