



CLINICAL GUIDELINES

CMM-601: Anterior Cervical Discectomy and Fusion Guidelines

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EviCore
By **EVERNORTH**

EviCore healthcare Clinical Decision Support Tool Diagnostic Strategies: This tool addresses common symptoms and symptom complexes. Requests for individuals with atypical symptoms or clinical presentations that are not specifically addressed will require physician review. Consultation with the referring physician, specialist and/or individual's Primary Care Physician (PCP) may provide additional insight.

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CMM-601.1: General Guidelines

Application of Guideline

- The determination of medical necessity for the performance of anterior cervical fusion with discectomy/corpectomy (with or without osteotomy) 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 anterior cervical fusion with discectomy/corpectomy 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) 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 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
 - ◆ Epidural hematoma

- ◆ Infection (e.g., discitis, epidural abscess, osteomyelitis)
- ◆ Neoplasms of the spine
- ◆ 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 incapacitated

CMM-601.2: Osteotomy

Anterior Osteotomy or Vertebral Column Resection

Anterior cervical osteotomy or vertebral column resection [VCR] is considered **medically necessary** (in addition to fusion) when **ALL** of the following criteria have been met:

- Performed for **EITHER** of the following:
 - ◆ Correction of fixed cervical kyphotic deformity
 - ◆ Convert a cervical kyphotic deformity from fixed to mobile
- Correction of cervical kyphotic deformity cannot be attained by cervical fusion (with or without decompression/corpectomy) alone
- **ALL** of the criteria for anterior cervical discectomy/corpectomy and fusion have been met per the applicable procedure-specific section(s):
 - ◆ **CMM-601.4: Initial Primary Anterior Cervical Discectomy and Fusion (ACDF)**
 - ◆ **CMM-601.5: Anterior Cervical Corpectomy**
 - ◆ **CMM-601.6: Repeat Anterior Cervical Discectomy and Fusion (ACDF) at the Same Level**
 - ◆ **CMM-601.7: Adjacent Segment Disease**
 - ◆ **CMM-601.8: ACDF Following Failed Cervical Disc Arthroplasty Surgery**

CMM-601.3: Anterior Cervical Discectomy

- Anterior cervical discectomy **must be performed with a cervical fusion** due to the iatrogenic instability/increased disc degeneration of the anterior cervical discectomy procedure.
- Anterior cervical discectomy is considered **medically necessary** when performed with a cervical fusion when the criteria in the applicable procedure-specific section(s) have been met:
 - ◆ **CMM-601.4: Initial Primary Anterior Cervical Discectomy and Fusion (ACDF)**
 - ◆ **CMM-601.6: Repeat Anterior Cervical Discectomy and Fusion (ACDF) at the Same Level**
 - ◆ **CMM-601.7: Adjacent Segment Disease**
 - ◆ **CMM-601.8: ACDF Following Failed Cervical Disc Arthroplasty Surgery**

CMM-601.4: Initial Primary Anterior Cervical Discectomy and Fusion (ACDF)

Initial primary anterior cervical discectomy and fusion (ACDF) is considered medically necessary when performed for **EITHER** of the following conditions when **ALL** of the associated criteria have been met:

Radiculopathy

- 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.)
 - ◆ Unrelenting 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)
 - ◆ Unrelenting 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
- Plain X-rays of the cervical spine including flexion/extension lateral views have been performed
- 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

- 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
- 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-601.5: Anterior Cervical Corpectomy

Anterior cervical corpectomy with fusion considered **medically necessary** and can be performed **as an alternative** for anterior cervical discectomy and fusion (ACDF) when **ALL** of the following criteria have been met:

- Complete corpectomy or partial corpectomy (i.e., **removal of at least one-half of the vertebral body** [not for resection of osteophytes alone]) is being performed for **ANY** of the following:
 - ◆ Infection
 - ◆ Trauma
 - ◆ Tumor
 - ◆ Compression at or behind the level of the vertebral body
- Anterior cervical corpectomy must be performed with a cervical fusion due to the iatrogenic instability of the cervical corpectomy procedure.
- **ALL** of the criteria for anterior cervical discectomy and fusion have been met per the in the applicable procedure-specific section(s):
 - ◆ **CMM-601.4: Initial Primary Anterior Cervical Discectomy with Fusion (ACDF)**
 - ◆ **CMM-601.6: Repeat Anterior Cervical Discectomy with Fusion (ACDF) at the Same Level**
 - ◆ **CMM-601.7: Adjacent Segment Disease**
 - ◆ **CMM-601.8: ACDF Following Failed Cervical Disc Arthroplasty Surgery**

CMM-601.6: Repeat Anterior Cervical Discectomy and Fusion (ACDF) at the Same Level

Repeat anterior cervical discectomy and fusion (ACDF) at the same level is considered **medically necessary** when performed for **ANY** of the following conditions when **ALL** of the associated criteria have 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.)

Unremitting Neck Pain with Pseudoarthrosis

- Greater than six (6) months since the prior anterior cervical discectomy and fusion (ACDF) at the same level
- Subjective 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 six (6) weeks 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 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 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 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 with Pseudoarthrosis

- Greater than six (6) months since the prior anterior cervical discectomy and fusion (ACDF) 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, 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 with Pseudoarthrosis

- Greater than six (6) months since the prior anterior cervical discectomy and fusion (ACDF) 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 stenosis

CMM-601.7: Adjacent Segment Disease

Anterior cervical discectomy and fusion (ACDF) for a degenerative spinal segment adjacent to a previous decompression or fusion procedure is considered **medically necessary** when performed for **EITHER** of the following conditions when **ALL** of the associated criteria have been met:

Radiculopathy

- Greater than six (6) months since the prior cervical decompression or fusion at an adjacent 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.)
 - ◆ Unrelenting 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)
 - ◆ Unrelenting 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
- Plain X-rays of the cervical spine (including flexion/extension lateral views) **and** advanced diagnostic imaging show successful decompression and fusion **at the previous operative level**

- 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

- 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 due to a neurocompressive pathology
 - ◆ Frequent falls
- Objective concordant 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
- 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-601.8: ACDF Following Failed Cervical Disc Arthroplasty Surgery

Anterior cervical discectomy and fusion (ACDF) following failed cervical disc arthroplasty surgery is considered **medically necessary** when performed 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 (i.e., 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
- Subjective symptoms include 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 that 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 any **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 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

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-601.9: Non-Indications

Not Medically Necessary

- **Anterior cervical discectomy/corpectomy and fusion** performed without meeting the criteria listed in the **General Guidelines** section (when applicable for urgent/emergent conditions) **and** the criteria in the applicable procedure-specific section(s) (**initial fusion**, **corpectomy**, **repeat fusion**, **adjacent segment disease**, or **fusion following failed disc arthroplasty**) is considered **not medically necessary**.
- **Anterior cervical discectomy/corpectomy and fusion** performed for **ANY** other reason is considered **not medically necessary** including, but not limited to, performed for **EITHER** of the following conditions:
 - ◆ Chronic non-specific neck or arm pain of unknown etiology
 - ◆ Cervical degenerative disc disease without radiculopathy or myelopathy

- **Anterior cervical discectomy/corpectomy** performed alone (i.e., performed without a cervical fusion) is considered **not medically necessary**.
- **Anterior cervical osteotomy or vertebral column resection (VCR)** performed without meeting the criteria listed in the **General Guidelines** section (when applicable for urgent/emergent conditions) **and** the criteria in **CMM-601.2 Osteotomy** is considered **not medically necessary**.

Experimental, Investigational, or Unproven (EIU)

- Anterior endoscopic cervical disc/nerve root decompression is considered **experimental, investigational or unproven (EIU)**, including **ANY** of the following procedures:
 - ◆ Anterior endoscopic cervical decompression with microforaminotomy (e.g., Jho procedure)
 - ◆ Anterior endoscopic cervical disc decompression (e.g., Cervical Deuk Laser Disc Repair)

Codes (CMM-601)

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
22220	Osteotomy of spine, including discectomy, anterior approach, single vertebral segment, cervical
+22226	Osteotomy of spine, including discectomy, anterior approach, single vertebral segment, each additional vertebral segment (List separately in addition to code for primary procedure)
22548	Arthrodesis, anterior transoral or extraoral technique, clivus-C1-C2 (atlas-axis), with or without excision of odontoid process
22551	Arthrodesis, anterior interbody, including disc space preparation, discectomy, osteophytectomy and decompression of spinal cord and/or nerve roots; cervical below C2
+22552	Arthrodesis, anterior interbody, including disc space preparation, discectomy, osteophytectomy and decompression of spinal cord and/or nerve roots; cervical below C2, each additional interspace (List separately in addition to code for separate procedure)
22554	Arthrodesis, anterior interbody technique, including minimal discectomy to prepare interspace (other than for decompression); cervical below C2
+22585	Arthrodesis, anterior interbody technique, including minimal discectomy to prepare interspace (other than for decompression); each additional interspace (List separately in addition to code for primary procedure)
+22845	Anterior instrumentation; 2 to 3 vertebral segments (List separately in addition to code for primary procedure)
+22846	Anterior instrumentation; 4 to 7 vertebral segments (List separately in addition to code for primary procedure)
+22853	Insertion of interbody biomechanical device(s) (e.g., synthetic cage, mesh) with integral anterior instrumentation for device anchoring (e.g., screws, flanges), when performed, to intervertebral disc space in conjunction with interbody arthrodesis, each interspace (List separately in addition to code for primary procedure)
+22854	Insertion of intervertebral biomechanical device(s) (e.g., synthetic cage, mesh) with integral anterior instrumentation for device anchoring (e.g., screws, flanges), when performed, to vertebral corpectomy(ies) (vertebral body resection, partial or complete) defect, in conjunction with interbody arthrodesis, each contiguous defect (List separately in addition to code for primary procedure)
+22859	Insertion of intervertebral biomechanical device(s) (e.g., synthetic cage, mesh, methylmethacrylate) to intervertebral disc space or vertebral body defect without interbody arthrodesis, each contiguous defect (List separately in addition to code for primary procedure)
63075	Discectomy, anterior, with decompression of spinal cord and/or nerve root(s), including osteophytectomy; cervical, single interspace
+63076	Discectomy, anterior, with decompression of spinal cord and/or nerve root(s), including osteophytectomy; cervical, each additional interspace (List separately in addition to code for primary procedure)

Code	Code Description/Definition
63081	Vertebral corpectomy (vertebral body resection), partial or complete, anterior approach with decompression of spinal cord and/or nerve roots(s); cervical, single segment
+63082	Vertebral corpectomy (vertebral body resection), partial or complete, anterior approach with decompression of spinal cord and/or nerve roots(s); cervical, single segment; cervical, each additional segment (List separately in addition to code for primary procedure)

Evidence Discussion (CMM-601)

Anterior Cervical Discectomy and Fusion

Risks of anterior discectomy and fusion include, but are not limited to, the following: infection; dysphagia; dysphonia; bleeding; vertebral artery injury; recurrent laryngeal nerve injury; esophageal or tracheal injury; dural tear; hematoma; nerve root injury; spinal cord injury; paralysis; and, death. Complications related to the implants (e.g., 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. Indications for surgery include individuals with underlying cervical degenerative disc disease with the clinical presentation of cervical radiculopathy or myelopathy. Given the possibility of significant surgical complications, proper surgical candidacy selection is crucial to minimize the risk benefit ratio. Supportive subjective symptoms and physical exam findings should be present and concordant with imaging findings as abnormal advanced imaging findings are not uncommon in asymptomatic individuals.

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: Cervical Fusion*. However, for individuals with myelopathy or other urgent/emergent conditions (e.g., progressive neurologic deficit), a trial of non-operative treatment would not be necessary.

Contraindications to anterior cervical discectomy and fusion, as noted in North American Spine Society (NASS) *Coverage Policy Recommendations: Cervical Fusion*, include treatment of discogenic axial neck pain and isolated cervical radiculopathy due to foraminal stenosis amenable to simple foraminotomy.

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-601)

1. Albert TJ, Murrell SE. Surgical management of cervical radiculopathy. *J Am Acad Orthop Surg*. 1999;7(6):368-376. doi:10.5435/00124635-199911000-00003.
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. American Medical Association. Code 20660 as an Independent or Unrelated Procedure-Coding Tip. *CPT® Assistant Newsletter*. April 2012:11. Accessed October 5, 2023. Available at: <https://ocm.ama-assn.org/OCM/CPTAA/Newsletters.do?articleType=IssueArticle&filename=20120411&hitTerms=corpectomy>.
5. An HS, Simpson HM, Glover JM, et al. Comparison between allograft plus demineralized bone matrix versus autograft in anterior cervical fusion: a prospective multicenter study. *Spine*. 1995;20(20):2211-2216.
6. Anderson PA, Subach BR, Riw KD. Predictors of outcome after anterior cervical discectomy and fusion: a multivariate analysis. *Spine*. 2009;34:161-166.
7. 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.
8. 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.
9. Bishop RC, Moore KA, Hadley MN. Anterior cervical interbody fusion using autogeneic and allogeneic bone graft substrate: a prospective comparative analysis. *J Neurosurg*. 1996;85:206-210.
10. Bohlman HH, Emery SE, Goodfellow DB, et al. Robinson anterior cervical discectomy and arthrodesis for cervical radiculopathy. Long-term followup of one hundred and twenty-two patients. *J Bone Joint Surg Am*. 1993;75:1298-307.
11. 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.
12. 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.
13. 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.
14. 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.
15. Brown MD, Malinin TI, Davis PB. A roentgenographic evaluation of frozen allografts versus autografts in anterior cervical spine fusions. *Clin Orthop Relat Res*. 1976;119:231-236.
16. Buttermann, GR. Anterior Cervical Discectomy and Fusion Outcomes over 10 Years. *Spine*. 2018;43(3):207-214.
17. 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.
18. Carrier CS, Bono CM, Lebl DR. Evidence-based analysis of adjacent segment degeneration and disease after ACDF: a systematic review. *Spine J*. 2013;13:1370-1378.
19. Cauthen JC, Kinard RE, Vogler JB, et al. Outcome analysis of noninstrumented anterior cervical discectomy and interbody fusion in 348 patients. *Spine*. 1998;23:188-192.
20. 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.
21. Childress MA, Becker BA. Nonoperative Management of Cervical Radiculopathy. *Am Fam Physician*. 2016;93(9):746-754.
22. 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.
23. Daniels AH, Riew KD, Yoo JU, et al. Adverse events associated with anterior cervical spine surgery. *JAAOS*. 2008;16(12):729-738. doi:10.5435/00124635-200812000-00005.
24. 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.

25. Eck JC, Humphreys SC, Hodges SD, et al. A comparison of outcomes of anterior cervical discectomy and fusion in patients with and without radicular symptoms. *J Surg Orthop Adv*. 2006;15:24-26.
26. Emery SE, Bohlman HH, Bolesta MJ, et al. Anterior cervical decompression and arthrodesis for the treatment of cervical spondylotic myelopathy. Two to seventeen year follow-up. *J Bone Joint Surg Am*. 1998;80:941-951.
27. Emery SE, Fisher JR, Bohlman HH. Three-level anterior cervical discectomy and fusion: radiographic and clinical results. *Spine*. 1997;22:2622-2624.
28. Epstein NE. Iliac Crest Autograft Versus Alternative Constructs for Anterior Cervical Spine Surgery: Pros, Cons and Costs. *Surg Neurol Int*. 2012;3(Suppl3):S143-S156.
29. Eubanks JD, Thorpe SW, Cheruvu VK, et al. Does smoking influence fusion rates in posterior cervical arthrodesis with lateral mass instrumentation? *Clinical Orthop Relat Res*. 2011;469(3):696-701.
30. 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): 089-1094.
31. 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.
32. Floyd T, Ohnmeiss D. A meta-analysis of autograft versus allograft in anterior cervical fusion. *Eur Spine J*. 2000;9:398-403.
33. Fountas KN, Kapsalaki E, Nikolakakos LG, et al. Anterior cervical discectomy and fusion associated complications. *Spine*. 2007;32(21):2310-7. doi:10.1097/BRS.0b013e318154c57e.
34. Harris A, Marrache M, Puvanesarajah V, et al. Are preoperative depression and anxiety associated with patient-reported outcomes, health care payments, and opioid use after anterior discectomy and fusion?. *Spine J*. 2020;20(8):1167-1175. doi:10.1016/j.spinee.2020.03.004.
35. Garringer SM, Sasso RC. Safety of anterior cervical discectomy and fusion performed as outpatient surgery. *J Spinal Disord Tech*. 2010;23(7):439-443.
36. Garvey TA, Transfeldt EE, Malcolm JR, et al. Outcome of anterior cervical discectomy and fusion as perceived by patients treated for dominant axial-mechanical cervical spine pain. *Spine*. 2002;27:1887-1895.
37. Glassman SD, Anagnost SC, Parker A, et al. The effect of cigarette smoking and smoking cessation on spinal fusion. *Spine (Phila Pa 1976)*. 2000;25(20):2608-2615.
38. Goedmakers CMW, de Vries F, Bosscher L, Peul WC, Arts MP, Vleggeert-Lankamp CLA. Long-term results of the NECK trial—implanting a disc prosthesis after cervical anterior discectomy cannot prevent adjacent segment disease: five-year clinical follow-up of a double-blinded randomised controlled trial. *Spine J*. 2023;23(3):350-360. doi:10.1016/j.spinee.2022.11.006.
39. Goffin J, Geusens E, Vantomme N, et al. Long-term follow-up after interbody fusion of the cervical spin. *J Spinal Disord Tech*. 2004;17:79-85.
40. Gore DR, Sepic SB. Anterior cervical fusion for degenerated or protruded discs. A review of one hundred and forty-six patients. *Spine*. 1984;9:667-671.
41. Gore DR, Sepic SB. Anterior discectomy and fusion for painful cervical disc disease. A report of 50 patients with an average follow-up of 21 years. *Spine*. 1998;23:2047-2051.
42. Gyu Yeul Ji, Chang Hyun Oh, Dong Ah Shin, et al. Artificial Disk Replacement Combined With Fusion Versus 2-Level Fusion in Cervical 2-Level Disk Disease With a 5-Year Follow-up. *Clin Spine Surg*. 2017;30(5):E620-E627. doi:10.1097/bsd.0000000000000316.
43. Hacker RJ, Miller CG. Failed anterior cervical foraminotomy. *J Neurosurg*. 2003;98(2 Suppl):126-130. doi:10.3171/spi.2003.98.2.0126.
44. Hashimoto M, Mochizuki M, Aiba A, et al. C5 palsy following anterior decompression and spinal fusion for cervical degenerative diseases. *Eur Spine J*. 2010;19(10):1702-1710. doi:10.1007/s00586-010-1427-5.
45. Hermansen A, Hedlund R, Vavruch L, et al. A comparison between the carbon fiber cage and the cloward procedure in cervical spine surgery: a ten to thirteen year follow-up of a prospective randomized study. *Spine*. 2011;36:919-925.
46. Hilibrand AS, Fye MA, Emery SE, et al. Impact of smoking on the outcome of anterior cervical arthrodesis with interbody or strut-grafting. *J Bone Joint Surg Am*. 2001;83-A:668-673.
47. 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.
48. Ishihara H, Kanamori M, Kawaguchi Y, et al. Adjacent segment disease after anterior cervical interbody fusion. *Spine J*. 2004;4:624-628.
49. 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.
50. Jacob K, Patel M, Parsons A, et al. Level-specific Perioperative and Clinical Outcome Comparison: Cervical Disk Replacement Versus Anterior Cervical Discectomy and Fusion at C5-C6 in Patients With Myeloradiculopathy. *JAAOS*. 2022;30(17):e1137-e1147. doi:10.5435/jaaos-d-21-01276.
51. 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*. 2023;48(18):1266-1271. doi:10.1097/brs.0000000000004754.

52. Jiménez-Almonte J, Hautala G, Abbenhaus E, et al. Spine patients demystified: what are the predictive factors of poor surgical outcome in patients after elective cervical and lumbar spine surgery?. *Spine J (Phila Pa 1976)*. 2020;20(10):1529-1534. doi:10.1016/j.spinee.2020.05.550.
53. Jung A, Schramm J. How to reduce recurrent laryngeal nerve palsy in anterior cervical spine surgery: a prospective observational study. *Neurosurgery*. 2010;67(1):10-5;discussion 15.
54. Kalsi-Ryan S, Singh A, Massicotte EM, et al. Ancillary Outcomes Measures for Assessment of Individuals with Cervical Spondylotic Myelopathy. *Spine*. 2013;(22 Suppl 1):S111-122.
55. Kim K, Hoffman G, Bae H, et al. Ten-Year Outcomes of 1- and 2-Level Cervical Disc Arthroplasty From the Mobi-C Investigational Device Exemption Clinical Trial. *Neurosurgery*. 2021;88(3):497-505. doi:10.1093/neuros/nyaa459.
56. Klein GR, Vaccaro AR, Albert TJ. Health outcome assessment before and after anterior cervical discectomy and fusion for radiculopathy: a prospective analysis. *Spine*. 2000;25:801-803.
57. Kuri M, Nakagawa M, Tanaka H, et al. Determination of the duration of preoperative smoking cessation to improve wound healing after head and neck surgery. *Anesthesiology*. 2005;102(5):892-896.
58. 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.
59. Kwon B, Kim Dh, Marvin A, et al. Outcomes following anterior cervical discectomy and fusion: the role of interbody disc height, angulation, and spinous process distance. *J Spinal Disord Tech*. 2005;18:304-308.
60. Laratta JL, Shillingford JN, Saifi C, Riew KD. Cervical Disc Arthroplasty: A Comprehensive Review of Single-Level, Multilevel, and Hybrid Procedures. *Global Spine J*. 2017;8(1):78-83. doi:10.1177/2192568217701095.
61. Lau D, Chou D, Ziewacz JE, et al. The effects of smoking on perioperative outcomes and pseudarthrosis following anterior cervical corpectomy: clinical article. *J Neurosurg Spine*. 2014;21(4):547-58.
62. Lawrence BD, Hilibrand AS, Brodt ED, et al. Predicting the risk of adjacent segment pathology in the cervical spine: a systematic review. *Spine*. 2012;37(22 Suppl):S52-S64.
63. 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.
64. Lee JC, Lee SH, Peters C, et al. Adjacent segment pathology requiring reoperation after anterior cervical arthrodesis: the influence of smoking, sex and number of operated levels. *Spine*. 2015;40:E571-E577.
65. Liu JT, Briner RP, Friedman JA. Comparison of inpatient vs. outpatient anterior cervical discectomy and fusion: a retrospective case series. *BMC Surgery*. 2009;9:3.
66. Loidolt T, Kurra S, Riew K, Levi A, Florman J, Lavelle W. Comparison of adverse events between cervical disc arthroplasty and anterior cervical discectomy and fusion: a 10-year follow-up. *Spine J*. 2021;21(2):253-264. doi:10.1016/j.spinee.2020.10.013.
67. Luszczek M, Smith JS, Fischgrund JS, et al. Does smoking have an impact on fusion rate in single-level anterior cervical discectomy and fusion with allograft and rigid plate fixation?: clinical article. *J Neurosurg Spine*. 2013;19(5):527-531.
68. 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.
69. Malloy KM, Hilibrand AS. Autograft versus allograft in degenerative cervical disease. *Clin Orthop Relat Res*. 2002;394:27-38.
70. 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.
71. Matsumoto M, Okada E, Ichihara D, et al. Anterior cervical decompression and fusion accelerates adjacent segment degeneration: comparison with asymptomatic volunteers in a ten-year magnetic resonance imaging follow-up study. *Spine*. 2010;35:36-43.
72. Matz PG, Holly LT, Groff MW, et al. Indications for anterior cervical decompression for the treatment of cervical degenerative radiculopathy. *J Neurosurg Spine*. 2009;11(2):174-182. doi:10.3171/2009.3.SPINE08720.
73. Matz PG, Holly LT, Mummaneni P, et al. Anterior cervical surgery for the treatment of cervical degenerative myelopathy. *J Neurosurg Spine*. 2009;11(2):170-173. doi:10.3171/2009.3.SPINE08724.
74. Matz PG, Ryken TC, Groff MW, et al. Techniques for anterior cervical decompression for radiculopathy. *J Neurosurg Spine*. 2009;11(2):183-197. doi:10.3171/2009.2.SPINE08721.
75. Mills E, Eyawo O, Lockhart I, et al. Smoking cessation reduces postoperative complications: a systematic review and meta-analysis. *Am J Med*. 2011;124(2):144-154.
76. 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>.
77. 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>.
78. 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>.

79. Palit M, Schofferman J, Goldthwaite N, et al. Anterior discectomy and fusion for the management of neck pain. *Spine*. 1999;24:2224-2228.
80. 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.
81. Papadopoulos EC, Huang RC, Girardi FP, et al. Three-level anterior cervical discectomy and fusion with plate fixation: radiographic and clinical results. *Spine*. 2006;31:897-902.
82. Patel CK, Fischgrund JS. Complications of anterior cervical spine surgery. *Instr Course Lect*. 2003;52:465-469.
83. Peolsson A, Peolsson M. Predictive factors for long-term outcome of anterior cervical decompression and fusion: a multivariate data analysis. *Eur Spine J*. 2008;17:406-414.
84. Qi M, Xu C, Liu Y, et al. Comparison of clinical outcomes between cervical disc arthroplasty and anterior cervical discectomy and fusion for the treatment of single-level cervical spondylosis: a 10-year follow-up study. *Spine J*. 2023;23(3):361-368. doi:10.1016/j.spinee.2022.11.013.
85. Quinto ES Jr, Paisner ND, Huish EG Jr, Senegor M. Ten-Year Outcomes of Cervical Disc Arthroplasty Versus Anterior Cervical Discectomy and Fusion: A Systematic Review With Meta-Analysis. *Spine (Phila Pa 1976)*. 2024;49(7):463-469. doi:10.1097/BRS.0000000000004887.
86. Raoi RD, Gore DR, Tang SJ, et al. Radiographic changes in the cervical spine following anterior arthrodesis: a long term analysis of 166 patients. *J Bone Joint Surg*. 2016;98:1606-1613.
87. 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.
88. 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.
89. Riley LH, Vaccaro AR, Dettori JR, Hashimoto R. Postoperative dysphagia in anterior cervical spine surgery. *Spine*. 2010;35(9 Suppl):S76-S85.
90. Samartzis D, Shen FH, Lyon C, et al. Does rigid instrumentation increase the fusion rate in on-level anterior cervical discectomy and fusion. *Spine J*. 2004;4:636-643.
91. 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.
92. Shen FH, Samartzis D, Khanna N, et al. Comparison of clinical and radiographic outcome in instrumented anterior cervical discectomy and fusion with or without direct uncovertebral joint decompression. *Spine J*. 2004;4:629-635.
93. Simões de Souza NF, Broekema AEH, Reneman MF, et al. Posterior Cervical Foraminotomy Compared with Anterior Cervical Discectomy with Fusion for Cervical Radiculopathy: Two-Year Results of the FACET Randomized Noninferiority Study. *J Bone Joint Surg Am*. 2024;106(18):1653-1663. doi:10.2106/JBJS.23.00775.
94. Singh M, Balmaceno-Criss M, Anderson G, et al. Anterior cervical discectomy and fusion versus cervical disc arthroplasty: an epidemiological review of 433,660 surgical patients from 2011 to 2021. *Spine J*. 2024;24(8):1342-1351. doi:10.1016/j.spinee.2024.02.016.
95. Sivaganesan A, Khan I, Pennings J, et al. Why are patients dissatisfied after spine surgery when improvements in disability and pain are clinically meaningful?. *Spine J (Phila Pa 1976)*. 2020;20(10):1535-1543. doi:10.1016/j.spinee.2020.06.008.
96. Sorensen LT. Wound healing and infection in surgery: the pathophysiological impact of smoking, smoking cessation, and nicotine replacement therapy: a systematic review. *Ann Surg*. 2012;255(6):1069-1079.
97. Stieber JR, Brown K, Donald GD, Cohen JD. Anterior cervical decompression and fusion with plate fixation as an outpatient procedure. *Spine J*. 2005;5(5):503-507.
98. Suchomel P, Barsa P, Buchavald P, et al. Autogenous versus allogenic bone grafts in instrumented anterior cervical discectomy and fusion: A prospective study with respect to bone union pattern. *Eur Spine J*. 2004;13:510-515.
99. Swezey RL. Conservative treatment of cervical radiculopathy. *J Clin Rheumatol*. 1999;5(2):65-73. doi:10.1097/00124743-199904000-00006.
100. Tetreault L, Le D, Côté P, Fehlings M. The Practical Application of Clinical Prediction Rules: A Commentary Using Case Examples in Surgical Patients with Degenerative Cervical Myelopathy. *Global Spine J*. 2015;5(6):457–465. doi:10.1055/s-0035-1567838.
101. Thayer L, Tiffany E, Carreira D. Addressing Smoking in Musculoskeletal Specialty Care. *J Bone Joint Surg Am*. 2021;103(22):2145-2152. doi:10.2106/jbjs.21.00108.
102. Tumialan LM, Gluf WM. Progressive vertebral body osteolysis after cervicomedial disc arthroplasty. *Spine (Phila Pa 1976)*. 2011;36(14):E973-E978.
103. Van Eck CF, Regan C, Donaldson WF, et al. The revisions rate and occurrence of adjacent segment disease after anterior cervical discectomy and fusion: a study of 672 consecutive patients. *Spine*. 2014;39:2143-2147.
104. Villavicencio AT, Pushchak E, Burneikiene S, Thramann JJ. The safety of instrumented outpatient anterior cervical discectomy and fusion. *Spine J*. 2007;7(2):148-153.
105. Wang JC, ed. *Advanced Reconstruction: Spine*. Rosemont, Ill: American Academy of Orthopaedic Surgeons; 2011. ISBN: 978-0-89-203581-6.

106. Wang JC, McDonough PW, Endow KK, et al. Increase fusion rates with cervical plating for two-level anterior cervical discectomy and fusion. *Spine*. 2000;25:41-45.
107. 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.
108. 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.
109. White AA 3rd, Southwick WO, Deponte RJ, Gainor JW, Hardy R. Relief of pain by anterior cervical-spine fusion for spondylosis. A report of sixty-five patients. *J Bone joint Surg Am*. 1973;55(3):525-534.
110. Wong J, Lam DP, Abrishami A, et al. Short-term preoperative smoking cessation and postoperative complications: a systematic review and meta-analysis. *Can J Anaesth*. 2012;59(3):268-279.
111. 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.
112. 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.
113. Yue WM, Brodner W, Highland TR. Long-term results after anterior cervical discectomy and fusion with allograft and plating: a 5 to 11 year radiologic and clinical follow-up study. *Spine*. 2005;30:2138-2144.
114. Zhang J, Meng F, Ding Y, et al. Comprehensive Analysis of Hybrid Surgery and Anterior Cervical Discectomy and Fusion in Cervical Diseases. *Medicine*. 2020;99(5):e19055. doi:10.1097/md.00000000000019055.
115. Zhuang T, Ku S, Shapiro L, Hu S, Cabell A, Kamal R. A Cost-Effectiveness Analysis of Smoking-Cessation Interventions Prior to Posterolateral Lumbar Fusion. *J Bone Joint Surg*. 2020;102(23):2032-2042. doi:10.2106/jbjs.20.00393.