

# CIGNA MEDICAL COVERAGE POLICIES - MUSCULOSKELETAL CMM-604: Posterior Cervical Fusion

Effective Date: August 04, 2026



**EviCore**  
By EVERNORTH

---

## 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.

This evidence-based medical coverage policy has been developed by EviCore, Inc. Some information in this coverage policy may not apply to all benefit plans administered by Cigna.

These guidelines include procedures EviCore does not review for Cigna. Please refer to the [Cigna CPT code list](#) for the current list of high-tech imaging procedures that EviCore reviews for Cigna.

CPT® (Current Procedural Terminology) is a registered trademark of the American Medical Association (AMA). CPT® five-digit codes, nomenclature and other data are copyright 2026 American Medical Association. All Rights Reserved. No fee schedules, basic units, relative values or related listings are included in the CPT book. AMA does not directly or indirectly practice medicine or dispense medical services. AMA assumes no liability for the data contained herein or not contained herein.

© Copyright 2026 EviCore healthcare

# Table of Contents

Guideline	Page
<b>CMM-604.1: General Guidelines.....</b>	<b>3</b>
<b>CMM-604.2: Osteotomy.....</b>	<b>6</b>
<b>CMM-604.3: Initial Primary Posterior Cervical Fusion for Conditions other than Pseudoarthrosis.....</b>	<b>9</b>
<b>CMM-604.4: Initial Primary Posterior Cervical Fusion with Posterior Cervical Decompression for Conditions other than Pseudoarthrosis.....</b>	<b>12</b>
<b>CMM-604.5: Posterior Cervical Fusion (Initial or Repeat) for Symptomatic Pseudoarthrosis.....</b>	<b>16</b>
<b>CMM-604.6: Repeat Posterior Cervical Fusion at the Same Level for Conditions other than Pseudoarthrosis.....</b>	<b>20</b>
<b>CMM-604.7: Posterior Cervical Fusion (with or without Decompression) Following Failed Cervical Disc Arthroplasty Surgery.....</b>	<b>22</b>
<b>CMM-604.8: Non-Indications.....</b>	<b>26</b>
<b>Codes (CMM-604).....</b>	<b>28</b>
<b>Evidence Discussion (CMM-604).....</b>	<b>31</b>
<b>References (CMM-604).....</b>	<b>34</b>

# CMM-604.1: General Guidelines

---

Guideline	Page
General Guidelines.....	4

CMM-604: Posterior Cervical Fusion

# General Guidelines

**CMM.SP.GG.604.1****v1.0.2026**

## 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)
    - time frame 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
    - progressive neurological deficit documented on two separate physical exams
    - neurocompressive pathology with ANY of the following:
      - 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
    - plain x-rays show instability and include EITHER of the following findings:

- subluxation or translation >3.5mm on static lateral or dynamic flexion/extension views
- sagittal plane angulation >11° between adjacent spinal segments on static or dynamic flexion/extension lateral views
- epidural hematoma
- infection (e.g., discitis, epidural abscess, osteomyelitis)
- primary or metastatic neoplastic disease causing pathologic fracture, cord compression, or instability
- vascular malformations (e.g., AVM)
- 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 incapacitated

### Health Equity Considerations

Health equity is the highest level of health for all individuals; health inequity is the avoidable difference in health status or distribution of health resources due to the social conditions in which individuals are born, grow, live, work, and age. Social determinants of health are the conditions in the environment that affect a wide range of health, functioning, and quality of life outcomes and risks. Examples include the following: safe housing, transportation, and neighborhoods; racism, discrimination, and violence; education, job opportunities, and income; access to nutritious foods and physical activity opportunities; access to clean air and water; and language and literacy skills.

# CMM-604.2: Osteotomy

---

Guideline	Page
CMM-604.2: Osteotomy.....	7

CMM-604: Posterior Cervical Fusion

# CMM-604.2: Osteotomy

CMM.SP.IN.604.2

v1.0.2026

## 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 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 decompression) alone.
- Posterior cervical fusion (with or without posterior cervical decompression) criteria have been met in the applicable procedure-specific section:
  - **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 cervical fusion (with or without posterior decompression) alone.
- Posterior cervical fusion (with or without posterior cervical decompression) criteria have been met in the applicable procedure-specific section:
  - **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

Guideline	Page
CMM-604.3: Initial Primary Posterior Cervical Fusion for Conditions other than Pseudoarthrosis.....	10

CMM-604: Posterior Cervical Fusion

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

CMM.SP.IN.604.3

v1.0.2026

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

### Instability Meeting Urgent/Emergent Criteria

- Plain x-rays show instability and include EITHER of the following findings:
  - subluxation or translation >3.5mm on static lateral or dynamic flexion/extension views
  - sagittal plane angulation >11° between adjacent spinal segments on static or dynamic flexion/extension lateral views

### Instability Not Meeting Urgent/Emergent Criteria

- 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 validated by objective cotinine testing methods (serum, urinary, or saliva) verified as within the normal range for the testing method and lab at which the test was performed

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

### Instability Meeting Urgent/Emergent Criteria

- Plain x-rays show instability and include EITHER of the following findings:
  - subluxation or translation >3.5mm on static lateral or dynamic flexion/extension views
  - sagittal plane angulation >11° between adjacent spinal segments on static or dynamic flexion/extension lateral views

### Rheumatoid Arthritis or Condition with Increased Incidence of Instability

- 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 includes BOTH of the following:
  - 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 validated by objective cotinine testing methods (serum, urinary, or saliva) verified as within the normal range for the testing method and lab at which the test was performed

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

---

Guideline	Page
CMM-604.4: Initial Primary Posterior Cervical Fusion with Posterior Cervical Decompression for Conditions other than Pseudoarthrosis.....	13

CMM-604: Posterior Cervical Fusion

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

CMM.SP.IN.604.4

v1.0.2026

Initial posterior cervical fusion with posterior cervical decompression (laminectomy, hemilaminectomy, and 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 validated by objective cotinine testing methods (serum, urinary, or saliva) verified as within the normal range for the testing method and lab at which the test was performed

## 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 validated by objective cotinine testing methods (serum, urinary, or saliva) verified as within the normal range for the testing method and lab at which the test was performed

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

### **Instability Meeting Urgent/Emergent Criteria**

- Plain x-rays show instability and include EITHER of the following findings:
  - subluxation or translation >3.5mm on static lateral or dynamic flexion/extension views
  - sagittal plane angulation >11° between adjacent spinal segments on static or dynamic flexion/extension lateral views

### **Rheumatoid Arthritis or Condition with Increased Incidence of Instability**

- 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 includes BOTH of the following:
  - 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

validated by objective cotinine testing methods (serum, urinary, or saliva) verified as within the normal range for the testing method and lab at which the test was performed

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

### **Instability Meeting Urgent/Emergent Criteria**

- Plain x-rays show instability and include EITHER of the following findings:
  - subluxation or translation >3.5mm on static lateral or dynamic flexion/extension views
  - sagittal plane angulation >11° between adjacent spinal segments on static or dynamic flexion/extension lateral views

### **Instability Not Meeting Urgent/Emergent Criteria**

- 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 validated by objective cotinine testing methods (serum, urinary, or saliva) verified as within the normal range for the testing method and lab at which the test was performed

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

---

Guideline	Page
CMM-604.5: Posterior Cervical Fusion (Initial or Repeat) for Symptomatic Pseudoarthrosis.....	17

CMM-604: Posterior Cervical Fusion

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

CMM.SP.IN.604.5

v1.0.2026

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 at the same level
- Symptoms include 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 BOTH of the following (unless contraindicated):
  - prescription strength analgesics, steroids, gabapentinoids, and/or nonsteroidal anti-inflammatory drugs (NSAIDs) for six (6) months
  - provider-directed exercise program (prescribed by a physical therapist, chiropractic provider, osteopathic or allopathic physician) for six (6) months
- Post-operative MRI/CT findings 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 smokeless tobacco products, and/or nicotine replacement therapy for at least six (6) weeks prior to planned surgery validated by objective cotinine testing methods (serum, urinary, or saliva) verified as within the normal range for the testing method and lab at which the test was performed

## Radiculopathy with Pseudoarthrosis

- Greater than six (6) months since the prior cervical fusion at the same level

- 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
- 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 nonsteroidal anti-inflammatory drugs (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 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 validated by objective cotinine testing methods (serum, urinary, or saliva) verified as within the normal range for the testing method and lab at which the test was performed

**Myelopathy with Pseudoarthrosis**

- Greater than six (6) months since the prior cervical fusion at the same level
- 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
- 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

Guideline	Page
CMM-604.6: Repeat Posterior Cervical Fusion at the Same Level for Conditions other than Pseudoarthrosis.....	21

CMM-604: Posterior Cervical Fusion

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

CMM.SP.IN.604.6

v1.0.2026

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

Guideline	Page
CMM-604.7: Posterior Cervical Fusion (with or without Decompression) Following Failed Cervical Disc Arthroplasty Surgery.....	23

CMM-604: Posterior Cervical Fusion

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

CMM.SP.IN.604.7

v1.0.2026

Posterior cervical fusion (with or without posterior cervical decompression) following a failed cervical total disc arthroplasty 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 total disc arthroplasty at the same level
- Symptoms include 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 BOTH of the following (unless contraindicated):
  - prescription strength analgesics, steroids, gabapentinoids, and/or nonsteroidal anti-inflammatory drugs (NSAIDs) for six (6) weeks
  - provider-directed exercise program (prescribed by a physical therapist, chiropractic provider, osteopathic or allopathic physician) for six (6) weeks
- Post-operative MRI/CT findings 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 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

CMM-604: Posterior Cervical Fusion

validated by objective cotinine testing methods (serum, urinary, or saliva) verified as within the normal range for the testing method and lab at which the test was performed

### **Radiculopathy**

- Greater than six (6) months since the prior cervical total disc arthroplasty at the same level
- 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
- 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 nonsteroidal anti-inflammatory drugs (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 validated by objective cotinine testing methods (serum, urinary, or saliva) verified as within the normal range for the testing method and lab at which the test was performed

### **Myelopathy**

- Greater than six (6) months since the prior cervical total disc arthroplasty at the same level
- 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
- 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

---

Guideline	Page
Not Medically Necessary.....	27

CMM-604: Posterior Cervical Fusion

# Not Medically Necessary

CMM.SP.NI.604.8

v1.0.2026

## 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**, **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)

---

Guideline	Page
Codes (CMM-604).....	29

CMM-604: Posterior Cervical Fusion

## Codes (CMM-604)

CMM.SP.PC.604

v1.0.2026

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
<b>22210</b>	Osteotomy of spine, posterior or posterolateral approach, 1 vertebral segment; cervical
<b>+22216</b>	Osteotomy of spine, posterior or posterolateral approach, 1 vertebral segment; each additional vertebral segment (List separately in addition to code for primary procedure)
<b>22590</b>	Arthrodesis, posterior technique, craniocervical (occiput-C2)
<b>22595</b>	Arthrodesis, posterior technique, atlas-axis (C1-C2)
<b>22600</b>	Arthrodesis, posterior or posterolateral technique, single interspace; cervical below C2 segment
<b>+22614</b>	Each additional vertebral segment (List separately in addition to code for primary procedure)
<b>+22840</b>	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)
<b>+22841</b>	Internal spinal fixation by wiring of spinous processes (List separately in addition to code for primary procedure)
<b>+22842</b>	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)
<b>+22843</b>	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)

CMM-604: Posterior Cervical Fusion

Code	Code Description/Definition
<b>63001</b>	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
<b>63015</b>	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
<b>63045</b>	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
<b>+63048</b>	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)
<b>63050</b>	Laminoplasty, cervical, with decompression of the spinal cord, 2 or more vertebral segments;
<b>63051</b>	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)
<b>63265</b>	Laminectomy for excision or evacuation of intraspinal lesion other than neoplasm, extradural; cervical
<b>63270</b>	Laminectomy for excision of intraspinal lesion other than neoplasm, intradural; cervical
<b>63275</b>	Laminectomy for biopsy/excision of intraspinal neoplasm; extradural, cervical
<b>63280</b>	Laminectomy for biopsy/excision of intraspinal neoplasm; intradural, extramedullary, cervical
<b>63285</b>	Laminectomy for biopsy/excision of intraspinal neoplasm; intradural, intramedullary, cervical
<b>63290</b>	Laminectomy for biopsy/excision of intraspinal neoplasm; combined extradural-intradural lesion, any level
<b>0219T</b>	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)

---

Guideline	Page
Evidence Discussion (CMM-604).....	32

CMM-604: Posterior Cervical Fusion

# Evidence Discussion (CMM-604)

CMM.SP.ED.604

v1.0.2026

## 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.<sup>4,12</sup> 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 surgical candidacy selection is critical to minimize the risk benefit ratio. As recommended by the North American Spine Society (NASS) *Coverage Policy Recommendations: Cervical Fusion*, 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.<sup>9,45,52</sup>

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.<sup>16,42,67</sup> Initial non-operative management is also noted as a recommendation in the North American Spine Society (NASS) *Coverage Policy Recommendations: Cervical Fusion*.<sup>51</sup> 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 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.<sup>31</sup> It was concluded that proper identification and treatment of these conditions prior to surgery may significantly improve many outcome measures in this population.

Evidence supports that the various methods of cotinine testing (serum, saliva, urinary) are sufficiently equivalent in accuracy to confirm nicotine abstinence. Serum testing cutoff values ranged from 3.0ng/mL to 20ng/mL. Salivary testing cutoff values ranged from 10ng/mL to 44ng/mL. Urinary testing cutoff is 10ng/mL.<sup>1,6,18,34</sup>

# References (CMM-604)

---

Guideline	Page
References (CMM-604).....	35

CMM-604: Posterior Cervical Fusion

# References (CMM-604)

CMM.SP.RF.604

v1.0.2026

1. Achilihu H, Feng J, Wang L, Bernert JT. Tobacco use classification by inexpensive urinary cotinine immunoassay test strips. *J Anal Toxicol*. 2019;43(2):149-153. doi:10.1093/jat/bky075.
2. American Academy of Orthopaedic Surgeons (AAOS®). *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>.
3. 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>.
4. Badiie 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.
5. 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.
6. Benowitz NL, Bernert JT, Foulds J, et al. Biochemical verification of tobacco use and abstinence: 2019 update. *Nicotine Tob Res*. 2020;22(7):1086-1097. doi:10.1093/ntr/ntz132.
7. 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.
8. 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.
9. 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.
10. 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.
11. Campbell RM. Spine deformities in rare congenital syndromes: clinical issues. *Spine*. 2009;34(17):1815-1827.
12. 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.
13. Crette S, Fehlings MG. Clinical practice. Cervical radiculopathy. *NEJM*. 2005;353(4):392-399. doi:10.1056/NEJMc043887.
14. 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.
15. 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.
16. Childress MA, Becker BA. Nonoperative management of cervical radiculopathy. *Am Fam Physician*. 2016;93(9):746-754.
17. 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. doi:10.1136/bmj.h1748.
18. Cooke F, Bullen C, Whittaker R, McRobbie H, Chen MH, Walker N. Diagnostic accuracy of NicAlert cotinine test strips in saliva for verifying smoking status. *Nicotine Tob Res*. 2008;10(4):607-612. doi:10.1080/14622200801978680.

19. 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.
20. 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.
21. 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.
22. 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.
23. 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.
24. 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.
25. 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.
26. Guzman JZ, Feldman ZM, McAnany S, Hecht AC, Qureshi SA, Cho SK. Osteoporosis in cervical spine surgery. *Spine*. 2016;41(8):662-668.
27. Hankinson TC, Anderson RC. Craniovertebral junction abnormalities in Down syndrome. *Neurosurgery*. 2010;66(3 Suppl):32-38.
28. 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.
29. 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.
30. Hsu WK. Advanced techniques in cervical spine surgery. *J Bone Joint Surg Am*. 2011;93(8):780-788.
31. 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.
32. 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 foraminotomy in a large national cohort. *Spine (Phila Pa 1976)*. 2023;48(18):1266-1271. doi:10.1097/BRS.0000000000004754.
33. Joaquim AF, Ghizoni E, Tedeschi H, Appenzeller S, Riew KD, MD. Radiological evaluation of cervical spine involvement in rheumatoid arthritis. *Neurosurg Focus*. 2015;38(4):E4. doi:10.3171/2015.1.focus14664.
34. 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.
35. Kim S. Overview of cotinine cutoff values for smoking status classification. *Int J Environ Res Public Health*. 2016;13(12):1236. Published 2016 Dec 14. doi:10.3390/ijerph13121236.
36. Krauss WE, Bledsoe JM, Clarke MJ, Nottmeier EW, Pichelmann MA. Rheumatoid arthritis of the craniovertebral junction. *Neurosurgery*. 2010;66(3 Suppl):83-95.
37. 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.
38. Kwon BK, Vaccaro AR, Grauer JN, Fisher CG, Dvorak MF. Subaxial cervical spine trauma. *JAAOS*. 2006;14(2):78-89.
39. 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.
40. Lawrence BD, Brodke DS. Posterior surgery for cervical myelopathy: indications, techniques, and outcomes. *Ortho Clin North Am*. 2012;43(1):29-40.
41. 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.
42. 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.
43. 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.

44. 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.
45. 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.
46. 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.
47. 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.
48. Molina CA, Gokaslan ZL, Sciubba DM. Diagnosis and management of metastatic cervical spine tumors. *Orthop Clin North Am*. 2012;43(1):75-87.
49. 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.
50. 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.
51. 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>.
52. 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>.
53. 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>.
54. 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.
55. Raizman NM, O'Brien JR, Poehling-Monaghan KL, Yu WD. Pseudarthrosis of the spine. *JAAOS*. 2009;17(8):494-503.
56. Raja M, Garg A, Yadav P, et al. Diagnostic methods for detection of cotinine level in tobacco users: a review. *J Clin Diagn Res*. 2016;10(3):ZE04-ZE06.
57. Rao RD, Gourab K, David KS. Operative treatment of cervical spondylotic myelopathy. *J Bone Joint Surg Am*. 2006;88(7):1619-1640.
58. 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.
59. 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.
60. 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.
61. 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.
62. 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.
63. Shin JH, Steinmetz MP, Benzell 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.
64. 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.

65. 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.
66. 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.
67. Swezey RL. Conservative treatment of cervical radiculopathy. *J Clin Rheumatol*. 1999;5(2):65-73. doi:10.1097/00124743-199904000-00006.
68. 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.
69. Tracy JA, Bartleson JD. Cervical spondylotic myelopathy. *Neurologist*. 2010;16(3):176-187.
70. Tretreault 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.
71. Turgut M. Klippel-Feil syndrome in association with posterior fossa dermoid tumour. *Acta Neurochirurgica*. 2009;151(3):269-276.
72. Wang VY, Chou D. The cervicothoracic junction. *Neurosurg Clin North Am*. 2007;18(2):365-371.
73. 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.
74. 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.
75. Wood GW II. Fractures, dislocations, and fracture-dislocations of the spine. In: Canale ST, Beaty JH, eds. *Campbell's Operative Orthopaedics*. 11<sup>th</sup> ed. Philadelphia, PA: Mosby Elsevier; 2008:1761-1850.
76. 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.
77. 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.
78. 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.