

Treatment for asymptomatic cervical spinal cord compression

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Disclosures

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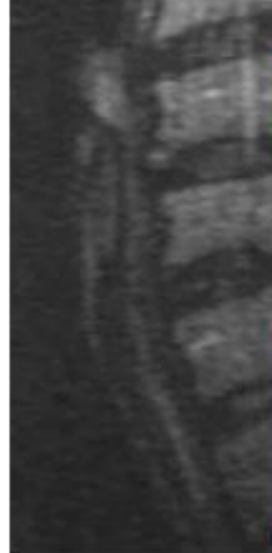
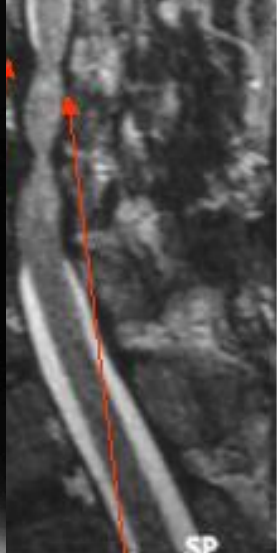
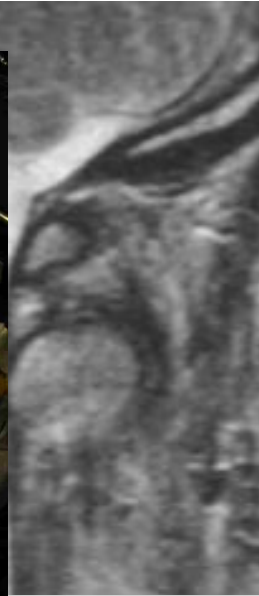
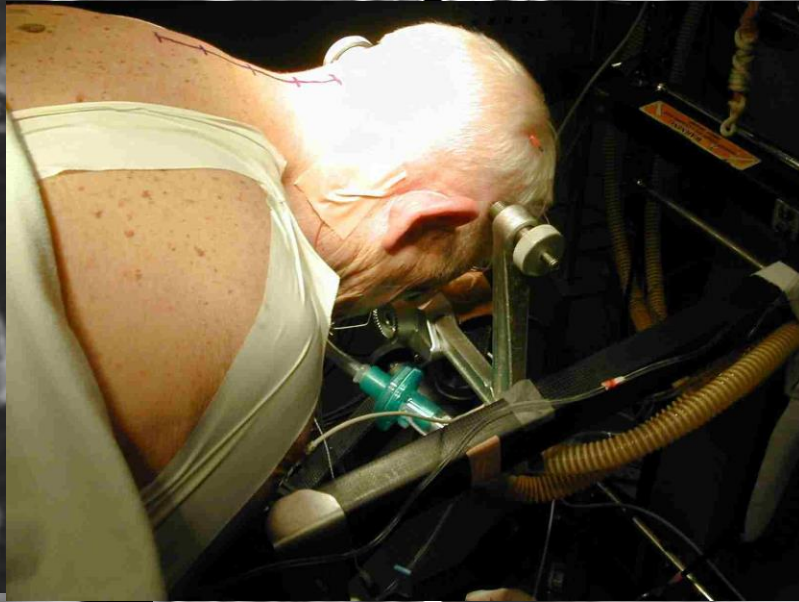
H-SP

MAY-2002

R-2001

45

6



ORTHOPAEDICS



Risk vs. Reward



mJOA

Motor dysfunction score of the upper extremity

- 0—Inability to move hands
- 1—Inability to eat w/a spoon, but able to move hands
- 2—Inability to button shirt, but able to eat w/a spoon
- 3—Able to button shirt w/great difficulty
- 4—Able to button shirt w/slight difficulty
- 5—No dysfunction

Motor dysfunction score of the lower extremity

- 0—Complete loss of motor and sensory function
- 1—Sensory preservation w/o ability to move legs
- 2—Able to move legs, but unable to walk
- 3—Able to walk on flat floor w/a walking aid (cane or crutch)
- 4—Able to walk up and/or down stairs w/hand rail
- 5—Moderate-to-significant lack of stability, but able to walk up and/or down stairs w/o hand rail
- 6—Mild lack of stability but walks w/smooth reciprocation unaided/
- 7—No dysfunction

Sensory dysfunction score of the upper extremities

- 0—Complete loss of hand sensation
- 1—Severe sensory loss or pain
- 2—Mild sensory loss
- 3—No sensory loss

Sphincter dysfunction score

- 0—Inability to micturate voluntarily
- 1—Marked difficulty w/micturition
- 2—Mild to moderate difficulty w/micturition
- 3—Normal micturition

I. Upper extremity function

- 0. Impossible to eat with either chopsticks or spoon
 - 1. Possible to eat with spoon, but not with chopsticks
 - 2. Possible to eat with chopsticks, but inadequate
 - 3. Possible to eat with chopsticks, but awkward
 - 4. Normal



Efficacy and Safety of Surgical Decompression in Patients with Cervical Spondylotic Myelopathy

Results of the AOSpine North America Prospective Multi-Center Study

Michael G. Fehlings, MD, PhD, Jefferson R. Wilson, MD, Branko Kopjar, MD, PhD, Sangwook Tim Yoon, MD, PhD, Paul M. Arnold, MD, Eric M. Massicotte, MD, Alexander R. Vaccaro, MD, PhD, Darrel S. Brodke, MD, Christopher I. Shaffrey, MD, Justin S. Smith, MD, Eric J. Woodard, MD, Robert J. Banco, MD, Jens R. Chapman, MD, Michael E. Janssen, DO, Christopher M. Bono, MD, Rick C. Sasso, MD, Mark B. Dekutoski, MD, and Ziya L. Gokaslan, MD

TABLE III Change in Outcome at Twelve Months According to Severity Group (N = 260)

	Mild*	Moderate*	Severe*	P Value†
mJOA	1.29 (0.70, 1.87)	2.58 (2.07, 3.09)	4.91 (4.34, 5.49)	<0.0001
Nurick grade	-1.54 (-1.86, -1.22)	-1.51 (-1.81, -1.22)	-1.74 (-2.08, -1.41)	NS
NDI	-12.05 (-16.34, -7.76)	-9.79 (-13.68, -5.90)	-12.53 (-17.02, -8.05)	NS
SF-36v2				
Physical functioning	5.64 (2.88, 8.39)	6.68 (4.23, 9.13)	5.16 (2.36, 7.97)	NS
Role limitation-physical	7.32 (4.27, 10.38)	7.78 (5.07, 10.49)	5.35 (2.18, 8.51)	NS
Bodily pain	7.95 (5.42, 10.48)	5.29 (2.99, 7.59)	5.94 (3.18, 8.70)	NS
General health	1.89 (-0.58, 4.37)	1.10 (-1.12, 3.32)	0.73 (-1.96, 3.43)	NS
Emotional well-being	7.25 (4.25, 10.25)	3.98 (1.15, 6.82)	8.57 (5.31, 11.83)	NS
Role limitation-emotional	5.49 (1.78, 9.21)	4.27 (0.82, 7.73)	6.35 (2.55, 10.16)	NS
Social functioning	7.14 (4.08, 10.19)	5.32 (2.29, 8.35)	6.42 (3.35, 9.49)	NS
Energy/fatigue	5.78 (2.83, 8.72)	5.04 (2.41, 7.67)	6.45 (3.53, 9.38)	NS
PCS score	6.36 (4.15, 8.57)	5.64 (3.67, 7.61)	4.77 (2.36, 7.17)	NS
MCS score	6.52 (4.24, 8.81)	4.26 (2.19, 6.34)	6.43 (3.98, 8.88)	NS

*The values are given as the mean, with the 95% confidence interval in parentheses. †NS = not significant.

- *Improvement in Functional and QoL outcomes across all groups*
 - *Seen across all severity groups*
- *Except for mJOA*
 - *Worse severity of disease = Greater improvement*

Measurement Parameters

- Cervical spinal canal
 - Sagittal A-P diameter
 - Transverse diameter
 - Area
 - A-P diameter/transverse diameter ratio (RAPT)
 - Torg ratio
- Cervical spinal cord
 - A-P diameter
 - Transverse diameter
 - Area
 - Cord-flattening ratio (A-P diameter divided by transverse diameter)
 - Circumference
 - Circularity

Canal Diameter

- Anatomic measurements
 - **C3-7 14.66-14.88 (1.68) mm**
 - Poor correlation with plain film measurements, esp at lower levels
 - Good correlation with CT
 - Senol et al, Clin Anat 2001



Average AP Canal Diameter

- Panjabi et al, 1991; direct measure (n=12)
- Inoue et al, 1996; CT (n=36)
- Gupta et al, 1982; X-ray (n=207)
- Hashimoto et al, 1977; X-ray (n=92)
- Matsuura et al, 1989; CT (n=100)
- Stanley et al, 1986; CT (n=52)
- Payne et al, 1957; X-ray (n=30)
 - Ito et al, Spine 2004

Average Canal Diameter (Bony)

- C2 = 18.6 (1.9) mm
- C3 = 15.4 (1.9) mm
- C4 = 15.3 (2.0) mm
- C5 = 15.2 (1.9) mm
- C6 = 15.4 (1.9) mm
- C7 = 15.1 (1.3) mm

Average Canal Diameter (Soft Tissue)

- ❑ *More relevant for cord compression*
- ❑ Nordquist, 1964; myelography (n=60)
- ❑ Chen et al, 1994; X-ray, radioopaque beads (n=5)
- ❑ Inoue et al, 1996; CT (n=36)
- ❑ Nuckley et al, 2002; transducer (n=14)

Average Canal Diameter (Soft Tissue)

- C2 = 14.2 (0.5) mm
- C3 = 12.1 (0.1) mm
- C4 = 11.9 (0.3) mm
- C5 = 12.0 (0.6) mm
- C6 = 11.6 (0.4) mm
- C7 = 11.7 (0.5) mm

Average Cord Diameter

- Nordquist, 1964; myelography (n=47)
- Thijssen et al, 1979; CT myelo (n=20)
- Kameyama et al, 1996; direct (n=12)
- Inoue et al, 1996; CT myelo (n=36)
- Devotka et al, 1982; myelo (n=100)

Average Cord Diameter

- C2 = 7.8 (1.4)
- C3 = 7.5 (1.4)
- C4 = 7.4 (1.5)
- C5 = 7.3 (1.4)
- C6 = 7.1 (1.3)
- C7 = 6.9 (1.2)

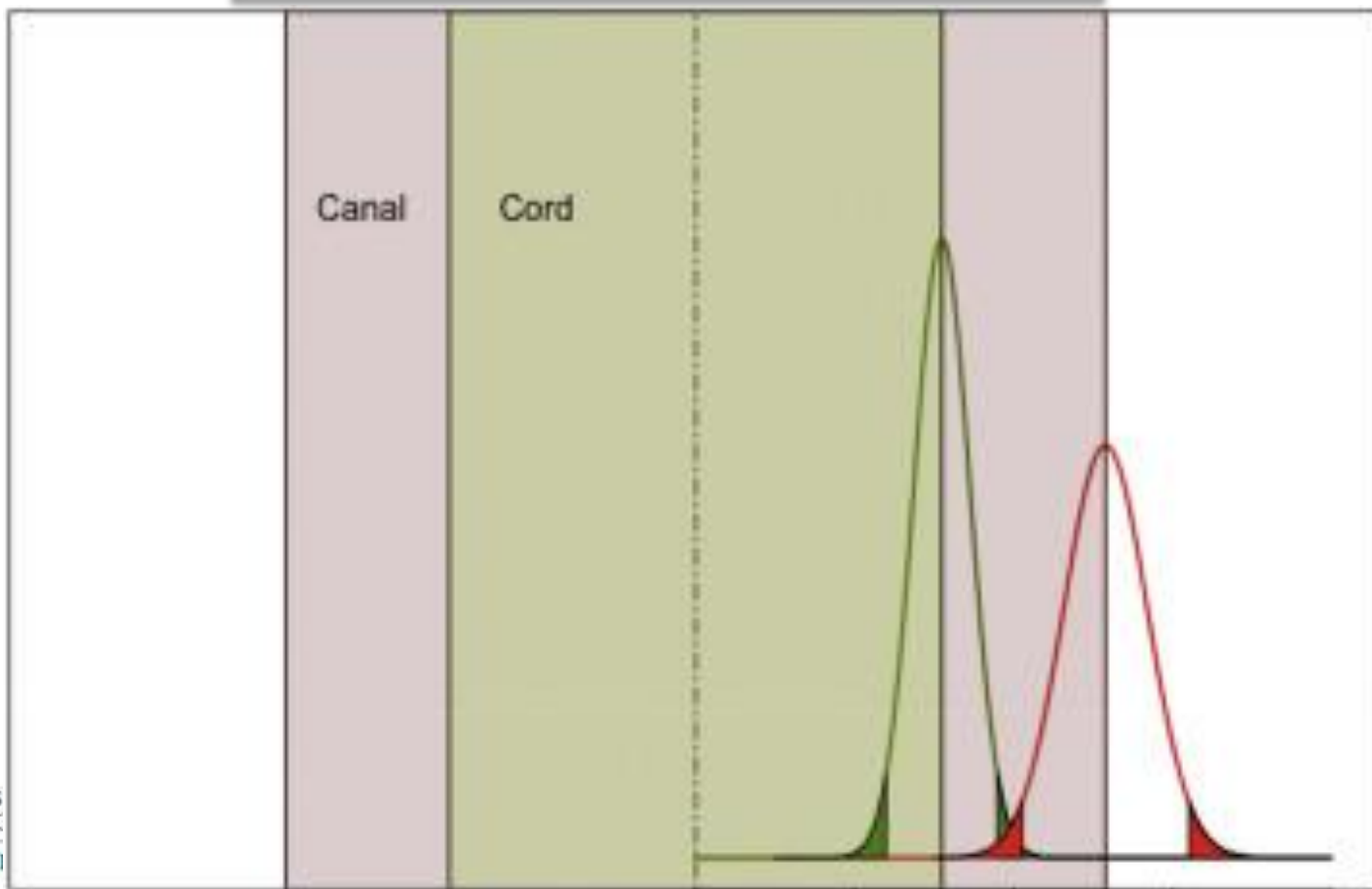
Congenital Cervical Spine Stenosis in a Multicenter Global Cohort of Patients With Degenerative Cervical Myelopathy: An Ambispective Report Based on a Magnetic Resonance Imaging Diagnostic Criterion

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BACKGROUND: Congenital spinal stenosis (CSS) of the cervical spine is a risk factor for acute spinal cord injury and development of degenerative cervical myelopathy (DCM).

OBJECTIVE: To develop magnetic resonance imaging (MRI)-based criteria to diagnose preexisting CSS and evaluate differences between patients with and without CSS.

METHODS: A secondary analysis of international prospectively collected data between 2005 and 2011 was conducted. We examined the data of 349 surgical DCM patients and 27 controls. Spinal canal and cord anteroposterior diameters were measured at noncompressed sites to calculate spinal cord occupation ratio (SCOR). Torg-Pavlov ratios and spinal

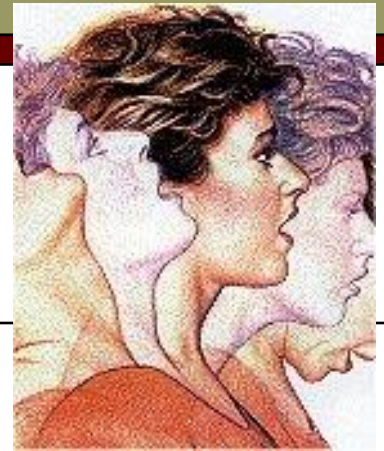


Physiologic Extension Narrows the Canal

- Disc bulging & ligamentum folding decrease canal by 1.1 mm
 - Chen et al, J Spinal Disord 1994



Whiplash



- C5-6 canal diameter during 6.5g impact
 - Soft tissue canal = 12.0 mm
 - Physiologic extension subtract 1.1 mm
 - Whiplash event subtract 3.5 mm
 - Equals **7.4 mm canal**

- C5 cord diameter = **7.3 mm**

Whiplash with Stenosis



- If soft tissue canal diameter equals cord diameter, 3.5 mm narrowing during whiplash injury results in 50% cord compression
- Below 3 m/s, 50% cord compression causes permanent loss of SSEPs in 50% of animal subjects

Decision point



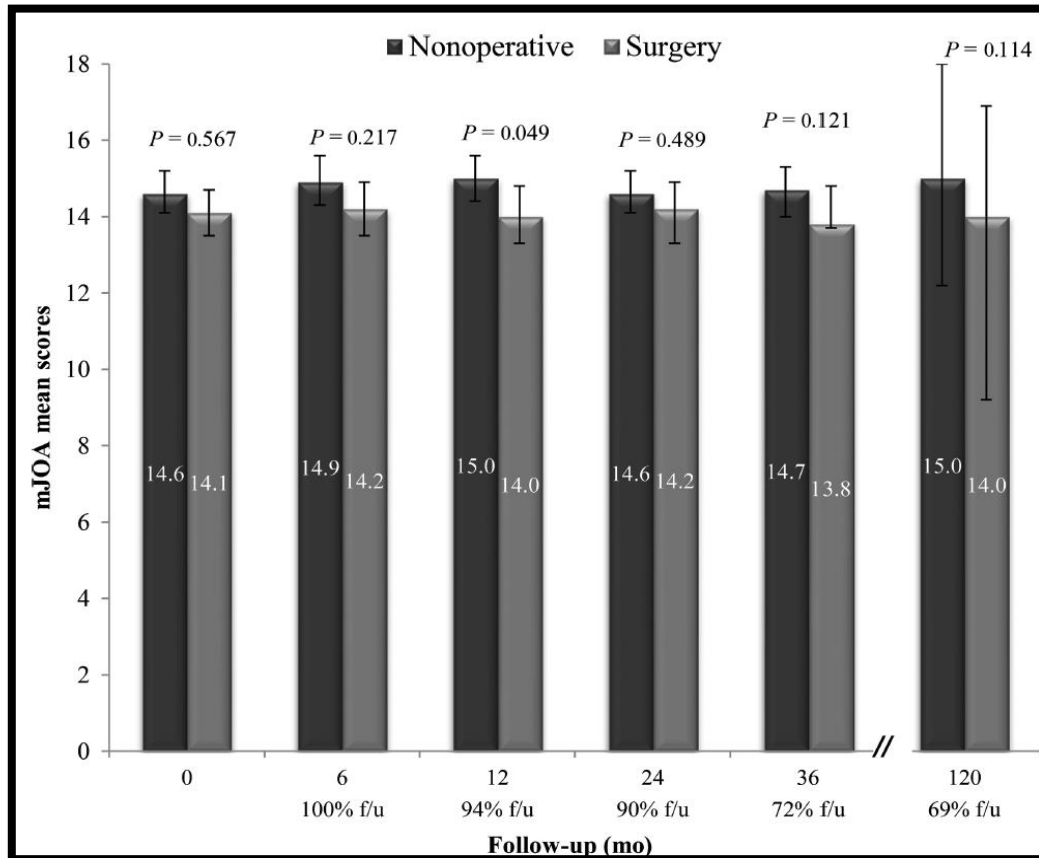
Reward > Risk ?

Risk > Reward ?



Z. Kadaňka
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I. Urbánek

Conservative treatment versus surgery in spondylotic cervical myelopathy: a prospective randomised study



Eur Spine J (2008) 17:421–431
DOI 10.1007/s00586-008-0585-1

ORIGINAL ARTICLE

Presymptomatic spondylotic cervical myelopathy: an updated predictive model

Josef Bednarik · Zdenek Kadanka · Ladislav Dusek ·
Milos Kerkovsky · Stanislav Vohanka · Oldrich Novotny ·
Igor Urbanek · Dagmar Kratochvilova

- 8% of asymptomatic patients develop myelopathy at 12 mos.
- 22.6% at 44 mos.

Eur Spine J (2013) 22:2228–2231
DOI 10.1007/s00586-013-2865-7

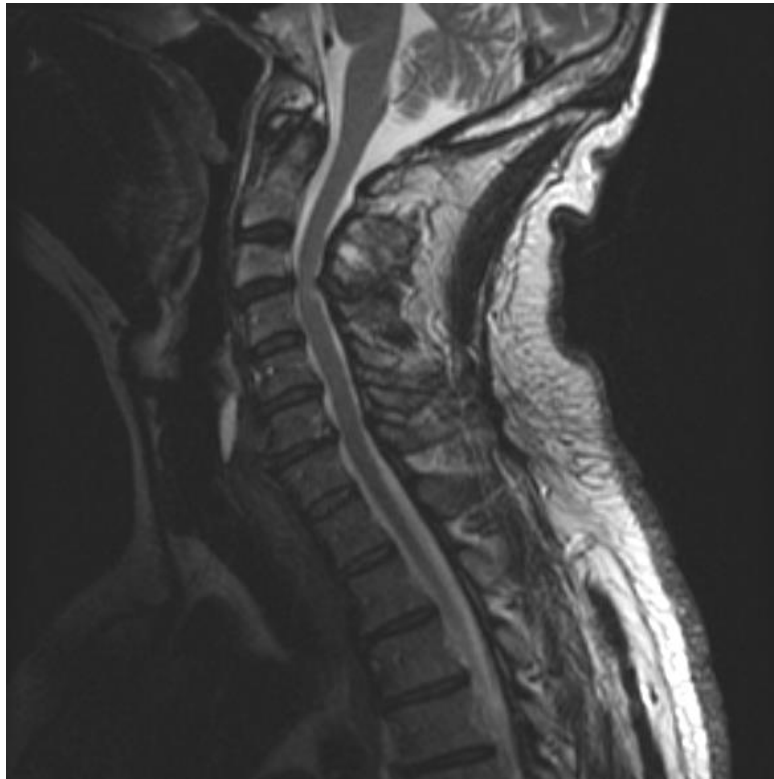
ORIGINAL ARTICLE

Clinical relationship between cervical spinal canal stenosis and traumatic cervical spinal cord injury without major fracture or dislocation

Tsuneaki Takao · Yuichiro Morishita · Seiji Okada · Takeshi Maeda ·
Fumihiko Katoh · Takayoshi Ueta · Eiji Mori · Itaru Yugue · Osamu Kawano ·
Keiichiro Shiba

- Spinal Injury network of Fukouka, Japan
- Measured risk of cervical spinal stenosis and spinal cord injury after trauma
- Relative risk 125x
- **Absolute risk 0.0017, 0.017%**

Decision Point



Reward > Risk ?

Risk > Reward ?



Efficacy and Safety of Surgical Decompression in Patients with Cervical Spondylotic Myelopathy

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- ❑ Overall Complication Rate
 - 18.7% (52 patients, 78 complications)
 - #1 – Dysphagia (3.6%)
 - #2 – Infection (2.9%)
- ❑ The complication rate did not differ between myelopathy severity groups

TABLE IV Treatment-Related Complications According to Disease Severity at Baseline

Complication	Mild (N = 85) (no.)	Moderate (N = 110) (no.)	Severe (N = 83) (no.)	All (N = 278)	
				No.	%
Altered mental status		1	1	2	0.7
C5 radiculopathy	2		3	5	1.8
Cardiopulmonary event	1	2	4	7	2.5
Deep infection			1	1	0.4
Durotomy	1	1	1	3	1.1
Dysphagia	3	4	3	10	3.6
Dysphonia		1		1	0.4
Epidural/ wound hematoma	2			2	0.7
Facial swelling	1			1	0.4
Gastrointestinal	1		1	2	0.7
Iatrogenic fracture during the operation		1		1	0.4
Instrumentation failure	1			1	0.4
Instrumentation or graft malposition/migration	2	1	2	5	1.8
Mental health complication			1	1	0.4
New neurological deficit (other)	1			1	0.4
New radiculopathy (not C5)	2	1		3	1.1
Numbness and tingling in hands		1		1	0.4
Pneumonia	1			1	0.4
Postoperative deformity		2		2	0.7
Pseudarthrosis	2	1	2	5	1.8
Renal complication			1	1	0.4
Reoperation, not otherwise specified		1		1	0.4
Serious bleeding			1	1	0.4
Sore throat	1			1	0.4
Stroke	1			1	0.4
Superficial infection	3	2	3	8	2.9
Symptomatic adjacent segment disease		1	1	2	0.7
Throat spasm	1			1	0.4
Thromboembolism			1	1	0.4
Worsening of axial neck pain	2			2	0.7
Worsening of myelopathy	2	1		3	1.1
Wound hematoma		1		1	0.4
Any	17	17	18	52	18.7

Complications

Efficacy and Safety of Surgery for Mild Degenerative Cervical Myelopathy: Results of the AOSpine North America and International Prospective Multicenter Studies

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BACKGROUND: There is controversy over the optimal treatment strategy for patients with mild degenerative cervical myelopathy (DCM).

OBJECTIVE: To evaluate the degree of impairment in baseline quality of life as compared to population norms, as well as functional, disability, and quality of life outcomes following surgery in a prospective cohort of mild DCM patients undergoing surgical decompression.

METHODS: We identified patients with mild DCM (modified Japanese Orthopaedic Association [mJOA] 15 to 17) enrolled in the prospective, multicenter AOSpine CSM-NA or CSM-I trials. Baseline quality of life Short Form-36 version 2 (SF-36v2) was compared to population norms by the standardized mean difference (SMD). Outcomes, including functional status (mJOA, Nurick grade), disability (NDI [Neck Disability Index]), and quality of life (SF-36v2), were evaluated at baseline and 6 mo, 1 yr, and 2 yr after surgery. Postoperative complica-

Progression of myelopathy	13 (6.74%)
Worsening of axial neck pain	12 (6.22%)
Dysphagia	11 (5.70%)
Superficial infection	6 (3.11%)
Screw malposition	6 (3.11%)
Postoperative deformity	4 (2.07%)
Hardware failure	3 (1.55%)
Deep infection	3 (1.55%)
New radiculopathy	3 (1.55%)
C5 radiculopathy	2 (1.04%)
Adjacent segment degeneration	2 (1.04%)
Dural tear	2 (1.04%)
Serious bleeding	2 (1.04%)
Wound hematoma	2 (1.04%)
Pseudoarthrosis	1 (0.52%)
Cardiopulmonary event	1 (0.52%)
≥ 1 complication	59 (30.57%)

0.52 – 6 %

Complication vs. Benefit

> 0.52 %



0.017%

A Clinical Practice Guideline for the Management of Patients With Degenerative Cervical Myelopathy: Recommendations for Patients With Mild, Moderate, and Severe Disease and Nonmyelopathic Patients With Evidence of Cord Compression

Global Spine Journal

2017, Vol. 7(3S) 70S-83S

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Recommendation

Part 4. Clinical Population: Nonmyelopathic Patients Without Symptoms of Radiculopathy

Population Description: Nonmyelopathic patients with imaging evidence of cord compression without signs or symptoms of radiculopathy

Key Question: Should operative management be used to treat non-myelopathic patients with evidence of cord compression without signs or symptoms of radiculopathy?

Recommendation: We suggest **not offering** prophylactic surgery for nonmyelopathic patients with evidence of cervical cord compression without signs or symptoms of radiculopathy. We suggest that these patients be counseled as to potential risks of progression, educated about relevant signs and symptoms of myelopathy, and be followed clinically.

Quality of Evidence: No identified evidence; based on clinical expert opinion

Strength of Recommendation: Weak

Thank you

