Percutaneous Vertebroplasty and Sacroplasty

Policy Number: 6.01.25
Origination: 2/2001
Last Review: 11/2017
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Policy
Blue Cross and Blue Shield of Kansas City (Blue KC) will provide coverage for percutaneous vertebroplasty when it is determined to be medically necessary because the criteria shown below are met.

When Policy Topic is covered
Percutaneous vertebroplasty may be considered medically necessary for the treatment of symptomatic osteoporotic vertebral fractures that have failed to respond to conservative treatment (e.g., analgesics, physical therapy and rest) for at least 6 weeks.

Percutaneous vertebroplasty may be considered medically necessary for the treatment of symptomatic osteoporotic vertebral fractures that are less than 6 weeks in duration that have led to hospitalization or persist at a level that prevents ambulation.

Percutaneous vertebroplasty may be considered medically necessary for the treatment of severe pain due to osteolytic lesions of the spine related to multiple myeloma or metastatic malignancies.

When Policy Topic is not covered
Percutaneous vertebroplasty is considered investigational for all other indications, including use in acute vertebral fractures due to osteoporosis or trauma.

Percutaneous sacroplasty is considered investigational for all indications, including use in sacral insufficiency fractures due to osteoporosis and sacral lesions due to metastatic malignancies or multiple myeloma.

Description of Procedure or Service

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osteoporotic vertebral fractures between 6 weeks and 1 year old

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### Percutaneous Vertebroplasty

Percutaneous vertebroplasty is an interventional technique involving the fluoroscopically guided injection of polymethylmethacrylate (PMMA) through a needle inserted into a weakened vertebral body. The technique has been investigated as an option to provide mechanical support and symptomatic relief in patients with osteoporotic vertebral compression fracture or in those with osteolytic lesions of the spine, ie, multiple myeloma or metastatic malignancies. Percutaneous vertebroplasty has also been investigated as an adjunct to surgery for aggressive vertebral body hemangiomas, and as a technique to limit blood loss related to surgery. Injection of PMMA is also being investigated for the treatment of sacral insufficiency fractures.

For individuals with symptomatic osteoporotic vertebral fractures of between 6 weeks and 1-year duration who receive vertebroplasty, the evidence includes 2 randomized sham-controlled trials, non-blinded randomized controlled trials (RCTs) comparing vertebroplasty with conservative management and systematic reviews of these RCTs. Relevant outcomes are symptoms, functional outcomes, quality of life, hospitalizations, medication use, and treatment-related morbidity. Despite the completion of numerous RCTs, including 2 with sham control, the efficacy of vertebroplasty for painful osteoporotic compression fractures remains uncertain. A 2016 meta-analysis that included the 2 sham-controlled trials concluded that vertebroplasty showed no significant benefit above sham for painful osteoporotic fractures. However, alternate interpretations are possible. There are methodologic issues with these studies, including but not limited to the choice of sham procedure and the potential effect of the sham procedure having a therapeutic effect by reducing pain. Questions have also been raised about the low percentage of patients screened who participated in the study, the volume of PMMA injected, and the inclusion of patients with chronic pain. Overall, conclusions
regarding the effect of vertebroplasty remain unclear. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals with symptomatic osteoporotic vertebral fractures of less than 6 weeks duration who receive vertebroplasty, the evidence includes a randomized sham-controlled trial and other non-blinded RCTs comparing vertebroplasty with conservative management. Relevant outcomes are symptoms, functional outcomes, quality of life, hospitalizations, medication use, and treatment-related morbidity. For acute fractures, conservative therapy consisting of rest, analgesics, and physical therapy is an option, and symptoms will resolve in a large percentage of patients with conservative treatment only. However, a sham-controlled RCT in patients who had severe pain of less than 6 weeks duration found a significant benefit of vertebroplasty for the treatment of osteoporotic vertebral fracture at the thoracolumbar junction. Other RCTs without sham control have reported that vertebroplasty is associated with significant improvements in pain and reduction in the duration of bedrest. Given the high morbidity associated with extended bedrest in older adults, this is considered to be a significant health benefit. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

For individuals with sacral insufficiency fractures who receive vertebroplasty, the evidence includes one prospective cohort and case series. Relevant outcomes are symptoms, functional outcomes, quality of life, hospitalizations, medication use, and treatment-related morbidity. No RCTs have been reported. The available evidence includes a prospective cohort study and a retrospective series with 243 patients. These studies reported rapid and sustained decreases in pain following percutaneous sacroplasty. Additional literature reports are mostly consistent in reporting immediate improvement following the procedure. However, due to the small size of the evidence base, harms associated with sacroplasty have not been adequately studied. The evidence is insufficient to determine the effects of the technology on health outcomes.

Vertebroplasty has been investigated as an intervention to provide mechanical support and symptomatic relief in patients with osteoporotic vertebral compression fracture or in those with osteolytic lesions of the spine, ie, multiple myeloma or metastatic malignancies. The results of clinical vetting in 2008 indicated uniform support for the use of vertebroplasty in painful osteoporotic fractures. After consideration of the available evidence and clinical input, it was concluded that the consistent results of numerous case series, including large prospective reports, together with the results of clinical vetting, were sufficient to determine that vertebroplasty was a reasonable treatment option in patients with vertebral fractures who fail to respond to conservative treatment (at least 6 weeks with analgesics, physical therapy, and rest). It is also clinically reasonable to consider the evidence supporting the clinical benefit of vertebroplasty in osteoporotic vertebral fracture to support its use in osteolytic lesions of the spine (eg, multiple myeloma, metastatic malignancies).
Background
*Note: Percutaneous kyphoplasty is addressed in a separate policy.

OSTEOPOROTIC FRACTURE

Vertebral Compression Fracture
Osteoporotic compression fractures are a common problem, and it is estimated that up to one-half of women and approximately one-quarter of men will have a vertebral fracture at some point in their lives. However, only about one-third of vertebral fractures actually reach clinical diagnosis, and most symptomatic fractures will heal within a few weeks or 1 month. Nonetheless, some individuals with acute fractures will have severe pain and decreased function that interferes with ability to ambulate and is not responsive to usual medical management. In addition, a minority of patients will exhibit chronic pain following osteoporotic compression fracture that presents challenges for medical management. Chronic symptoms do not tend to respond to the management strategies for acute pain such as bedrest, immobilization or bracing device, and analgesic medication, sometimes including narcotic analgesics. The source of chronic pain after vertebral compression fracture may not be from the vertebra itself but may be predominantly related to strain on muscles and ligaments secondary to kyphosis. This type of pain frequently is not improved with analgesics and may be better addressed through exercise. Improvements in pain and ability to function are the primary relevant outcomes of interest for treatment of osteoporotic fractures.

Sacral Insufficiency Fractures
Sacral insufficiency fractures (SIFs) are the consequence of stress on weakened bone and are often the cause of low back pain in the elderly population. Osteoporosis is the most common risk factor for SIF. Spontaneous fracture of the sacrum in patients with osteoporosis was described by Lourie in 1982 and presents as lower back and buttock pain with or without referred pain in the legs.(1,2) Although common, SIFs can escape detection due to low provider suspicion and poor sensitivity on plain radiographs, slowing the application of appropriate intervention. Similar interventions are used for sacral and vertebral fractures including bedrest, bracing, and analgesics. Initial clinical improvements may occur quickly; however, the resolution of all symptoms may not occur for 9 to 12 months.(1,3)

VERTEBRAL AND SACRAL BODY METASTASIS
Metastatic malignant disease involving the spine generally involves the vertebrae/sacrum, with pain being the most frequent complaint. While radiation and chemotherapy are frequently effective in reducing tumor burden and associated symptoms, pain relief may be delayed days to weeks, depending on tumor response. Further, these approaches rely on bone remodeling to regain strength in the vertebrae/sacrum, which may necessitate supportive bracing to minimize the risk of vertebral/sacral collapse during healing. Improvements in pain and ability to function are the primary relevant outcomes of interest for treatment of bone malignancy with percutaneous vertebroplasty or sacroplasty.
PERCUTANEOUS VERTEBROPLASTY
It has been proposed that vertebroplasty may provide an analgesic effect through mechanical stabilization of a fractured or otherwise weakened vertebral body. However, other possible mechanisms of effect have been postulated, including thermal damage to intraosseous nerve fibers.

PERCUTANEOUS SACROPLASTY
Sacroplasty evolved from the treatment of insufficiency fractures in the thoracic and lumbar vertebrae with vertebroplasty. The procedure, essentially identical, entails guided injection of polymethylmethacrylate (PMMA) through a needle inserted into the fracture zone. While first described in 2000 as a treatment for symptomatic sacral metastatic lesions,(4,5) it is most often described as a minimally invasive procedure employed as an alternative to conservative management(6-8) for SIFs.

In all clinical situations, adverse effects related to complications from vertebroplasty and sacroplasty are the primary harms to be considered. Principal safety concerns relate to the incidence and consequences of leakage of the injected polymethylmethacrylate (PMMA). Use of a bis-glycidal dimethacrylate (Bis-GMA) composite material (Cortoss) for vertebroplasty has also been reported.(9)

REGULATORY STATUS
Vertebroplasty is a surgical procedure and, as such, is not subject to U.S. Food and Drug Administration (FDA) approval.

Polymethylmethacrylate (PMMA) bone cement was available as a drug product before enactment of FDA’s device regulation and was at first considered what FDA terms a “transitional device.” It was transitioned to a class III device requiring premarketing applications. Several orthopedic companies have received approval of their bone cement products since 1976. In 1999, PMMA was reclassified from class III to class II, which requires future 510(k) submissions to meet “special controls” instead of “general controls” to assure safety and effectiveness. Thus, use of PMMA in vertebroplasty represented an off-label use of an FDA-regulated product before 2005. In 2005, PMMA bone cements such as Spine-Fix® Biomimetic Bone Cement and Osteopal® V were cleared for marketing by FDA through the 510(k) process for the fixation of pathologic fractures of the vertebral body using vertebroplasty or kyphoplasty procedures.
The use of PMMA in sacroplasty is an off-label use of an FDA-regulated product (bone cements such as Spine-Fix® Biomimetic Bone Cement and Osteopal® V), because the 510(k) approval was for the fixation of pathologic fractures of the vertebral body using vertebroplasty or kyphoplasty procedures. Sacroplasty was not included. FDA product code: NDN.

In May 2009, Cortoss® Bone Augmentation Material received marketing clearance by the FDA. Cortoss® is a non-resorbable synthetic material that is a composite resin-based, bis-glycidal dimethacrylate (Bis-GMA). FDA classifies this product as a PMMA bone cement.

ArthroCare received FDA clearance for the Parallax® Contour® Vertebral Augmentation Device in 2010. The device creates a void in cancellous bone that can then be filled with bone cement.

**Rationale**

This evidence review was originally created in 2000 and has been updated regularly with searches of the MEDLINE database. The most recent literature update was performed through March 23, 2017. Following is a summary of key studies to date.

Assessment of efficacy for therapeutic intervention involves a determination of whether the intervention improves health outcomes. The optimal study design for this purpose is a randomized controlled trial (RCT) that includes clinically relevant measures of health outcomes. Nonrandomized comparative studies and uncontrolled studies can sometimes provide useful information on health outcomes, but are prone to biases such as noncomparability of treatment groups, placebo effect, and variable natural history of the condition.

**PERCUTANEOUS VERTEBROPLASTY FOR VERTEBRAL COMPRESSION FRACTURES OF BETWEEN 6 WEEKS AND 1 YEAR DURATION**

This review was originally informed by a 2000 TEC Assessment, which was updated periodically through 2010.(10-15) Subsequent evidence includes a number of randomized controlled trials (RCTs), 2 of which included a sham control, and numerous RCTs that compared vertebroplasty with conservative management.

**Systematic Reviews**

A 2015 Cochrane review by Buchbinder et al evaluated the evidence on vertebroplasty for the treatment of vertebral compression fractures.(16) Eleven RCTs and 1 quasi-RCT were included in the systematic review. Two trials identified compared vertebroplasty with a sham procedure (n=209 patients; Buchbinder et al [2009](17) and Kallmes et al [2009](18), detailed below), 6 compared vertebroplasty with usual care (n=566), and 4 compared vertebroplasty with kyphoplasty (n=545). The sham-controlled trials were considered to be at low risk of bias. All other trials were judged to be at high risk of bias due to lack of blinding. Evidence was rated as moderate quality based on the low number of subjects in the sham controlled trials. Meta-analysis of the 2 sham-controlled trials
indicated that vertebroplasty does not result in clinically significant improvements in pain, disability, quality of life, or treatment success. Results did not differ for patients with pain durations of 6 weeks or less compared to pain lasting more than 6 weeks. Sensitivity analysis indicated that studies comparing vertebroplasty to conservative management were likely to have overestimated the treatment effect. The rate of serious adverse events did not differ significantly between the vertebroplasty and control groups, but serious adverse events related specifically to the vertebroplasty procedure included osteomyelitis, cord compression, thecal sac injury, and respiratory failure.

Staples et al (2011) conducted a patient-level meta-analysis of the 2 sham-controlled trials described below to determine whether vertebroplasty is more effective than sham in specific subsets of patients. This subset analysis focused on duration of pain (≤6 weeks vs >6 weeks) and severity of pain (score <8 or ≥8 on an 11-point numeric rating scale [NRS]). Included in the analysis were 209 participants (78 from the Australian trial, 131 from the U.S. trial); 27% had pain of recent onset and 47% had severe pain at baseline. The primary outcome measures, pain scores and function on the RMDQ at 1 month, were not significantly different between groups. Responders’ analyses were also conducted based on a 3-unit improvement in pain scores, a 3-unit improvement on the RMDQ, and a 30% improvement in each of the pain and disability outcomes. The only difference observed between groups was a trend for a higher proportion of the vertebroplasty group to achieve at least 30% improvement in pain scores (RR=1.32; 95% CI, 0.98 to 1.76; p=0.07), a result that may have been confounded by the greater use of opioid medications in that group.

Randomized Controlled Trials

**Vertebroplasty vs Medical Management With Sham Controls**

Two sham-controlled trials were published in 2009 and are included in the systematic reviews described above. The 2 RCTs compared vertebroplasty to medical management using a sham control (that included local anesthetic), which mimicked the vertebroplasty procedure up to the point of cement injection. Buchbinder et al reported results of a 4-center, randomized, double-blind, sham-controlled trial with 78 patients with 1 or 2 painful osteoporotic vertebral fractures of duration less than 1 year. Patients were assigned to undergo vertebroplasty or sham procedure (ie, injection of local anesthetic into the facet capsule and/or periosteum). Ninety-one percent of participants completed 6 months of follow-up. The participants, investigators (other than the radiologists performing the procedure), and outcome assessors were blind to the treatment assignment. Blinding was maintained through 24-month follow-up of this trial.

The primary outcome was overall pain (over the course of the previous week) measured on a VAS from 0 to 10, with 1.5 representing the minimal clinically important difference. A sample size of 24 per group was calculated to provide sufficient power to show a 2.5-point post-procedure difference assuming a 3-point SD. All analyses were performed according to intention-to-treat (ITT) principles. For the primary outcome of overall pain, the authors reported no significant
difference in VAS pain score at 3, 12, or 24 months. With reductions in pain and improvements in quality of life observed in both groups, the authors concluded vertebroplasty provided no benefit.

Kallmes et al conducted a multicenter, randomized, double-blind, sham-controlled trial (INVEST) in which 131 participants with 1 to 3 painful osteoporotic vertebral fractures were assigned to undergo vertebroplasty or sham procedure (injection of local anesthetic into the facet capsule and/or periosteum).(18) Participants had back pain for no more than 12 months and had a current pain rating of at least 3 on VAS at baseline. Participants were evaluated at baseline, then again at various time points to 1 year postprocedure. Ninety-seven percent completed a 1-month follow-up, and 95% completed 3 months. The primary outcomes were scores on the Roland-Morris Disability Questionnaire (RMDQ) and average back pain intensity during the preceding 24 hours at 1 month, with a reduction of 30% on the RMDQ and VAS pain considered a clinically meaningful difference.(21) The trial initially had 80% power to detect differences in both primary and secondary outcomes with 250 patients, with a 2-sided - of 0.05 on the basis of a 2.5-unit advantage for vertebroplasty over placebo on the RMDQ and 1.0-point difference on VAS. After recruitment difficulty and interim analysis on the first 90 participants, target sample size was decreased to 130 participants with 80% power for primary aims maintained. All primary analyses were performed using ITT principles and results presented as mean scores for the RMDQ and pain intensity.

For the primary end points at 1 month, there were no significant between-group differences. There was a trend toward a higher clinically meaningful improvement in pain at 1 month (30% reduction from baseline) in the vertebroplasty group (64% vs 48%, respectively; p=0.06). At 3 months, 43% from the control group vs 12% in the vertebroplasty group crossed over (p<0.001). The crossovers did not affect study outcomes, because they occurred after the primary outcome assessment. However, significantly more participants in the control group chose to cross over than in the vertebroplasty group. By 1 year, 16% of patients who underwent vertebroplasty and 60% of control subjects had crossed over to the alternative procedure (p<0.001).(22) As-treated analysis found no significant difference in RMDQ or pain scores between the 2 groups. ITT analysis found a modest 1-point difference in pain rating, but no significant difference in RMDQ. There was a significant difference in the percentage of patients showing a 30% or greater improvement in pain (70% of patients randomized to vertebroplasty vs 45% of patients randomized to the control group).

**Vertebroplasty vs Medical Management Without Sham Controls**

Chen et al reported a nonblinded RCT of vertebroplasty compared with conservative management in 2014.(23) The study included 89 patients with chronic compression fractures confirmed by magnetic resonance imaging (MRI) and persistent severe pain for 3 months or longer. Evaluation was performed at 1 week and at 1, 3, 6, and 12 months. Over the course of the year, pain scores decreased from 6.5 to 2.5 in the vertebroplasty group and from 6.4 to 4.1 in the control group (p<0.001). Complete pain relief was reported by 84.8% of patients.
in the vertebroplasty group compared with 34.9% of controls. The final Oswestry Disability Index score was 15.0 in the vertebroplasty group and 32.1 in the conservative management group (p<0.001), and the final RMDQ score was 8.1 for vertebroplasty and 10.7 for controls (p<0.001).

In 2011, Farrokhi et al reported blinded RCT that compared vertebroplasty with optimal medical management in 82 patients.(24) Patients had painful osteoporotic vertebral compression fractures that were refractory to analgesic therapy for at least 4 weeks and less than 1 year. The patients and the physicians involved in the treatment of the patients were not aware of the treatment that the other group was receiving. Control of pain and improvement in quality of life were measured by independent raters before treatment and at 1 week and 2, 6, 12, 24, and 36 months after the beginning of treatment. Radiologic evaluation to measure vertebral body height and correction of deformity was performed before and after treatment and after 36 months of follow-up. At 1 week, the mean VAS score decreased from 8.4 to 3.3 in the vertebroplasty group and from 7.2 to 6.4 in the conservative management group, with between-group differences that remained significant through 6 months of follow-up. Group differences on the Oswestry Disability Index lower back pain score were significantly lower in the vertebroplasty group throughout the 36 months of the study. New symptomatic adjacent fractures developed in 1 patient (2.6%) in the vertebroplasty group and 6 patients (15.4%) in the conservative management group. In 1 patient, epidural cement leakage caused severe lower-extremity pain and weakness that was treated with bilateral laminectomy and evacuation of bone cement.

Nonrandomized Comparative Studies
In 2011 and 2015, Edidin et al reported mortality risk in Medicare patients who had vertebral compression fractures and had been treated with vertebroplasty, kyphoplasty or nonoperatively.(25,26) These studies were industry-funded. In the 2015 report, they identified 1,038,956 patients who had vertebral compression fractures between 2005 and 2009. The data set included 141,343 kyphoplasty patients and 75,364 vertebroplasty patients. Survival was calculated from the index diagnosis date until death or the end of follow-up (up to 4 years). Propensity matching was used to control for multiple covariates, which included age, sex, race, census region, socioeconomic status, comorbidities in 12 months prior to diagnosis and type of fracture, and year of fracture. The matched cohort included 100,649 nonoperated patients, 36,657 kyphoplasty patients, and 24,313 vertebroplasty patients. Analysis of the whole data set before matching indicated that patients in the non-operated cohort had a 55% (95% CI, 53% to 56%, p<0.001) higher risk of mortality than the kyphoplasty cohort and 25% (95% CI, 23% to 26%, p<0.001) higher mortality than the vertebroplasty cohort. After propensity matching, the risk of mortality at 4 years was 47.2% in the nonoperated group compared to 42.3% in the kyphoplasty group (p<0.001) and 46.2% in the vertebroplasty group (p<0.001).
Section Summary: Percutaneous Vertebroplasty in Patients With a Vertebral Compression Fracture of Less Than 1 Year Duration

Despite the completion of numerous RCTs, including 2 with sham control, the efficacy of vertebroplasty for painful osteoporotic compression fractures of less than 1 year remains uncertain. A 2016 meta-analysis that included the 2 randomized, sham-controlled trials from 2009 concluded that vertebroplasty showed no significant benefit above sham for painful osteoporotic fractures. However, some uncertainty remains around the interpretation of their conclusions. While the use of a sham procedure is a major methodologic strength to control for nonspecific (placebo) effects, the sham used in the trial is not without controversy, given that the effect of injecting local anesthetic in the facet capsule and/or periosteum is unknown. Also, the appropriateness of chosen outcome measures to detect clinically meaningful differences in pain may not have been optimal, as the studies were underpowered to detect differences in clinical response rates. Questions have also been raised about the low percentage of patients screened who participated in the study, the volume of PMMA injected, and the inclusion of patients with chronic pain.

Percutaneous Vertebroplasty for Vertebral Compression Fractures of Less Than 6 Weeks

Randomized Controlled Trials

Vertebroplasty vs Medical Management With Sham Controls

In 2016, Clark et al reported results from the VAPOUR trial (see Table 1). (27) VAPOUR was a multicenter double-blind trial of vertebroplasty in 120 patients with vertebral fractures of less than 6 weeks in duration and back pain of at least 7 out of 10 on an NRS. Two authors had participated in the 2009 study published by Kallmes et al and the trial followed a similar protocol. Both outcomes assessors and patients were masked to treatment allocation, and independent statisticians unmasked the data and prepared the trial report. The sham-vertebroplasty procedure included subcutaneous lidocaine but no periosteal numbing. Manual skin pressure and tapping on the needle was performed to simulate the needle advance, and the investigators discussed polymethylmethacrylate (PMMA) mixing and injection during the procedure. The primary outcome, the percentage of patients with an NRS score less than 4 out of 10 at 14 days after the procedure, was met in a greater percentage of patients in the vertebroplasty group (44%) than in the sham control group (21%). This between-group difference was maintained through 6 months.

Table 1. Results From Sham-Controlled Trial of Vertebroplasty by Clark et al (2016)²⁷

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<th>Outcomes</th>
<th>Verteplasty</th>
<th>Sham</th>
<th>Difference (95% CI)</th>
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<td></td>
<td>N (n (%))</td>
<td>N (n (%))</td>
<td>Mean (SD)</td>
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<td>Proportion of patients with NRS score &lt;4a</td>
<td>55 (24 (44%))</td>
<td>57 (12 (21%))</td>
<td>23 (6 to 39)</td>
<td>0.011</td>
</tr>
<tr>
<td>14 days</td>
<td>51 (35 (69%))</td>
<td>51 (24 (47%))</td>
<td>22 (3 to 40)</td>
<td>0.027</td>
</tr>
<tr>
<td>6 months</td>
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<td></td>
</tr>
<tr>
<td>Reduction in NRS pain score</td>
<td>55</td>
<td>57</td>
<td>4.2 (2.7)</td>
<td>1.2 (0.1 to 2.3)</td>
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</table>
Other outcome measures were significantly improved in the vertebroplasty group at 1 or both of the time points (see Table 1). The benefit of vertebroplasty was found predominantly in the thoracolumbar subgroup, with 48% (95% CI, 27% to 68%) more patients meeting the primary endpoint (61% in the vertebroplasty group vs 13% in the control group). The investigators commented that the thoracolumbar junction is subject to increased dynamic load, and fractures at this junction have the highest incidence of mobility. No benefit from vertebroplasty was found in the non-thoracolumbar subgroup. Postprocedural hospital stay was reduced from a mean of 14 days in the control group to 8.5 days after vertebroplasty, even though physicians who determined the discharge date remained blinded to treatment. In the vertebroplasty group, there were 2 serious adverse events due to sedation and transfer to the radiology table. In the control group, 2 patients developed spinal cord compression; 1 underwent decompressive surgery and the other, not a surgical candidate, became paraplegic.

**Vertebroplasty vs Medical Management Without Sham Controls**

VERTOS II, reported by Klazen et al in 2010, was an open-label randomized trial of 202 patients at 6 hospitals in the Netherlands and Belgium. (28) Out of 431 patients who were eligible for randomization, 229 (53%) had spontaneous pain relief during assessment. Participants with at least 1 painful osteoporotic vertebral fracture of 6 weeks or less in duration were assigned to undergo vertebroplasty or conservative management (ie, bedrest, analgesia, cast, physical support). The primary outcome was pain relief of 3 points measured on a 10-point VAS at 1 month and 1 year. A sample size of 100 per group was calculated to provide sufficient power to show a 25% difference in pain relief. All analyses were
performed according to ITT principles. Clinically significant pain relief was defined as 30% change on the VAS (0-10 scale).

One hundred one subjects were enrolled into the treatment group and 101 into the control arm; 81% completed 12-month follow-up. There were no significant differences in the primary outcome (pain relief of 3 points) measured at 1 month and 1 year. Vertebroplasty resulted in greater pain relief than did medical management through 12 months (<0.001); there were significant between group differences in mean VAS score at 1 month (2.6; 1.74 to 3.37; p<0.001) and at 1 year (2.0; 1.13 to 2.80; p<0.001). Survival analysis showed significant pain relief was quicker (29.7 vs 115.6 days) and was achieved in more patients after vertebroplasty than after conservative management.

Yi et al (2014) assessed the occurrence of new vertebral compression fractures after treatment with cement augmenting procedures (vertebroplasty or kyphoplasty) versus conservative treatment in an RCT with 290 patients (363 affected vertebrae).(29) Surgically treated patients were discharged the next day. Patients treated conservatively (pain medication, bedrest, body brace, physical therapy) had a mean length of stay of 13.7 days. Return to usual activity occurred at 1 week for 87.6% of operatively treated patients and at 2 months for 59.2% of conservatively treated patients. All patients were evaluated with radiographs and MRI at 6 months and then at yearly intervals until the last follow-up session. At a mean follow-up of 49.4 months (range, 36-80 months), 10.7% of patients had experienced 42 new symptomatic vertebral compression fractures. There was no significant difference in the incidence of new vertebral fractures between the operative (18 total; 9 adjacent, 9 nonadjacent) and conservative (24 total; 5 adjacent, 16 nonadjacent, 3 same level) groups, but the mean time to a new fracture was significantly shorter in the operative compared with nonoperative group (9.7 months vs 22.4 months).

In 2016, Leali et al published a short report of a multicenter RCT with 400 patients with osteoporotic thoracic or lumbar vertebral compression fractures who were treated with vertebroplasty or conservative therapy.(30) Fractures were treated within 2 weeks of onset of pain. Details of randomization and rate of follow-up were not reported. At 1 day after treatment, the vertebroplasty group had a reduction in pain scores and improvement in physical function, with VAS pain scores decreasing from 4.8 (5.0 max) to 2.3 (p=0.023.) and the Oswestry Disability Index (ODI) improving from 53.6% to 31.7% (p=0.012). Sixty-five percent of patients treated with vertebroplasty had stopped all analgesics within 48 hours. The conservatively group showed no benefit in the first 48 hours, but by 6 weeks VAS and ODI scores were described as similar in the 2 groups (specific data was not reported). Evaluation of this study is limited by the incomplete reporting.

A 2016 RCT by Yang et al compared vertebroplasty to conservative therapy in 135 patients over 70 years of age with severe back pain due to an osteoporotic vertebral fracture after minor or mild trauma.(31) Vertebroplasty was performed at a mean of 8.4 days after pain onset. Patients in the conservative therapy group
were placed in bedrest for at least 2 weeks after diagnosis with analgesics, followed by bracing and assistive devices. All patients receiving vertebroplasty could stand and walk with a brace at 1 day posttreatment while only 12 (23.5%) patients could stand up and walk after 2 weeks of bedrest. The average duration of bedrest from pain onset was 7.8 ± 4.7 days (range, 2-15 days) in the vertebroplasty group compared to 32.5 ± 14.3 days (range, 14-60 days) in the conservative therapy group. At 1-year follow-up, there was a similar percentage of additional compression fractures, but a significantly higher complication rate in the conservative therapy group (35.3%) compared to the vertebroplasty group (16.1%; p<0.001). Complications included pneumonia, urinary tract infection, deep vein thrombosis, depression, and sleep disorders.

**Section Summary: Percutaneous Vertebroplasty in Patients with a Vertebral Compression Fracture of Less than 6 Weeks Duration**

In a sham-controlled RCT, where no anesthetic was injected into the periosteum, there was a significant benefit of vertebroplasty in patients who had severe pain of less than 6 weeks duration following vertebral fracture at the thoracolumbar junction. Other RCTs without sham control have reported that vertebroplasty is associated with significant improvements in pain, earlier improvement in function and reduction in the duration of bedrest compared to conservatively managed patients.

**PERCUTANEOUS SACROPLASTY**

Sacroplasty is an evolving technique with numerous methods (short axis, long axis, balloon-assisted short axis, iliosacral screws). No randomized trials of sacroplasty have been reported. The largest prospective report is an observational cohort study of 52 consecutive patients undergoing sacroplasty for sacral insufficiency fractures using the short-axis technique.(32) Patients had a mean age of 75.9 years and a mean duration of symptoms of 34.5 days (range, 4-89 days) and mean VAS score of 8.1 at baseline. Improvement on the VAS was measured at 30 minutes and 2, 4, 12, 24, and 52 weeks postprocedure. At each interval, statistically significant improvement over baseline was observed and maintained through 52 weeks.

The largest series is a 2013 retrospective multicenter analysis of 204 patients with painful sacral insufficiency fractures and 39 patients with symptomatic sacral lesions treated with either the short-axis or long-axis technique.(33) One hundred sixty-nine patients had bilateral sacral insufficiency fractures and 65 patients had additional fractures of the axial skeleton. VAS improved from 9.2 before treatment to 1.9 after treatment in patients with sacral insufficiency fractures, and from 9.0 to 2.6 in patients with sacral lesions. There was 1 case of radicular pain due to extravasation of cement requiring surgical decompression.

There are several retrospective reviews with about 50 patients each. One from 2014 has described a series of 57 patients treated with sacroplasty for sacral insufficiency fractures.(34) The short- or long-axis approach was dictated by the length and type of the fracture and patient anatomy. Follow-up data at 2.5 weeks was available for 45 (79%) patients, and the outcome measures were
inconsistent. For example, activity pain scores were collected from 13 patients, and rest pain scores were collected from 29 patients. Of the 45 patients with outcome data, 37 (82%) were reported to have experienced either a numeric or descriptive decrease from initial pain of at least 30%.

There are complications of cement leakage with sacroplasty that are not observed with vertebroplasty. Leakage of PMMA into the presacral space, spinal canal, sacral foramen, or sacroiliac joint may result in pelvic injection of PMMA, sacral nerve root or sacral spinal canal compromise, or sacroiliac joint dysfunction.(35) Performing sacroplasty only on zone 1 fractures can minimize these risks.(36)

**Section Summary: Percutaneous Sacroplasty**

No RCTs on percutaneous sacroplasty for sacral insufficiency have been reported. The available evidence includes one prospective cohort study with 52 patients and a retrospective series with 243 patients. These studies reported rapid and sustained decreases in pain following percutaneous sacroplasty. Additional literature reports are mostly consistent in reporting immediate improvement following the procedure. Due to the small size of the evidence base, harms associated with sacroplasty have not been adequately studied. The small numbers of treated patients leave uncertainty regarding the impact of sacroplasty on health outcomes.

**SUMMARY OF EVIDENCE**

For individuals with symptomatic osteoporotic vertebral fractures of between 6 weeks and 1-year duration who receive vertebroplasty, the evidence includes 2 randomized sham-controlled trials, non-blinded randomized controlled trials (RCTs) comparing vertebroplasty with conservative management and systematic reviews of these RCTs. Relevant outcomes are symptoms, functional outcomes, quality of life, hospitalizations, medication use, and treatment-related morbidity. Despite the completion of numerous RCTs, including 2 with sham control, the efficacy of vertebroplasty for painful osteoporotic compression fractures remains uncertain. A 2016 meta-analysis that included the 2 sham-controlled trials concluded that vertebroplasty showed no significant benefit above sham for painful osteoporotic fractures. However, alternate interpretations are possible. There are methodologic issues with these studies, including but not limited to the choice of sham procedure and the potential effect of the sham procedure having a therapeutic effect by reducing pain. Questions have also been raised about the low percentage of patients screened who participated in the study, the volume of PMMA injected, and the inclusion of patients with chronic pain. Overall, conclusions regarding the effect of vertebroplasty remain unclear. The evidence is insufficient to determine the effects of the technology on health outcomes.

For individuals with symptomatic osteoporotic vertebral fractures of less than 6 weeks duration who receive vertebroplasty, the evidence includes a randomized sham-controlled trial and other non-blinded RCTs comparing vertebroplasty with conservative management. Relevant outcomes are symptoms, functional outcomes, quality of life, hospitalizations, medication use, and treatment-related morbidity. For acute fractures, conservative therapy consisting of rest, analgesics,
and physical therapy is an option, and symptoms will resolve in a large percentage of patients with conservative treatment only. However, a sham-controlled RCT in patients who had severe pain of less than 6 weeks duration found a significant benefit of vertebroplasty for the treatment of osteoporotic vertebral fracture at the thoracolumbar junction. Other RCTs without sham control have reported that vertebroplasty is associated with significant improvements in pain and reduction in the duration of bedrest. Given the high morbidity associated with extended bedrest in older adults, this is considered to be a significant health benefit. The evidence is sufficient to determine that the technology results in a meaningful improvement in the net health outcome.

For individuals with sacral insufficiency fractures who receive vertebroplasty, the evidence includes one prospective cohort and case series. Relevant outcomes are symptoms, functional outcomes, quality of life, hospitalizations, medication use, and treatment-related morbidity. No RCTs have been reported. The available evidence includes a prospective cohort study and a retrospective series with 243 patients. These studies reported rapid and sustained decreases in pain following percutaneous sacroplasty. Additional literature reports are mostly consistent in reporting immediate improvement following the procedure. However, due to the small size of the evidence base, harms associated with sacroplasty have not been adequately studied. The evidence is insufficient to determine the effects of the technology on health outcomes.

SUPPLEMENTAL INFORMATION

CLINICAL INPUT FROM PHYSICIAN SPECIALTY SOCIETIES AND ACADEMIC MEDICAL CENTERS
While the various physician specialty societies and academic medical centers may collaborate with and make recommendations during this process, through the provision of appropriate reviewers, input received does not represent an endorsement or position statement by the physician specialty societies or academic medical centers, unless otherwise noted.

2014 Input
In response to requests, input was received from 2 physician specialty societies and 3 academic medical centers while this policy was under review in 2014.
Focused input was sought on the treatment of acute vertebral fractures when there is severe pain that has led to hospitalization or persists at a level that prevents ambulation, and on the treatment of traumatic fractures that have remained symptomatic after 6 weeks of conservative treatment. Clinical input on these issues was mixed.

**2008 Input**

In response to requests, input was received from 5 physician specialty societies and 2 academic medical centers while this policy was under review in 2008. Unsolicited input was received from a sixth physician specialty society. All reviewers disagreed with the proposed policy and provided references in support of the use of vertebroplasty.

**PRACTICE GUIDELINES AND POSITION STATEMENTS**

**American College of Radiology et al**

In 2012, joint practice guidelines on the performance of vertebral augmentation were published by the American College of Radiology (ACR), the American Society of Neuroradiology (ASN), the American Society of Spine Radiology (ASSR), the Society of Interventional Radiology (SIR), and the Society of Neurointerventional Surgery (SNIS). Methods to achieve internal vertebral body stabilization included vertebroplasty, balloon kyphoplasty, radiofrequency ablation and coblation, mechanical void creation, and injection of bone graft material or bone substitutes. ACR, ASN, ASSR, SIR, and SNIS considered vertebral augmentation to be an established and safe procedure and provide guidelines for appropriate patient selection, qualifications and responsibilities of personnel, specifications of the procedure, equipment quality control, and quality improvement and documentation. These guidelines addressed vertebral augmentation in general and referred to all percutaneous techniques used.(37)

These 5 societies also published a joint position statement on percutaneous vertebral augmentation in 2014. The statement indicated that percutaneous vertebral augmentation with the use of vertebroplasty or kyphoplasty is a safe, efficacious, and durable procedure in appropriate patients with symptomatic osteoporotic and neoplastic fractures, when performed in a manner in accordance with public standards. The document also stated that these procedures are offered only when nonoperative medical therapy has not provided adequate pain relief or pain is significantly altering patients’ quality of life.(38)

In a 2014 quality improvement guideline from SIR, failure of medical therapy is defined as follows(39):

1. For a patient rendered nonambulatory as a result of pain from a weakened or fractured vertebral body, pain persisting at a level that prevents ambulation despite 24 hours of analgesic therapy;
2. For a patient with sufficient pain from a weakened or fractured vertebral body that physical therapy is intolerable, pain persisting at that level despite 24 hours of analgesic therapy; or
3. For any patient with a weakened or fractured vertebral body, unacceptable side effects such as excessive sedation, confusion, or constipation as a result of the analgesic therapy necessary to reduce pain to a tolerable level.

**American Academy of Orthopaedic Surgeons**

In 2010, the American Academy of Orthopaedic Surgeons (AAOS) approved a new clinical practice guideline on the treatment of osteoporotic spinal compression fractures, which is available online. AAOS approved a strong recommendation against the use of vertebroplasty for patients who “present with an osteoporotic spinal compression fracture on imaging with correlating clinical signs and symptoms and who are neurologically “intact.” With this recommendation, AAOS expressed its confidence that future evidence is unlikely to overturn the existing evidence. As a note, these recommendations were based on a literature review through September 2009; therefore, the 2010 Klazen trial was not included in the systematic review.(40)

**National Institute for Health and Care Excellence**

The U.K.’s National Institute for Health and Care Excellence (NICE) concluded in its 2003 guidance on percutaneous vertebroplasty that the current evidence on the safety and efficacy of vertebroplasty for vertebral compression fractures appeared adequate to support the use of this procedure to provide pain relief for people with severe painful osteoporosis with loss of height and/or compression fractures of the vertebral body.(41) The guidance also recommended that the procedure be limited to patients whose pain is refractory to more conservative treatment. A 2013 NICE guidance indicated that percutaneous vertebroplasty and percutaneous balloon kyphoplasty are recommended as treatment options for treating osteoporotic vertebral compression fractures in persons having severe, ongoing pain after a recent unhealed vertebral fracture, despite optimal pain management and whose pain has been confirmed through physical exam and imaging to be at the level of the fracture.(42)

In 2008, NICE issued guidance on the diagnosis and management of adults with metastatic spinal cord compression.(43) This guidance indicated that vertebroplasty or kyphoplasty should be considered for the patients who have vertebral metastases and no evidence of spinal cord compression or spinal instability if they have mechanical pain resistant to conventional pain management and vertebral body collapse.

**U.S. PREVENTIVE SERVICES TASK FORCE RECOMMENDATIONS**

Not applicable.

**MEDICARE NATIONAL COVERAGE**

There is no national coverage determination (NCD). In the absence of an NCD, 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

<table>
<thead>
<tr>
<th>NCT No.</th>
<th>Trial Name</th>
<th>Planned Enrollment</th>
<th>Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ongoing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCT02370628</td>
<td>Vertebroplasty in the treatment of acute fracture trial (The VITTA Trial)</td>
<td>495</td>
<td>Apr 2018</td>
</tr>
</tbody>
</table>

NCT: national clinical trial.

References:

11. Blue Cross and Blue Shield Technology Evaluation Center (TEC). Percutaneous vertebroplasty for vertebral fractures caused by osteoporosis, malignancy, or hemangioma. TEC Assessments. 2004;Volume 19:Tab 13. PMID 11055834
12. Blue Cross and Blue Shield Technology Evaluation Center (TEC). Percutaneous vertebroplasty for vertebral fractures caused by osteoporosis or malignancy. TEC Assessments. 2005;Volume 20:Tab 6. PMID 11055834
13. Blue Cross and Blue Shield Technology Evaluation Center (TEC). Percutaneous vertebroplasty or kyphoplasty for vertebral fractures caused by osteoporosis or malignancy. TEC Assessments. 2008;Volume 23:Tab 5. PMID 11055834
14. Blue Cross and Blue Shield Technology Evaluation Center (TEC). Percutaneous vertebroplasty or kyphoplasty for vertebral fractures caused by osteoporosis. TEC Assessments. 2009;Volume 24:Tab 7. PMID 11055834


**Billing Coding/Physician Documentation Information**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>22510</td>
<td>Percutaneous vertebroplasty (bone biopsy included when performed), 1 vertebral body, unilateral or bilateral injection, inclusive of all imaging guidance; cervicothoracic</td>
</tr>
<tr>
<td>22511</td>
<td>Percutaneous vertebroplasty (bone biopsy included when performed), 1 vertebral body, unilateral or bilateral injection, inclusive of all imaging guidance; lumbosacral</td>
</tr>
<tr>
<td>22512</td>
<td>Percutaneous vertebroplasty (bone biopsy included when performed), 1 vertebral body, unilateral or bilateral injection, inclusive of all imaging guidance; each additional cervicothoracic or lumbosacral vertebral body (List separately in addition to code for primary procedure)</td>
</tr>
<tr>
<td>0200T</td>
<td>Percutaneous sacral augmentation (sacroplasty), unilateral injection(s), including the use of a balloon or mechanical device, when used, 1 or more needles</td>
</tr>
<tr>
<td>0201T</td>
<td>Percutaneous sacral augmentation (sacroplasty), bilateral injections, including the use of a balloon or mechanical device, when used, 2 or more needles</td>
</tr>
</tbody>
</table>

**ICD-10 Codes**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>C41.2</td>
<td>Malignant neoplasm of vertebral column</td>
</tr>
<tr>
<td>C79.510</td>
<td>Secondary malignant neoplasm of bone and bone marrow; code range</td>
</tr>
<tr>
<td>C75.52</td>
<td>Multiple myeloma; code range</td>
</tr>
<tr>
<td>D18.09</td>
<td>Hemangioma of other sites</td>
</tr>
<tr>
<td>D47.29</td>
<td>Other specified neoplasms of uncertain behavior of lymphoid, hematopoietic and related issues</td>
</tr>
<tr>
<td>M48.50</td>
<td>Collapsed vertebra, not elsewhere classified; code range</td>
</tr>
</tbody>
</table>
**M48.58**  
Age related osteoporosis with current pathological fracture, vertebra(e)

**M80.08**  
Pathological fracture, other site

**M84.48**  
Pathological fracture in neoplastic disease, vertebrae

**M84.58**  
Pathological fracture in other disease, other site

CPT 22520, 22521 and 22522 were deleted 1/1/2015.  
HCPCS Codes S2360 and 2361 deleted 1/1/2016.

### Additional Policy Key Words

N/A

### Policy Implementation/Update Information

- **2/1/01**  
  New policy.  Added to Radiology section, considered medically necessary for certain indications.

- **2/1/02**  
  No policy statement changes.

- **2/1/03**  
  No policy statement changes.  Added CPT codes.

- **6/1/04**  
  Policy statement revised to include discussion of percutaneous kyphoplasty as investigational.  Policy statement revised to indicate percutaneous vertebroplasty as investigational except when pain is severe and debilitating, and cannot be relieved by correct medical therapy, other causes of pain, such as herniated intervertebral disk have been ruled out, and the affected vertebra has not been extensively destroyed and is at least one-third of its original height.

- **2/1/05**  
  No policy statement changes.

- **2/1/06**  
  Added to Surgery section.  Removed percutaneous kyphoplasty from this policy and is now discussed under a separate policy.

- **2/1/07**  
  No policy statement changes.  Coding Updated.

- **2/1/08**  
  No policy statement changes.

- **10/7/08**  
  Policy statement revised; medically necessary if not responding to conservative treatment.

- **11/1/09**  
  No policy statement changes.

- **11/1/10**  
  Policy statement revised to indicate use in acute vertebral fractures as investigational.

- **11/1/11**  
  Policy revised to include percutaneous sacroplasty (previously addressed in a separate policy); remains investigational.  No changes to the policy statements on percutaneous vertebroplasty.

- **11/1/12**  
  No policy statement changes.

- **11/1/13**  
  No policy statement changes.

- **11/1/14**  
  No policy statement changes.

- **11/1/15**  
  Updated CPT codes.  No policy statement changes.

- **11/1/16**  
  “Spinal lesions” in 4th policy statement changed to “sacral lesions” to clarify the intent.

- **7/1/17**  
  Added; vertebroplasty may be medically necessary in vertebral fractures of less than 6 weeks duration that prevent ambulation.
11/1/17  No policy statement changes.

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