

Cigna Medical Coverage Policies – Musculoskeletal Posterior Cervical Fusion

Effective February 25, 2026



Instructions for use

The following coverage policy applies to health benefit plans administered by Cigna. Coverage policies are intended to provide guidance in interpreting certain standard Cigna benefit plans and are used by medical directors and other health care professionals in making medical necessity and other coverage determinations. Please note the terms of a customer's particular benefit plan document may differ significantly from the standard benefit plans upon which these coverage policies are based. For example, a customer's benefit plan document may contain a specific exclusion related to a topic addressed in a coverage policy.

In the event of a conflict, a customer's benefit plan document always supersedes the information in the coverage policy. In the absence of federal or state coverage mandates, benefits are ultimately determined by the terms of the applicable benefit plan document. Coverage determinations in each specific instance require consideration of:

1. The terms of the applicable benefit plan document in effect on the date of service
2. Any applicable laws and regulations
3. Any relevant collateral source materials including coverage policies
4. The specific facts of the particular situation

Coverage policies relate exclusively to the administration of health benefit plans. Coverage policies are not recommendations for treatment and should never be used as treatment guidelines.

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CMM-604: Posterior Cervical Fusion

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CMM-604.1: General Guidelines

Application of Guideline

- The determination of medical necessity for the performance of posterior cervical fusion is always made on a case-by-case basis.
- For additional timing and documentation requirements, see **CMM-600.1: Prior Authorization Requirements**.

Urgent/Emergent Indications/Conditions

- The presence of urgent/emergent indications/conditions warrants definitive surgical treatment. **Imaging findings noted in the applicable procedure section(s) are required.**
 - ◆ The following criteria are **NOT** required for confirmed urgent/emergent conditions:
 - Plain X-rays of the cervical spine
 - Provider-directed non-surgical management
 - Proof of smoking cessation
 - Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)
 - Timeframe for repeat procedure
- Urgent/emergent conditions for posterior cervical fusion include **ANY** of the following:
 - ◆ Acute/unstable traumatic spinal fractures or dislocations with neural compression
 - ◆ Central cord syndrome
 - ◆ Myelopathy or Cord signal changes on MRI due to cord compression
 - ◆ Documentation of progressive neurological deficit on two separate physical exams
 - ◆ **ANY** of the following due to a neurocompressive pathology
 - Motor weakness of grade 3/5 or less of specified muscle(s)
 - Rapidly progressive symptoms of motor loss
 - Bowel incontinence
 - Bladder incontinence/retention
 - ◆ Occipitocervical and/or Atlantoaxial (C1-C2) instability (non-traumatic) and/or spinal cord compression due to **ANY** of the following:
 - Rheumatoid arthritis
 - Congenital abnormality of occipitocervical/C1-C2 vertebrae
 - Os odontoideum
 - ◆ Epidural hematoma
 - ◆ Infection (e.g., discitis, epidural abscess, osteomyelitis)
 - ◆ Primary or metastatic neoplastic disease causing pathologic fracture, cord compression, or instability
 - ◆ A condition otherwise meeting criteria listed in the applicable procedure section(s) with documentation of severe debilitating pain and/or dysfunction to

the point of being incapacitatePlain X-rays show instability and include **EITHER** of the following findings:

- Subluxation or translation of more than 3.5 mm on static lateral or dynamic flexion/extension views
- Sagittal plane angulation of more than 11 degrees between adjacent spinal segments on static or dynamic flexion/extension lateral plain X-rays
- ◆ Vascular malformations (e.g., AVM)

CMM-604.2: Osteotomy

Posterior Column Osteotomy (PCO)

Posterior cervical column osteotomy (PCO) (i.e., Smith-Peterson osteotomy [SPO] or Ponte osteotomy) is considered **medically necessary** (in addition to fusion) when **ALL** of the following criteria have been met:

- Performed for correction of non-fixed cervical kyphotic deformity requiring 5° to 10° of correction (SPO) per spinal segment
- Correction of cervical kyphotic deformity cannot be attained by cervical fusion (with or without posterior cervical decompression) alone
- **ALL** of the criteria for cervical fusion (with or without posterior cervical decompression) have been met per the applicable procedure-specific section(s) below:
 - ◆ **CMM-604.3: Initial Primary Posterior Cervical Fusion for Conditions other than Pseudoarthrosis**
 - ◆ **CMM-604.4: Initial Posterior Cervical Fusion with Posterior Cervical Decompression for Conditions other than Pseudoarthrosis**
 - ◆ **CMM-604.5: Posterior Cervical Fusion (Initial or Repeat) for Symptomatic Pseudoarthrosis**
 - ◆ **CMM-604.6: Repeat Posterior Cervical Fusion (with or without a Decompression) at the Same Level for Conditions other than Pseudoarthrosis**
 - ◆ **CMM-604.7: Posterior Cervical Fusion (with or without Decompression) Following Failed Cervical Disc Arthroplasty**

Three-Column Osteotomy or Vertebral Column Resection

Cervical three-column osteotomy (i.e., pedicle subtraction osteotomy [PSO] or vertebral column resection [VCR]) is considered **medically necessary** (in addition to fusion) when **ALL** of the following criteria have been met:

- Performed for correction of fixed cervical kyphotic deformity
- Correction of cervical kyphotic deformity cannot be attained by posterior cervical fusion (with or without posterior cervical decompression) alone

➤ **ALL** of the criteria for posterior cervical fusion (with or without posterior cervical decompression) have been met per the applicable procedure-specific section(s) below:

- ◆ **CMM-604.3: Initial Primary Posterior Cervical Fusion for Conditions other than Pseudoarthrosis**
- ◆ **CMM-604.4: Initial Posterior Cervical Fusion with Posterior Cervical Decompression for Conditions other than Pseudoarthrosis**
- ◆ **CMM-604.5: Posterior Cervical Fusion (Initial or Repeat) for Symptomatic Pseudoarthrosis**
- ◆ **CMM-604.6: Repeat Posterior Cervical Fusion (with or without a Decompression) at the Same Level for Conditions other than Pseudoarthrosis**
- ◆ **CMM-604.7: Posterior Cervical Fusion (with or without Decompression) Following Failed Cervical Disc Arthroplasty**

CMM-604.3: Initial Primary Posterior Cervical Fusion for Conditions other than Pseudoarthrosis

Initial posterior cervical fusion is considered **medically necessary** for **ANY** of the following conditions when **ALL** of the associated criteria have been met:

Symptomatic Cervical Spondylosis with Instability

EITHER of the following clinical scenarios:

➤ Plain X-rays show instability and include **EITHER** of the following findings (meeting urgent/emergent criteria):

- ◆ Subluxation or translation of more than 3.5 mm on static lateral views
- ◆ Sagittal plane angulation of more than 11 degrees between adjacent spinal segments on static or dynamic flexion/extension lateral plain X-rays

➤ **ALL** of the following criteria have been met:

- ◆ Plain X-rays of the cervical spine including flexion/extension lateral views have been performed
- ◆ Imaging study shows corresponding pathologic anatomy
- ◆ Individual is unresponsive to a reasonable and medically appropriate course of conservative treatment (e.g., rest, medication, cervical collar)
- ◆ Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)
- ◆ Documentation of nicotine-free status with **EITHER** of the following:
 - Individual is a never-smoker
 - Individual has refrained from smoking, use of smokeless tobacco products, and/or nicotine replacement therapy for at least six (6) weeks prior to planned surgery as evidenced by blood cotinine lab results of ≤ 10 ng/mL

Clinical Conditions with an Increased Incidence of Congenital and/or Acquired Cervical Spinal Instability

EITHER of the following clinical scenarios:

- Plain X-rays show instability and include **EITHER** of the following findings (meeting urgent/emergent criteria):
 - ◆ Subluxation or translation of more than 3.5 mm on static lateral views
 - ◆ Sagittal plane angulation of more than 11 degrees between adjacent spinal segments on static or dynamic flexion/extension lateral plain X-rays
- **ALL** of the following criteria have been met:
 - ◆ Documentation of rheumatoid arthritis or a clinical condition with an increased incidence of congenital and/or acquired cervical spinal instability (e.g., Down syndrome, mucopolysaccharidoses, spondyloepiphyseal dysplasia, pseudoachondroplasia, etc.)
 - ◆ Imaging evidence of subluxation and/or spinal cord compression
 - ◆ Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)
 - ◆ Documentation of nicotine-free status with **EITHER** of the following:
 - Individual is a never-smoker
 - Individual has refrained from smoking, use of tobacco products, and/or nicotine replacement therapy for at least six (6) weeks prior to planned surgery as evidenced by blood cotinine lab results of ≤ 10 ng/mL

CMM-604.4: Initial Primary Posterior Cervical Fusion with Posterior Cervical Decompression for Conditions other than Pseudoarthrosis

Initial posterior cervical fusion with posterior cervical decompression (laminectomy/hemilaminectomy/laminoplasty) is considered **medically necessary** for **ANY** of the following conditions when **ALL** of the associated criteria have been met:

Radiculopathy

- The individual is a candidate for an initial posterior cervical decompression per **CMM-603.2: Initial Primary Posterior Cervical Decompression (Laminectomy/Hemilaminectomy/Laminoplasty)**
- Plain X-rays of the cervical spine including flexion/extension lateral views have been performed
- Documentation of nicotine-free status with **EITHER** of the following:
 - ◆ Individual is a never-smoker
 - ◆ Individual has refrained from smoking, use of smokeless tobacco products, and/or nicotine replacement therapy for at least six (6) weeks prior to planned surgery as evidenced by blood cotinine lab results of ≤ 10 ng/mL

Myelopathy

- The individual is a candidate for an initial posterior cervical decompression per **CMM-603.2: Initial Primary Posterior Cervical Decompression (Laminectomy/Hemilaminectomy/Laminoplasty)**
- Imaging must show neutral or lordotic alignment (i.e., without kyphosis)

Concurrent Stabilization Procedure

- Posterior cervical fusion is performed concurrently for **EITHER** of the following:
 - ◆ As a concurrent stabilization procedure with corpectomy, laminectomy, or other procedure at the cervicothoracic junction (i.e., C7 and T1)
 - ◆ As a concurrent stabilization procedure with a laminectomy, especially at C2
- Plain X-rays of the cervical spine including flexion/extension lateral views have been performed
- Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)
- Documentation of nicotine-free status with **EITHER** of the following:
 - ◆ Individual is a never-smoker
 - ◆ Individual has refrained from smoking, use of smokeless tobacco products, and/or nicotine replacement therapy for at least six (6) weeks prior to planned surgery as evidenced by blood cotinine lab results of ≤10 ng/mL

Clinical Conditions with an Increased Incidence of Congenital and/or Acquired Cervical Spinal Instability

EITHER of the following clinical scenarios:

- Plain X-rays show instability and include **EITHER** of the following findings (meeting urgent/emergent criteria):
 - ◆ Subluxation or translation of more than 3.5 mm on static lateral views
 - ◆ Sagittal plane angulation of more than 11 degrees between adjacent spinal segments on static or dynamic flexion/extension lateral plain X-rays
- **ALL** of the following criteria have been met:
 - ◆ Documentation of rheumatoid arthritis or clinical conditions with an increased incidence of congenital and/or acquired cervical spinal instability (e.g., Down syndrome, mucopolysaccharidoses, spondyloepiphyseal dysplasia, pseudoachondroplasia, etc.)
 - ◆ Imaging includes **BOTH** of the following:
 - Imaging evidence of subluxation and/or spinal cord compression
 - Plain X-rays of the cervical spine including flexion/extension lateral views have been performed
 - ◆ Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)

- ◆ Documentation of nicotine-free status with **EITHER** of the following:
 - Individual is a never-smoker
 - Individual has refrained from smoking, use of smokeless tobacco products, and/or nicotine replacement therapy for at least six (6) weeks prior to planned surgery as evidenced by blood cotinine lab results of ≤ 10 ng/mL

Symptomatic Cervical Instability or Spinal Cord/Root Compression Requiring Posterior Fusion

EITHER of the following clinical scenarios:

- Plain X-rays show instability and include **EITHER** of the following findings (meeting urgent/emergent criteria):
 - ◆ Subluxation or translation of more than 3.5 mm on static lateral views
 - ◆ Sagittal plane angulation of more than 11 degrees between adjacent spinal segments on static or dynamic flexion/extension lateral plain X-rays
- **ALL** of the following criteria have been met:
 - ◆ Plain X-rays of the cervical spine including flexion/extension lateral views have been performed
 - ◆ Imaging study shows corresponding pathologic anatomy
 - ◆ Individual is unresponsive to a reasonable and medically appropriate course of conservative treatment (e.g., rest, medication, cervical collar)
 - ◆ Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)
 - ◆ Documentation of nicotine-free status with **EITHER** of the following:
 - Individual is a never-smoker
 - Individual has refrained from smoking, use of smokeless tobacco products, and/or nicotine replacement therapy for at least six (6) weeks prior to planned surgery as evidenced by blood cotinine lab results of ≤ 10 ng/mL

CMM-604.5: Posterior Cervical Fusion (Initial or Repeat) for Symptomatic Pseudoarthrosis

A posterior cervical fusion (initial or repeat) is considered **medically necessary** for symptomatic pseudoarthrosis after a prior cervical fusion at the same level for **ANY** of the following conditions when **ALL** of the associated criteria have been met:

Unremitting Neck Pain with Pseudoarthrosis

- Greater than six (6) months since the prior cervical fusion surgery at the same level
- Significant level of pain on a daily basis defined as clinically significant functional impairment (e.g., inability to perform household chores, prolonged standing, etc.)
- Post-operative physical exam findings are concordant with the individual's symptoms
- Less than clinically meaningful improvement with six (6) months of non-surgical treatment with **BOTH** of the following (unless contraindicated):

- ◆ Prescription strength analgesics, steroids, gabapentinoids, and/or NSAIDs
- ◆ Provider-directed exercise program prescribed by a physical therapist, chiropractic provider, osteopathic or allopathic physician
- Post-operative MRI/CT shows findings that are concordant with the individual's symptoms
- Post-operative imaging (performed at no less than six (6) months after the prior cervical fusion) shows pseudoarthrosis at the requested level(s)
- Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)
- Documentation of nicotine-free status with **EITHER** of the following:
 - ◆ Individual is a never-smoker
 - ◆ Individual has refrained from smoking, use of tobacco products, and/or nicotine replacement therapy for at least six (6) weeks prior to planned surgery as evidenced by blood cotinine lab results of ≤ 10 ng/mL

Radiculopathy with Pseudoarthrosis

- Greater than six (6) months since the prior cervical fusion surgery at the same level
- Subjective symptoms include **BOTH** of the following:
 - ◆ Significant level of pain on a daily basis defined as clinically significant functional impairment (e.g., inability to perform household chores, prolonged standing, etc.)
 - ◆ Unremitting radicular pain to shoulder girdle and/or upper extremity resulting in disability
- Objective physical exam findings include **ANY** of the following:
 - ◆ Dermatomal sensory deficit
 - ◆ Motor deficit (e.g., biceps, triceps weakness)
 - ◆ Reflex changes
 - ◆ Shoulder abduction relief sign
 - ◆ Nerve root tension sign (e.g., Spurling's maneuver)
 - ◆ Unremitting radicular pain to shoulder girdle and/or upper extremity without concordant objective physical exam findings
- Less than clinically meaningful improvement with at least **TWO** of the following (unless contraindicated):
 - ◆ Prescription strength analgesics, steroids, gabapentinoids, and/or NSAIDs for six (6) weeks
 - ◆ Provider-directed exercise program prescribed by a physical therapist, chiropractic provider, osteopathic or allopathic physician for six (6) weeks
 - ◆ Epidural steroid injection(s) or selective nerve root block(s) performed at the same level(s) as the requested surgery
- Post-operative imaging (performed at no less than six (6) months after the prior cervical fusion) shows pseudoarthrosis at the requested level(s)

- Post-operative MRI/CT shows neural structure compression at the requested level(s) that is concordant with the individual's symptoms **and** physical exam findings and that is caused by **ANY** of the following:
 - ◆ Herniated disc(s) (retained disc material or a recurrent disc herniation)
 - ◆ Synovial cyst or arachnoid cyst
 - ◆ Central/lateral/foraminal stenosis
 - ◆ Osteophytes
- Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)
- Documentation of nicotine-free status including **EITHER** of the following:
 - ◆ Individual is a never-smoker
 - ◆ Individual has refrained from smoking, use of smokeless tobacco products, or nicotine replacement therapy for at least six (6) weeks prior to planned surgery as evidenced by blood cotinine lab results of \leq 10 ng/mL

Myelopathy with Pseudoarthrosis

- Greater than six (6) months since the prior cervical fusion surgery at the same level
- Subjective symptoms include **ANY** of the following:
 - ◆ Upper/lower extremity weakness, numbness, or pain
 - ◆ Fine motor dysfunction (buttoning, handwriting, clumsiness of hands)
 - ◆ Gait disturbance
 - ◆ New-onset bowel or bladder dysfunction
 - ◆ Frequent falls
- Objective physical exam findings include **ANY** of the following:
 - ◆ Grip and release test
 - ◆ Ataxic gait
 - ◆ Hyperreflexia
 - ◆ Hoffmann sign
 - ◆ Babinski sign
 - ◆ Tandem walking test demonstrating ataxia
 - ◆ Inverted brachial radial reflex
 - ◆ Increased muscle tone or spasticity
 - ◆ Clonus
 - ◆ Myelopathic hand
- Post-operative imaging (performed at no less than six (6) months after the prior cervical fusion) shows pseudoarthrosis at the requested level(s)
- Post-operative MRI/CT shows findings that are concordant with the individual's symptoms **and** physical exam findings and that are caused by **EITHER** of the following:
 - ◆ Cervical spinal cord compression
 - ◆ Cervical spinal stenosis

CMM-604.6: Repeat Posterior Cervical Fusion at the Same Level for Conditions other than Pseudoarthrosis

Repeat posterior cervical fusion (with or without posterior cervical decompression) at the same level is considered **medically necessary** for the following condition when the associated criteria has been met:

Malposition or Failure of Implant/Instrumentation or Structural Bone Graft

- Post-operative imaging shows evidence of malposition or failure of the implant/instrumentation or structural bone graft (e.g., migration, pedicle screw breakage, pedicle screw loosening, dislodged hooks, rod breakage, rod bending, rod loosening, loss of curve correction, decompensation, etc.)

CMM-604.7: Posterior Cervical Fusion (with or without Decompression) Following Failed Cervical Disc Arthroplasty Surgery

Posterior cervical fusion (with or without posterior cervical decompression) following a failed cervical disc arthroplasty implant is considered **medically necessary** for **ANY** of the following conditions when **ALL** of the associated criteria have been met:

Failed Cervical Disc Arthroplasty Implant

- Post-operative imaging shows evidence of cervical disc arthroplasty implant malposition or failure (e.g., subsidence, loosening, infection, dislocation/subluxation, vertebral body fracture, dislodgement)

Unremitting Neck Pain

- Greater than six (6) months since the prior cervical disc arthroplasty at the same level
- Significant level of pain on a daily basis defined clinically significant functional impairment (e.g., inability to perform household chores, prolonged standing, etc.)
- Post-operative physical exam findings are concordant with the individual's symptoms
- Less than clinically meaningful improvement with **BOTH** of the following for at least six (6) weeks (unless contraindicated):
 - ◆ Prescription strength analgesics, steroids, gabapentinoids, and/or NSAIDs
 - ◆ Provider-directed exercise program prescribed by a physical therapist, chiropractic provider, osteopathic or allopathic physician
- Post-operative MRI/CT shows findings that are concordant with the individual's symptoms
- Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)
- Documentation of nicotine-free status including **EITHER** of the following:
 - ◆ Individual is a never-smoker

- ◆ Individual has refrained from smoking, use of smokeless tobacco products, and/or nicotine replacement therapy for at least six (6) weeks prior to planned surgery as evidenced by blood cotinine lab results of ≤10 ng/mL

Radiculopathy

- Greater than six (6) months since the prior cervical disc arthroplasty at the same level
- Subjective symptoms include **BOTH** of the following:
 - ◆ Significant level of pain on a daily basis defined as clinically significant functional impairment (e.g., inability to perform household chores, prolonged standing, etc.)
 - ◆ Unremitting radicular pain to shoulder girdle and/or upper extremity resulting in disability
- Objective physical exam findings include **ANY** of the following:
 - ◆ Dermatomal sensory deficit
 - ◆ Motor deficit (e.g., biceps, triceps weakness)
 - ◆ Reflex changes
 - ◆ Shoulder abduction relief sign
 - ◆ Nerve root tension sign (e.g., Spurling's maneuver)
 - ◆ Unremitting radicular pain to shoulder girdle and/or upper extremity without concordant objective physical exam findings
- Less than clinically meaningful improvement with at least **TWO** of the following (unless contraindicated):
 - ◆ Prescription strength analgesics, steroids, gabapentinoids, and/or NSAIDs for six (6) weeks
 - ◆ Provider-directed exercise program prescribed by a physical therapist, chiropractic provider, osteopathic, or allopathic physician for six (6) weeks
 - ◆ Epidural steroid injection(s) or selective nerve root block(s) performed at the same level(s) as the requested surgery
- Post-operative MRI/CT shows neural structure compression at the requested level(s) that is concordant with the individual's symptoms **and** physical exam findings and that is caused by **ANY** of the following:
 - ◆ Herniated disc(s) (retained disc material or a recurrent disc herniation)
 - ◆ Synovial cyst or arachnoid cyst
 - ◆ Central/lateral/foraminal stenosis
 - ◆ Osteophytes
- Absence of unmanaged significant mental and/or behavioral health disorders (e.g., major depressive disorder, chronic pain syndrome, secondary gain, opioid and alcohol use disorders)
- Documentation of nicotine-free status with **EITHER** of the following:
 - ◆ Individual is a never-smoker
 - ◆ Individual has refrained from smoking, use of smokeless tobacco products, and/or nicotine replacement therapy for at least six (6) weeks prior to planned surgery as evidenced by blood cotinine lab results of ≤10 ng/mL

Myelopathy

- Greater than six (6) months since the prior cervical disc arthroplasty procedure at the same level
- Subjective symptoms include **ANY** of the following:
 - ◆ Upper/lower extremity weakness, numbness, or pain
 - ◆ Fine motor dysfunction (buttoning, handwriting, clumsiness of hands)
 - ◆ Gait disturbance
 - ◆ New-onset bowel or bladder dysfunction
 - ◆ Frequent falls
- Objective physical exam findings include **ANY** of the following:
 - ◆ Grip and release test
 - ◆ Ataxic gait
 - ◆ Hyperreflexia
 - ◆ Hoffmann sign
 - ◆ Babinski sign
 - ◆ Tandem walking test demonstrating ataxia
 - ◆ Inverted brachial radial reflex
 - ◆ Increased muscle tone or spasticity
 - ◆ Clonus
 - ◆ Myelopathic hand
- Post-operative MRI/CT shows findings that are concordant with the individual's symptoms **and** physical exam findings and that are caused by **EITHER** of the following:
 - ◆ Cervical spinal cord compression
 - ◆ Cervical spinal stenosis

CMM-604.8: Non-Indications

Not Medically Necessary

Posterior Cervical Fusion (with or without Posterior Cervical Decompression)

- Posterior cervical fusion (with or without posterior cervical decompression) performed without meeting the criteria in the **General Guidelines** (when applicable for urgent/emergent conditions) **and** the criteria in the applicable procedure-specific section (initial [604.3; 604.4; 604.5; or, 604.7], repeat [604.5 or 604.6], or following failed disc arthroplasty) is considered **not medically necessary**.
- Posterior cervical fusion (with or without posterior cervical decompression) is considered **not medically necessary** when performed for **ANY** of the following **sole indications**:
 - ◆ Signs and symptoms with no correlation to imaging studies
 - ◆ Annular tears
 - ◆ Disc bulge with no neural impingement or cord compression on imaging
 - ◆ Concordant Discography
 - ◆ MR Spectroscopy results
 - ◆ Degenerative disc disease
 - ◆ Isolated facet fusion, with or without instrumentation, including allograft bone graft substitutes used exclusively as **stand-alone** stabilization devices (e.g., DTRAX® [cervical], TruFuse® [any level], NuFix® [any level])

Osteotomy

- Posterior cervical column osteotomy performed without meeting the criteria in the **General Guidelines** (when applicable for urgent/emergent conditions) **and** the **posterior column osteotomy (PCO) criteria** in **CMM-604.2 Osteotomy** is considered **not medically necessary**.
- Cervical three-column osteotomy or vertebral column resection (VCR) performed without meeting the criteria in the **General Guidelines** (when applicable for urgent/emergent conditions) **and** the **cervical three-column osteotomy/VCR criteria** in **CMM-604.2 Osteotomy** is considered **not medically necessary**.

Codes (CMM-604)

The inclusion of any code in this table does not imply that the code is under management or requires prior authorization. Refer to the applicable health plan for management details. Prior authorization of a code listed in this table is not a guarantee of payment. The Certificate of Coverage or Evidence of Coverage policy outlines the terms and conditions of the member's health insurance policy.

Code	Code Description/Definition
22210	Osteotomy of spine, posterior or posterolateral approach, 1 vertebral segment; cervical
+22216	Osteotomy of spine, posterior or posterolateral approach, 1 vertebral segment; each additional vertebral segment (List separately in addition to code for primary procedure)
22590	Arthrodesis, posterior technique, craniocervical (occiput-C2)
22595	Arthrodesis, posterior technique, atlas-axis (C1-C2)
22600	Arthrodesis, posterior or posterolateral technique, single interspace; cervical below C2 segment
+22614	Each additional vertebral segment (List separately in addition to code for primary procedure)
+22840	Posterior non-segmental instrumentation (e.g., Harrington rod technique, pedicle fixation across 1 interspace, atlantoaxial transarticular screw fixation, sublaminar wiring at C1, facet screw fixation) (List separately in addition to code for primary procedure)
+22841	Internal spinal fixation by wiring of spinous processes (List separately in addition to code for primary procedure)
+22842	Posterior segmental instrumentation (e.g., pedicle fixation, dual rods with multiple hooks and sublaminar wires); 3 to 6 vertebral segments (List separately in addition to code for primary procedure)
+22843	Posterior segmental instrumentation (e.g., pedicle fixation, dual rods with multiple hooks and sublaminar wires); 7 to 12 vertebral segments (List separately in addition to code for primary procedure)
63001	Laminectomy with exploration and/or decompression of spinal cord and/or cauda equina, without facetectomy, foraminotomy or discectomy (e.g. spinal stenosis), 1 or 2 vertebral segments; cervical
63015	Laminectomy with exploration and/or decompression of spinal cord and/or cauda equina, without facetectomy, foraminotomy or discectomy (e.g., spinal stenosis), more than 2 vertebral segments; cervical
63045	Laminectomy, facetectomy and foraminotomy (unilateral or bilateral with decompression of spinal cord, cauda equina and/or nerve root[s], [e.g., spinal or lateral recess stenosis]), single vertebral segment; cervical
+63048	Laminectomy, facetectomy and foraminotomy (unilateral or bilateral with decompression of spinal cord, cauda equina and/or nerve root[s], [e.g. spinal or lateral recess stenosis]), single vertebral segment; each additional vertebral segment, cervical, thoracic, or lumbar (List separately in addition to code for primary procedure)
63050	Laminoplasty, cervical, with decompression of the spinal cord, 2 or more vertebral segments;

Code	Code Description/Definition
63051	Laminoplasty, cervical, with decompression of the spinal cord, 2 or more vertebral segments; with reconstruction of the posterior bony elements (including the application of bridging bone graft and non-segmental fixation devices (e.g., wire, suture, mini-plates), when performed)
63265	Laminectomy for excision or evacuation of intraspinal lesion other than neoplasm, extradural; cervical
63270	Laminectomy for excision of intraspinal lesion other than neoplasm, intradural; cervical
63275	Laminectomy for biopsy/excision of intraspinal neoplasm; extradural, cervical
63280	Laminectomy for biopsy/excision of intraspinal neoplasm; intradural, extramedullary, cervical
63285	Laminectomy for biopsy/excision of intraspinal neoplasm; intradural, intramedullary, cervical
63290	Laminectomy for biopsy/excision of intraspinal neoplasm; combined extradural-intradural lesion, any level
0219T	Placement of a posterior intrafacet implant(s), unilateral or bilateral, including imaging and placement of bone graft(s) or synthetic device(s), single level; cervical

Evidence Discussion (CMM-604)

Posterior Cervical Fusion

Risks of posterior cervical fusion surgery include, but are not limited to, the following: infection; persistent or incomplete relief of symptoms; dural tear; deep vein thrombosis; pulmonary embolus; stroke; bleeding; vertebral artery injury; nerve root injury; spinal cord injury; paralysis; and, death. Complications related to the implants (e.g., misplacement, migration, subsidence, screw failure/backout) are also possible. Late complications include adjacent segment disease and pseudoarthrosis often necessitating revision surgery at the adjacent or index levels. This may start a cascade of multiple fusions, more complications and poor long term outcome. Some of these complications can be devastating and lead to poor outcome. Primary indications for surgery include individuals with radiculopathy or myelopathy. Other indications include instability in the setting of infection, tumor, trauma and localized or global deformity. Given the potential possibility for significant complications, proper patient selection is critical to minimize the risk benefit ratio. As recommended by the North American Spine Society (NASS) Coverage Policy Recommendations, history, symptoms, physical exam findings, and imaging findings should support posterior cervical fusion. Subjective symptoms and examination findings need to be concordant with imaging as is not uncommon for asymptomatic individuals to have abnormalities on MRI.

Multiple studies have shown that the vast majority of individuals with cervical radiculopathy will improve with a 4-6 week course of non-operative treatment. Initial non-operative management is also noted as a recommendation in the North American Spine Society (NASS) Coverage Policy Recommendations. However, for individuals with myelopathy or other urgent/emergent conditions (e.g., progressive neurologic deficit, instability due to other disorders) a trial of non-operative treatment would not be necessary.

Contraindications to posterior cervical fusion, as noted in the North American Spine Society (NASS) Coverage Policy Recommendations: *Cervical Fusion*, include treatment of discogenic axial neck pain without neurological symptoms, asymptomatic spinal stenosis without MRI evidence of intrinsic spinal cord signal change and no instability during isolated foraminal stenosis surgery.

Jackson et al. (2020) noted higher rates of postoperative complications and worse functional outcomes in individuals with psychological disorders undergoing spinal surgery. It was concluded that proper identification and treatment of these conditions prior to surgery may significantly improve many outcome measures in this population.

References (CMM-604)

1. American Academy of Orthopaedic Surgeons (AAOS)®. *Position Information Statement 1047: The effects of tobacco exposure on the musculoskeletal system*. Feb 2016. © American Academy of Orthopaedic Surgeons (AAOS). Available at: <https://www.aaos.org/globalassets/about/bylaws-library/information-statements/1047-tobacco-use-and-orthopaedic-surgery-3.pdf>.
2. American Academy of Orthopaedic Surgeons (AAOS)®. *OrthoInfo: Orthopaedic Surgery and Smoking*. May 2024. © American Academy of Orthopaedic Surgeons (AAOS). Available at: <https://orthoinfo.aaos.org/en/treatment/surgery-and-smoking>.
3. Bader RK, Mayer R, Pennicooke B, Chou D, Mummaneni PV, Tan LA. Complications following posterior cervical decompression and fusion: a review of incidence, risk factors, and prevention strategies. *J Spine Surg*. 2020;6(1):323-333. doi:10.21037/jss.2019.11.01.
4. Barton C, Kalakoti P, Bedard NA, Hendrickson NR, Saifi C, Pugely AJ. What Are the Costs of Cervical Radiculopathy Prior to Surgical Treatment? *Spine*. 2019;44(13):937-942. doi:10.1097/brs.0000000000002983.
5. Bond M, McIntosh G, Fisher C, et al. Treatment of Mild Cervical Myelopathy. *Spine (Phila Pa 1976)*. 2019;44(22):1606-1612. doi:10.1097/brs.0000000000003124.
6. Boonstra AM, Schiphorst Preuper HR, Balk GA, Stewart RE. Cut-off points for mild, moderate, and severe pain on the visual analogue scale for pain in patients with chronic musculoskeletal pain. *Pain*. 2014;155(12):2545-2550. doi:10.1016/j.pain.2014.09.014.
7. Brinjikji W, Luetmer PH, Comstock B, et al. Systematic literature review of imaging features of spinal degeneration in asymptomatic populations. *AJNR Am J Neuroradiol*. 2015;36(4):811-816. doi:10.3174/ajnr.A4173.
8. Broekema AEH, Simões de Souza NF, Soer R, et al. Noninferiority of Posterior Cervical Foraminotomy vs Anterior Cervical Discectomy With Fusion for Procedural Success and Reduction in Arm Pain Among Patients With Cervical Radiculopathy at 1 Year. *JAMA Neurol*. 2023;80(1):40-40. doi:10.1001/jamaneurol.2022.4208.
9. Campbell RM. Spine deformities in rare congenital syndromes: clinical issues. *Spine*. 2009;34(17):1815-1827.
10. Cardoso MJ, Koski TR, Ganju A, Liu JC. Approach-related complications after decompression for cervical ossification of the posterior longitudinal ligament. *Neurosurg Focus*. 2011;30(3):E12. doi:10.3171/2011.1.FOCUS10278.
11. Carette S, Fehlings MG. Clinical practice. Cervical radiculopathy. *NEJM*. 2005;353(4):392-399.
12. Celestre PC, Pazmiño PR, Mikhael MM, et al. Minimally invasive approaches to the cervical spine. *Orthop Clin North Am*. 2012;43(1):137-147. doi:10.1016/j.ocl.2011.08.007.
13. Chatley A, Kumar R, Jain V, Behari S, Sahu R. Effect of spinal cord signal intensity changes on clinical outcome after surgery for cervical spondylotic myelopathy. *J Neurosurg Spine*. 2009;11(5):562-567. doi:10.3171/2009.6.spine091.
14. Childress MA, Becker BA. Nonoperative Management of Cervical Radiculopathy. *Am Fam Physician*. 2016;93(9):746-754.
15. Cohen SP, Hanling S, Bicket MC, et al. Epidural steroid injections compared with gabapentin for lumbosacral radicular pain: multicenter randomized double blind comparative efficacy study. *BMJ*. 2015;350:h1748. Published 2015 Apr 16.. doi:10.1136/bmj.h1748.
16. Dorward IG, Lenke LG. Osteotomies in the posterior-only treatment of complex adult spinal deformity: a comparative review. *Neurosurg Focus*. 2010;28(3):E4. doi:10.3171/2009.12.focus09259.
17. Dru AB, Lockney DT, Vaziri S, et al. Cervical Spine Deformity Correction Techniques. *Neurospine*. 2019;16(3):470-482. doi:10.14245/ns.1938288.144.
18. Dvorak MF, Fisher CG, Fehlings MG, et al. The surgical approach to subaxial cervical spine injuries: an evidence-based algorithm based on the SLIC classification system. *Spine*. 2007;32(23):2620-2629. doi:10.1097/BRS.0b013e318158ce16.
19. Farshad M, Burgstaller JM, Held U, et al. Do preoperative corticosteroid injections increase the risk for infections or wound healing problems after spine surgery? *Spine*. 2018;43(15):1089-1094.
20. Fejer R, Jordan A, Hartvigsen J. Categorising the severity of neck pain: Establishment of cut-points for use in clinical and epidemiological research. *Pain*. 2005;119(1-3):176-182. doi:10.1016/j.pain.2005.09.033.
21. Ghogawala Z, Martin B, Benzel EC, et al. Comparative effectiveness of ventral vs dorsal surgery for cervical spondylotic myelopathy. *Neurosurgery*. 2011;68(3):622-631. doi:10.1227/NEU.0b013e31820777cf.
22. Grabowski G, Cornett CA, Kang JD. Esophageal and vertebral artery injuries during complex cervical spine surgery--avoidance and management. *Orthop Clin North Am*. 2012;43(1):63-74.
23. Guzman JZ, Feldman ZM, McAnany S, Hecht AC, Qureshi SA, Cho SK. Osteoporosis in Cervical Spine Surgery. *Spine*. 2016;41(8):662-668.
24. Hankinson TC, Anderson RC. Craniovertebral junction abnormalities in Down syndrome. *Neurosurgery*. 2010;66(3 Suppl):32-38.
25. Hecht AC, Koehler SM, Laudone JC, Jenkins A, Qureshi S. Is intraoperative CT of posterior cervical spine instrumentation cost-effective and does it reduce complications? *Clin Orthop Relat Res*. 2011;469(4):1035-1041.

26. Hilton B, Tempest-Mitchell J, Davies B, Kotter M. Assessment of degenerative cervical myelopathy differs between specialists and may influence time to diagnosis and clinical outcomes. *PLoS ONE*. 2018;13(12). doi:10.1371/journal.pone.0207709.

27. Hsu WK. Advanced techniques in cervical spine surgery. *J Bone Joint Surg Am*. 2011;93(8):780-788.

28. Jackson KL, Rumley J, Griffith M, Agochukwu U, DeVine J. Correlating Psychological Comorbidities and Outcomes After Spine Surgery. *Global Spine J*. 2020;10(7):929-939. doi:10.1177/2192568219886595.

29. Jayaram RH, Joo P, Gouzoulis MJ, Ratnasamy PP, Caruana D, Moore HE. Single-level Anterior Cervical discEctomy and Fusion has Lower Five-year Revisions than Posterior Cervical Foraminalotomy in a Large National Cohort. *Spine*. 2023;48(18):1266-1271. doi:10.1097/brs.0000000000004754.

30. Komotar RJ, Mocco J, Kaiser MG. Surgical management of cervical myelopathy: indications and techniques for laminectomy and fusion. *Spine J*. 2006;6(6 Suppl):252S-267S.

31. Krauss WE, Bledsoe JM, Clarke MJ, Nottmeier EW, Pichelmann MA. Rheumatoid arthritis of the cranivertebral junction. *Neurosurgery*. 2010;66(3 Suppl):83-95.

32. Kushchayev SV, Glushko T, Jarraya M, et al. ABCs of the degenerative spine. *Insights Imaging*. 2018;9(2):253-274. doi:10.1007/s13244-017-0584-z.

33. Kwon BK, Vaccaro AR, Grauer JN, Fisher CG, Dvorak MF. Subaxial cervical spine trauma. *JAAOS*. 2006;14(2):78-89.

34. La Marca F, Brumblay H. Smith-Petersen Osteotomy in Thoracolumbar Deformity Surgery. *Neurosurgery*. 2008;63(3):A163-A170. doi:10.1227/01.neu.0000320428.67620.4f.

35. Lawrence BD, Brodke DS. Posterior surgery for cervical myelopathy: indications, techniques, and outcomes. *Ortho Clin North Am*. 2012;43(1):29-40.

36. Lee BS, Nault R, Grabowski M, et al. Utility of repeat magnetic resonance imaging in surgical patients with lumbar stenosis without disc herniation. *Spine J*. 2019;19(2):191-198. doi:10.1016/j.spinee.2018.06.357.

37. Luyao H, Xiaoxiao Y, Tianxiao F, Yuandong L, Ping Wang. Management of Cervical Spondylotic Radiculopathy: A Systematic Review. *Global Spine J*. 2022;12(8):1912-1924. doi:10.1177/21925682221075290.

38. Machino M, Yukawa Y, Ito K, et al. Risk Factors for Poor Outcome of Cervical Laminoplasty for Cervical Spondylotic Myelopathy in Patients with Diabetes. *J Bone Joint Surg Am*. 2014;96:2049-2055.

39. Manzano GR, Casella G, Wang MY, D'ODCS, Levi AD. A Prospective, Randomized Trial Comparing Expansile Cervical Laminoplasty versus Cervical Laminectomy and Fusion for Multi-level Cervical Myelopathy. *Neurosurgery*. 2012;70(2):264-277. doi:10.1227/NEU.0b013e3182305669.

40. Matsumoto M, Fujimura Y, Suzuki N, et al. MRI of cervical intervertebral discs in asymptomatic subjects. *J Bone Joint Surg Br*. 1998;80(1):19-24. doi:10.1302/0301-620x.80b1.7929.

41. Matz PG, Anderson PA, Groff MW, et al. Cervical laminoplasty for the treatment of cervical degenerative myelopathy. *J Neurosurg Spine*. 2009;11(2):157-169. doi:10.3171/2009.1.SPINE08726.

42. McDonald C, Hershman S, Hogan W, et al. Cervical Laminoplasty Versus Posterior Laminectomy and Fusion: Trends in Utilization and Evaluation of Complication and Revision Surgery Rates. *JAAOS*. 2022;30(17):858-866. doi:10.5435/jaaos-d-22-00106.

43. Molina CA, Gokaslan ZL, Sciubba DM. Diagnosis and management of metastatic cervical spine tumors. *Orthop Clin North Am*. 2012;43(1):75-87.

44. Mummaneni PV, Kaiser MG, Matz PG, et al. Preoperative patient selection with magnetic resonance imaging, computed tomography, and electroencephalography: does the test predict outcome after cervical surgery? *J Neurosurg*. 2009;11(2):119-129. doi:10.3171/2009.3.SPINE08717.

45. Mummaneni PV, Kaiser MG, Matz PG, et al. Cervical surgical techniques for the treatment of cervical spondylotic myelopathy. *J Neurosurg Spine*. 2009;11(2):130-141. doi:10.3171/2009.3.SPINE08728.

46. National Hospital Discharge Database Analysis, all payers, all applicable states, 2009-2010. [Context Link 1, 2, 3].

47. North American Spine Society (NASS). *Coverage Policy Recommendations: Cervical Fusion*. May 2023. Burr Ridge, IL. North American Spine Society (NASS). Available at: <https://www.spine.org/coverage>.

48. North American Spine Society (NASS). *Evidence-Based Clinical Guidelines for Multidisciplinary Spine Care: Diagnosis and Treatment of Cervical Radiculopathy from Degenerative Disorders*. 2010. Burr Ridge, IL. North American Spine Society (NASS). Available at: <https://www.spine.org>.

49. North American Spine Society (NASS). Hills BB, Kasliwal MK, eds. Cervical Radiographic Parameters in the Management of Cervical Spine Disorders: The Minimum that Needs to Be Measured. *SpineLine*. 2019;20(5):12-16. Available at: <https://www.spine.org/Portals/0/assets/downloads/Publications/SpineLine/SeptOct19.pdf>.

50. Panagopoulos J, Hush J, Steffens D, Hancock MJ. Do MRI Findings Change Over a Period of Up to 1 Year in Patients With Low Back Pain and/or Sciatica? *Spine*. 2017;42(7):504-512. doi:10.1097/brs.0000000000001790.

51. Raizman NM, O'Brien JR, Poehling-Monaghan KL, Yu WD. Pseudarthrosis of the spine. *JAAOS*. 2009;17(8):494-503.

52. Raja M, Garg A, Yadav P, Jha K, Handa S. Diagnostic Methods for Detection of Cotinine Level in Tobacco Users: A Review. *J Clin Diagn Res*. 2016;10(3):ZE04-ZE06. doi:10.7860/JCDR/2016/17360.7423.

53. Rao RD, Gourab K, David KS. Operative treatment of cervical spondylotic myelopathy. *J Bone Joint Surg Am*. 2006;88(7):1619-1640.

54. Ries ZG, Glassman SD, Vasilyev I, Metcalfe L, Carreon LY. Updated imaging does not affect revision rates in adults undergoing spine surgery for lumbar degenerative disease. *J Neurosurg Spine*. Published online Nov 2018. 2019;30(2):228-223. doi:10.3171/2018.8.spine18586.
55. Sasso RC, Anderson PA, Riew KD, Heller JG. Results of cervical arthroplasty compared with anterior discectomy and fusion: four-year clinical outcomes in a prospective, randomized controlled trial. *Orthopedics*. 2011;34(11):889.
56. Sakaura H, Hosono N, Mukai Y, Ishii T, Iwasaki M, Yoshikawa H. Long-term outcome of laminoplasty for cervical myelopathy due to disc herniation: a comparative study of laminoplasty and anterior spinal fusion. *Spine (Phila Pa 1976)*. 2005;30(7):756-759.
57. Shafshak TS, Elnemr R. The Visual Analogue Scale Versus Numerical Rating Scale in Measuring Pain Severity and Predicting Disability in Low Back Pain. *J Clin Rheumatol*. 2020;27(7):1. doi:10.1097/rhu.0000000000001320.
58. Shetty GM, Song HR, Unnikrishnan R, Suh SW, Lee SH, Hur CY. Upper cervical spine instability in pseudoachondroplasia. *J Pediatr Orthop*. 2007;27(7):782-787.
59. Shin JH, Steinmetz MP, Benzel EC, Krishnaney AA. Dorsal versus ventral surgery for cervical ossification of the posterior longitudinal ligament: considerations for approach selection and review of surgical outcomes. *Neurosurg Focus*. 2011;30(3):E8.
60. Siemionow K, Janusz P, Phillips FM, et al. Clinical and Radiographic Results of Indirect Decompression and Posterior Cervical Fusion for Single-Level Cervical Radiculopathy Using an Expandable Implant with 2-Year Follow-Up. *J Neurol Surg A Cent Eur Neurosurg*. 2016;77(6):482-488. Epub 2016 Jun 8. doi:10.1055/s-0036-1584210.
61. Sivaganesan A, Kim HJ. A Review of Indications, Surgical Technique, and Outcomes for the Cervical Pedicle Subtraction Osteotomy. *JAAOS*. 2022;30(3):e295-e300. doi:10.5435/jaaos-d-21-00177.
62. Sun Q, Hu A, Zhang Y, et al. Do intramedullary spinal cord changes in signal intensity on MRI affect surgical opportunity and approach for cervical myelopathy due to ossification of the posterior longitudinal ligament? *Eur Spine J*. 2011;20(9):1466-1473. doi:10.1007/s00586-011-1813-7.
63. Swezey RL. Conservative treatment of cervical radiculopathy. *J Clin Rheumatol*. 1999;5(2):65-73. doi:10.1097/00124743-199904000-00006.
64. Thayer LS, Tiffany EM, Carreira DS. Addressing Smoking in Musculoskeletal Specialty Care. *J Bone Joint Surg Am*. 2021;103(22):2145-2152. doi:10.2106/jbjs.21.00108. doi:10.2106/JBJS.21.00108.
65. Tracy JA, Bartleson JD. Cervical spondylotic myelopathy. *Neurologist*. 2010;16(3):176-187.
66. Tetreault L, Tan G, Kopjar B, et al. Clinical and surgical predictors of complications following surgery for the treatment of cervical spondylotic myelopathy: results from the multicenter, prospective AOSpine International Study of 479 patients. *Neurosurgery*. 2016;79(1):33-44. doi:10.1227/NEU.0000000000001151.
67. Turgut M. Klippel-Feil syndrome in association with posterior fossa dermoid tumour. *Acta Neurochirurgica*. 2009;151(3):269-276.
68. Wang VY, Chou D. The cervicothoracic junction. *Neurosurg Clin North Am*. 2007;18(2):365-371.
69. Weinberg D, Chugh AJ, Gebhart JJ, et al. Magnetic resonance imaging of the cervical spine under-represents sagittal plane deformity in degenerative myelopathy patients. *Int J Spine Surg*. 2016;10:32. doi:10.14444/3032.
70. White AA, Johnson RM, Panjabi MM, Southwick WO. Biomechanical analysis of clinical stability in the cervical spine. *Clin Orthop Relat Res*. 1975;(109):85-96. doi:10.1097/00003086-197506000-00011.
71. Wood GW II. Fractures, dislocations, and fracture-dislocations of the spine. In: Canale ST, Beaty JH, eds. *Campbell's Operative Orthopaedics*. 11th ed. Philadelphia, PA: Mosby Elsevier; 2008:1761-1850.
72. Yaksi A, Özgönenel L, Özgönenel B. The Efficiency of Gabapentin Therapy in Patients With Lumbar Spinal Stenosis. *Spine*. 2007;32(9):939-942. doi:10.1097/01.brs.0000261029.29170.e6.
73. Yin L, Zhang J, Wu Y, Li J, Yang Q. Increased signal intensity of spinal cord on T2W magnetic resonance imaging for cervical spondylotic myelopathy patients. *Medicine (Baltimore)*. 2020;99(49):e23098. doi:10.1097/md.00000000000023098.
74. Zechmeister I, Winkler R, Mad P. Artificial total disc replacement versus fusion for the cervical spine: a systematic review. *Eur Spine J*. 2011;20(2):177-184.