**SEARCH TERMS**

C5 AND (PALSY OR WEAKNESS OR PARALYSIS )) AND (CERVICAL OR MYELOPATHY OR RADICULOPATHY OR SPINE OR SPINAL OR OPLL OR "Ossification of Posterior Longitudinal Ligament"[Mesh] OR "OSSIFICATION OF LIGAMENTUM FLAVUM") AND (SURGERY OR FUSION OR LAMINOPLASTY OR LAMINECTOMY OR DECOMPRESSION OR DISCECTOMY OR CORPECTOMY) AND (PREDICT\* OR PROGNOS\* OR RISK FACTOR OR FACTOR)

Inclusion/exclusion

|  |  |  |
| --- | --- | --- |
|  | Inclusion | Exclusion |
| Patient population | * Adult patients (≥18 years-old) with cervical myelopathy, radiculopathy or myeloradiculopathy as a result of degenerative disease, undergoing cervical decompression | * Surgery for trauma, cancer, infection * Preop C5 palsy |
| Risk factors | * Demographic (Age, sex, smoking, weight) * Clinical (myelopathy, OPLL, DM, others) * Radiological (SC shift, post-op lordosis, Δ lordosis, residual foraminal stenosis) * Procedural (decompression with vs without foraminotomy; anterior vs posterior; ACDF vs ACCF vs laminectomy vs laminoplasty vs laminectomy and fusion; number of levels) |  |
| Outcome | * Documented postoperative C5 palsy | * Documented intra-op injury |
| Study Design | * Prospective or retrospective cohort studies evaluating risk factors for C5 palsy using multivariate analysis | * Univariate analysis |
| Timing | * 2000-2019 | * Prior to 2000 |

Table S1: Demographic, clinical, surgical and radiographic factors potentially associated with C5 palsy following surgery of the cervical spine.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | **Posterior Approach** | | | | | | | | | | **Anterior Approach** | | | | **Mixed Approach** | | |
|  |  | Baba | Blizzard | Bydon | Bydon2 | Kaneyama | Lee | Liu | Nori | Tsuji | Wu | Bydon2 | Eskander | Kratzig | Wang | Chugh | Lubleski | **Nassr** |
|  | CoE: | 2016 | 2016 | 2014 | 2014 | 2010 | 2017 | 2017 | 2017 | 2017 | 2014 | 2014 | 2012 | 2017 | 2015 | 2017 | 2014 | 2017 |
| III | III | III | III | I | II | III | II | III | II | III | II | III | II | III | III | II |
|  | Risk Factor |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Demographic | Age |  | no | no | no | no | no | no | yes | no | no | yes | no | yes | no | no | no | no |
| Sex |  | no | no | no | no | no | no | no |  | no | no | no |  | no |  | no | no |
| Smoking |  | no | no | no |  |  | no |  |  |  | no | no |  |  |  |  | no |
| Diabetes |  | no | no | no |  |  | no |  |  |  | no | no |  |  |  |  | no |
| BMI |  | no | no | no |  |  |  |  |  |  | no | no |  |  |  | no |  |
| Comorbidities |  | no | no | no |  |  |  |  |  |  | no |  |  |  |  |  |  |
| Clinical | Preop Nurick, JOA or NDI |  |  |  | no | no |  | no | no | no |  | no | no |  | no |  |  |  |
| OPLL |  |  |  |  | yes | no | no | no |  | yes |  |  |  | no |  |  | no |
| Diagnosis |  |  |  | no |  |  | no |  |  |  | no |  |  | no |  |  |  |
| Longer duration of disease |  |  |  |  |  |  | yes |  |  | no |  | no |  | no |  |  |  |
| Surgical | No. of surgical levels |  |  | no | no | no |  |  | no | no |  | no |  |  | no |  | no |  |
| Allograft |  |  | no | no |  |  |  |  |  |  | no |  |  |  |  |  |  |
| Autograft |  |  | no | no |  |  |  |  |  |  | no |  |  |  |  |  |  |
| Radiographic | Preop FD C4/5 | no | yes |  |  |  | yes |  | yes |  | yes |  |  |  | yes |  | yes |  |
| Posterior shift C4/5 | yes |  | yes |  |  |  |  | no |  | no |  |  | yes |  |  |  |  |
| Preop C2-C7 angle | no | no |  |  |  | no |  |  | no |  |  |  |  |  |  |  |  |
| Change in C2-C7 angle |  | no | no |  |  |  |  |  |  |  |  |  |  | yes | no |  |  |
| APSAP C4/5 | no |  |  |  | no |  |  |  |  | no |  |  |  |  |  |  |  |
| High intensity signal C3-5 | no |  |  |  | no | no | yes | no |  | no |  |  |  | no |  |  |  |
| Lamina open angle | no | no |  |  |  |  |  |  | no |  |  |  |  |  |  | yes |  |
| Preop Ishihara index |  | no |  |  | no |  |  |  |  | no |  |  |  |  | no |  |  |
| No. of compressed segments | no |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |
| Preop APD C4/5 |  | yes |  |  |  |  |  |  |  |  |  | no |  |  |  | yes |  |
| Postop C2-C7 |  | no |  |  |  |  |  | no |  |  |  |  |  |  |  |  |  |
| Preop cord rotation |  |  |  |  |  |  |  |  |  |  |  | yes |  |  | yes |  |  |
| Hinge angle C4, 5, 6 | no |  |  |  |  |  | no |  |  |  |  |  |  |  |  |  |  |
| Postop Ishihara index |  | no |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |

APD = anteroposterior diameter of the spinal canal; APSAP = anterior protrusion of the superior articular process; DF = diameter of foramen; JOA = Japanese Orthopedic Association score; NDI = Neck Disability Index; OPLL = ossification of posterior longitudinal ligament

Table S2: Strength of evidence table assessing risk factors for C5 palsy following cervical spine surgery in phase 1 prognostic studies.

| **Prognostic factors** | **No. Studies**  **(no. patients)** | **Overall Quality** | **Conclusions** | **Study Limitations** | **Serious Inconsistency** | **Serious Indirectness** | **Serious Imprecision** | **Publication Bias** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Demographic**   * Age * Sex, smoking, diabetes, BMI, Comorbidities | 16 (4639)  range 4-13 (1124-2511) | Very Low  Low | Mixed results; possible association unclear  No association found consistently across studies | Yes  Yes | Yes  No | No  No | No  No | No  No |
| **Clinical**   * OPLL, duration of symptoms * Diagnosis * Severity as measured by Nurick, JOA, NDI | range 4-7  (536-842)  3 (1232)  range 4-7  (1232-2034) | Low  Low  High | Mixed results; possible association unclear  No association found consistently across studies  No association found consistently across studies | No  Yes  No | Yes  No  No | No  No  No | Yes  No  No | No  No  No |
| **Surgical**   * Number of surgical levels, allograft, autograft | range 2-7  (1001-1928) | Low | No association found consistently across studies | Yes | No | No | No | No |
| **Radiographic**   * Preop narrow DF C4/5 * Preop and postop C2-C7 angle; APSAP C4/5; preop or postop Ishihara Index; number of compressed segments; HIS C3-5; hinge angle C4-6      * Posterior shift C4/5, change in C2-C7 angle, lamina open angle, preop APD C4/5 * Preop cord rotation | 7 (825)  range 2-7  (117- 889)  range 3-7  (355-2189)  2 (280) | High  Moderate  Very Low  Moderate | Associated in 6 of 7 studies and all the highest quality studies  No association found consistently across studies  Mixed results; possible association unclear  Consistently associated in 2 studies | No  No  Yes  No | No  No  Yes  No | No  No  No  No | No  Yes  Yes  Yes | No  No  No  No |

Table S3: Risk of bias (RoB) and class of evidence (CoE) for cohort studies of prognosis

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Study | Prospective design | Participants in both cohorts came from the same population | Complete follow-up ≥80% | F/U long enough for outcomes | Objective, unbiased outcomes | Accounting for other prognostic factors | RoB Rating | CoE |
| Tsuji 2017 | No | Yes | No (75%) | Yes | Yes | Yes | Mod high | III |
| Nori 2017 | No | Yes | Yes | Yes | Yes | Yes | Mod low | II |
| Nassr 2007 | No | Yes | Yes | Yes | Yes | Yes | Mod low | II |
| Lee 2017 | No | Yes | Yes | Yes | Yes | Yes | Mod low | II |
| Krätzig 2017 | No | Yes | No (unknown) | Yes | Yes | Yes | Mod high | III |
| Baba 2016 | No | Yes | No (unknown) | Yes | Yes | Yes | Mod high | III |
| Wang 2015 | No | Yes | Yes | Yes | Yes | Yes | Mod low | II |
| Blizzard 2015 | No | Yes | No (unknown) | Yes | No (unknown) | Yes | Mod high | III |
| Liu 2017 | No | Yes | No (unknown) | Yes | No (unknown) | Yes | Mod high | III |
| Kaneyama 2010 | yes | Yes | Yes | Yes | Yes | Yes | Low | I |
| Bydon 2014 | No | Yes | No (59%) | Yes | Yes | Yes | Mod high | III |
| Chugh 2017 | No | Yes | No (unknown) | Yes | Yes | Yes | Mod high | III |
| Lubleski 2014 | No | Yes | No (unknown) | Yes | Yes | Yes | Mod high | III |
| Wu 2014 | No | Yes | Yes | Yes | Yes | Yes | Mod low | II |
| Eskander | No | Yes | Yes | Yes | Yes | Yes | Mod low | II |
| Bydon 2014 (2) | No | Yes | No (unknown) | Yes | Yes | Yes | Mod high | III |

Table S4: Criteria for CoE for studies of prognosis.

|  |  | **Studies of Prognosis** | |
| --- | --- | --- | --- |
| **Class** | **Risk of bias** | **Study design** | **Criteria** |
| **I** | **Low risk:**  Study adheres to commonly held tenets of high quality design, execution and avoidance of bias | Good quality cohort\* | * Prospective design * Patients at similar point in the course of their disease or treatment * F/U rate of ≥ 80%† * Patients followed long enough for outcomes to occur * Accounting for other prognostic factors‡ |
| **II** | **Moderately low risk:**  Study has potential for some bias; does not meet all criteria for class I but deficiencies not likely to invalidate results or introduce significant bias | Moderate quality cohort | * Prospective design, with violation of one of the other criteria for good quality cohort study * Retrospective design, meeting all the rest of the criteria in class I |
| **III** | **Moderately high risk:**  Study has flaws in design and/or execution that increase potential for bias that may invalidate study results | Poor quality cohort  Good quality case-control or cross-sectional study | * Prospective design with violation of 2 or more criteria for good quality cohort, or * Retrospective design with violation of 1 or more criteria for good quality cohort * A good case-control study§ * A good cross-sectional study\*\* |
| **IV** | **High risk:**  Study has significant potential for bias; does not include design features geared toward minimizing bias and/or does not have a comparison group | Poor quality case-control or cross-sectional  Case series§ | * Other than a good case-control study * Other than a good cross-sectional study * Any case series†† design |

\*Cohort studies follow individuals with the exposure of interest over time and monitor for occurrence of the outcome of interest.

†Applies to cohort studies only.

‡Authors must consider other factors that might influence patient outcomes and should control for them if appropriate.

§A good case-control study must have the all of the following: all incident cases from the defined population over a specified time period, controls that represent the population from which the cases come, exposure that precedes an outcome of interest, and accounting for other prognostic factors.

Table S5: Excluded articles

|  |  |
| --- | --- |
| Study | Reason for exclusion |
| 1. Chen Y, Chen D, Wang X, Guo Y, He Z. C5 palsy after laminectomy and posterior cervical fixation for ossification of posterior longitudinal ligament. J Spinal Disord Tech. 2007;20(7):533-5. | No multivariate analysis |
| 2. Hasegawa K, Homma T, Chiba Y. Upper extremity palsy following cervical decompression surgery results from a transient spinal cord lesion. Spine (Phila Pa 1976). 2007;32(6):E197-202. | >30% other than C5 palsy |
| 3. Hatta Y, Shiraishi T, Hase H, et al. Is posterior spinal cord shifting by extensive posterior decompression clinically significant for multisegmental cervical spondylotic myelopathy? Spine (Phila Pa 1976). 2005;30(21):2414-9. | No multivariate analysis |
| 4. Hitchon PW, Moritani T, Woodroffe RW, et al. C5 palsy following posterior decompression and instrumentation in cervical stenosis: Single center experience and review. Clin Neurol Neurosurg. 2018;174:29-35. | No multivariate analysis |
| 5. Imagama S, Matsuyama Y, Yukawa Y, et al. C5 palsy after cervical laminoplasty: a multicentre study. J Bone Joint Surg Br. 2010;92(3):393-400. | No multivariate analysis |
| 6. Kang KC, Suk KS, Kim HS, et al. Preoperative Risk Factors of C5 Nerve Root Palsy After Laminectomy and Fusion in Patients With Cervical Myelopathy: Analysis of 70 Consecutive Patients. Clin Spine Surg. 2017;30(9):419-24. | No multivariate analysis |
| 7. Kim GU, Lee GW. Selective blocking laminoplasty in cervical laminectomy and fusion to prevent postoperative C5 palsy. Spine J. 2018. | No multivariate analysis |
| 8. Klement MR, Kleeman LT, Blizzard DJ, Gallizzi MA, Eure M, Brown CR. C5 palsy after cervical laminectomy and fusion: does width of laminectomy matter? Spine J. 2016;16(4):462-7. | No multivariate analysis |
| 9. Komagata M, Nishiyama M, Endo K, Ikegami H, Tanaka S, Imakiire A. Prophylaxis of C5 palsy after cervical expansive laminoplasty by bilateral partial foraminotomy. Spine J. 2004;4(6):650-5. | No multivariate analysis |
| 10. Lee SH, Suk KS, Kang KC, et al. Outcomes and Related Factors of C5 Palsy Following Cervical Laminectomy With Instrumented Fusion Compared With Laminoplasty. Spine (Phila Pa 1976). 2016;41(10):E574-9. | No multivariate analysis |
| 11. Liu G, Reyes MR, Riew KD. Why Does C5 Palsy Occur After Prophylactic Bilateral C4-5 Foraminotomy in Open-Door Cervical Laminoplasty? A Risk Factor Analysis. Global Spine J. 2017;7(7):696-702. | No multivariate analysis |
| 12. Minoda Y, Nakamura H, Konishi S, et al. Palsy of the C5 nerve root after midsagittal-splitting laminoplasty of the cervical spine. Spine (Phila Pa 1976). 2003;28(11):1123-7. | No multivariate analysis |
| 13. Radcliff KE, Limthongkul W, Kepler CK, et al. Cervical laminectomy width and spinal cord drift are risk factors for postoperative C5 palsy. J Spinal Disord Tech. 2014;27(2):86-92. | No multivariate analysis |
| 14. Sieh KM, Leung SM, Lam JS, Cheung KY, Fung KY. The use of average Pavlov ratio to predict the risk of post operative upper limb palsy after posterior cervical decompression. J Orthop Surg Res. 2009;4:24. | No multivariate analysis |
| 15. Takase H, Murata H, Sato M, et al. Delayed C5 Palsy After Anterior Cervical Decompression Surgery: Preoperative Foraminal Stenosis and Postoperative Spinal Cord Shift Increase the Risk of Palsy. World Neurosurg. 2018;120:e1107-e19. | No multivariate analysis |
| 16. Takemitsu M, Cheung KM, Wong YW, Cheung WY, Luk KD. C5 nerve root palsy after cervical laminoplasty and posterior fusion with instrumentation. J Spinal Disord Tech. 2008;21(4):267-72. | No multivariate analysis |
| 17. Planchard RF, Maloney PR, Mallory GW, et al. Postoperative Delayed Cervical Palsies: Understanding the Etiology. Global Spine J. 2016;6(6):571-83. | 30% other than C5 palsy |
| 18. Kurakawa T, Miyamoto H, Kaneyama S, Sumi M, Uno K. C5 nerve palsy after posterior reconstruction surgery: predictive risk factors of the incidence and critical range of correction for kyphosis. Eur Spine J. 2016;25(7):2060-7. | Population has 50% non-degenerative disease |

Table S6: All factors abstracted

|  |  | Blizzard | Nori | Tsuji | Lee | Kratzig | **Nassr** | Baba | Wang | Liu | Kaneyama | Bydon | Lubleski | Bydon2 | Bydon2 | Chugh | Wu | Eskander |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Risk Factor | 2016 | 2017 | 2017 | 2017 | 2017 | 2017 | 2016 | 2015 | 2017 | 2010 | 2014 | 2014 | 2014 | 2014 | 2017 | 2014 | 2012 |
| Demographic Factors | Age | no | yes | no | no | yes | no |  | no | no | no | no | no | yes | no | no | no | no |
| Sex | no | no |  | no |  | no |  | no | no | no | no | no | no | no |  | no | no |
| Race | no |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BMI | no |  |  |  |  |  |  |  |  |  | no | no | no | no |  |  | no |
| Smoking | no |  |  |  |  | no |  |  | no |  | no |  | no | no |  |  | no |
| Employment status |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | no |
| Diabetes | no |  |  |  |  | no |  |  | no |  | no |  | no | no |  |  | no |
| Comorbidities | no |  |  |  |  |  |  |  |  |  | no |  | no | no |  |  |  |
| Clinical Factors | Diagnosis |  |  |  |  |  |  |  | no | no |  |  |  | no | no |  |  |  |
| OPLL |  | no |  | no |  | no |  |  | no | yes |  |  |  |  |  | yes |  |
| Longer duration of disease |  |  |  |  |  |  |  | no | yes |  |  |  |  |  |  | no | no |
| Preop severity (Nurick, JOA, NDI) |  | no | no |  |  |  |  | no | no | no |  |  | no | no |  |  | no |
| Post op JOA |  |  | no |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| JOA recovery rate |  |  | no |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Preop SF-36 PCS, MCS |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | no |
| Muscle test deltoid |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |
| Muscle test biceps |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |
| Reflex deltoid |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |
| Reflex biceps |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |
| CMAP deltoid |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |
| CMAP biceps |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |
| ROM flexion and extension | no |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Surgical Factors | Corpectomy 3-5 levels |  |  |  |  |  | yes |  |  |  |  |  |  |  |  |  |  |  |
| No. of corpectomies 2 vs 1 |  |  |  |  | yes |  |  |  |  |  |  |  |  |  |  |  |  |
| C4 VS C6 corpectomy |  |  |  |  | yes |  |  |  |  |  |  |  |  |  |  |  |  |
| C5 VS C6 corpectomy |  |  |  |  | yes |  |  |  |  |  |  |  |  |  |  |  |  |
| Laminoplasty + lam vs lam |  | yes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Laminoplasty+PIF vs laminoplasty |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | yes |  |
| Laminoplasty open door vs double door |  |  |  |  |  |  |  |  |  | yes |  |  |  |  |  |  |  |
| Multi vs 1 level foraminotomy |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |  |
| Foraminotomy |  |  |  |  |  |  |  |  |  |  |  |  | no | yes |  |  |  |
| Ant vs combined approach |  |  |  |  |  | no |  |  |  |  |  |  |  |  |  |  |  |
| Ant vs posterior |  |  |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |
| No. of surgical levels |  | no | no |  |  |  |  | no |  | no | no | no | no | no |  |  |  |
| Prior ant. surgery C4/5 |  |  |  |  |  |  |  |  |  |  |  |  | no | no |  |  |  |
| Allograft |  |  |  |  |  |  |  |  |  |  | no |  | no | no |  |  |  |
| Autograft |  |  |  |  |  |  |  |  |  |  | no |  | no | no |  |  |  |
| Specific levels of surgery |  |  |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |
| PLL resect complete **or** partial |  |  |  |  |  | yes |  |  |  |  |  |  |  |  |  |  |  |
| Incidence of durotomy |  |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |
| Op time |  |  |  |  | yes |  |  |  |  |  |  |  |  |  |  |  |  |
| Radiographic Factors | No. of compressed segments |  |  |  |  |  |  | no |  |  |  |  |  |  |  |  | no |  |
| Preop APD C4/5 | yes |  |  |  |  |  |  |  |  |  |  | yes |  |  |  |  | no |
| Change in APD C4/5 |  |  |  | no |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Cross-sectional area cord |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | no |
| Preop cord rotation |  |  |  |  |  |  |  |  |  |  |  |  |  |  | yes |  | yes |
| APSAP C4/5 |  |  |  |  |  |  | no |  |  | no |  |  |  |  |  | no |  |
| APSAP C5/6 |  |  |  |  |  |  | no |  |  |  |  |  |  |  |  |  |  |
| Preop C4/5 angle | no |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| DW - SW |  | yes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Preop foraminal diameter C4/5 | yes | yes |  | yes |  |  | no | yes |  |  |  | yes |  |  |  | yes |  |
| Preop foraminal stenosis C4/5 |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |  |
| Change foraminal diameter C4/5 |  |  |  |  |  |  |  |  |  |  | yes |  |  |  |  |  |  |
| Preop foraminal diameter right | no |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Preop foraminal diameter left | no |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Preop foraminal grade C4/5 right |  |  |  |  |  |  |  |  |  |  |  |  |  |  | no |  |  |
| Preop foraminal grade C4/5 left |  |  |  |  |  |  |  |  |  |  |  |  |  |  | no |  |  |
| Postop segmental lordosis | no |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Foraminal diameter C5/6 |  |  |  |  |  |  | no |  |  |  |  |  |  |  |  |  |  |
| Preop foraminal area C4/5 right |  |  |  |  |  |  |  |  |  |  |  |  |  |  | no |  |  |
| Preop foraminal area C4/5 left |  |  |  |  |  |  |  |  |  |  |  |  |  |  | no |  |  |
| Preop foraminal grade C4/5 right |  |  |  |  |  |  |  |  |  |  |  |  |  |  | no |  |  |
| Preop foraminal grade C4/5 left |  |  |  |  |  |  |  |  |  |  |  |  |  |  | no |  |  |
| High intensity signal C3/4 |  | no |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |
| High intensity signal C4/5 |  |  |  | no |  |  |  | no | yes | no |  |  |  |  |  |  |  |
| High intensity signal C3-5 |  |  |  |  |  |  | no |  |  |  |  |  |  |  |  | no |  |
| Hinge angle C4, 5, 6 |  |  |  |  |  |  | no |  | no |  |  |  |  |  |  |  |  |
| Intervertebral Ht. variation |  |  |  |  |  |  |  | yes |  |  |  |  |  |  |  |  |  |
| Lamina open angle | no |  | no |  |  |  | no |  |  |  |  | yes |  |  |  |  |  |
| MRI cord compression |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |  |
| Occupying rate SC C/4 |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |  |  |
| Overall MRI signal change |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |  |
| Position of gutter C4,5,6 |  |  |  |  |  |  | no |  |  |  |  |  |  |  |  |  |  |
| Posterior shift C4/5 |  | no |  |  | yes |  | yes |  |  |  | yes |  |  |  |  | no |  |
| Posterior shift C5/6 |  |  |  |  |  |  | no |  |  |  |  |  |  |  |  |  |  |
| preop C2-C7 angle | no |  | no | no |  |  | no |  |  |  |  |  |  |  |  |  |  |
| Postop C2-C7 | no | no |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Change in C2-C7 angle | no |  |  |  |  |  |  | yes |  |  | no |  |  |  | no |  |  |
| Preop Ishihara index | no |  |  |  |  |  |  |  |  | no |  |  |  |  | no | no |  |
| Preop Pavlov ratio C4, 5 |  |  |  | no |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Preop cervical curvature index |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | no |  |
| Postop Ishihara index | no |  |  |  |  |  |  |  |  |  |  |  |  |  |  | no |  |
| Space anterior to SC |  |  | yes |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Vertebral trough width |  |  |  |  |  |  |  | yes |  |  |  |  |  |  |  |  |  |
| Compression level C3/4 |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |
| Compression level C4/5 |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |
| Cord inclination |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |  |
| Dural expansion |  |  |  |  |  |  |  |  |  |  | no |  |  |  |  |  |  |
| Stenosis of multiple segments |  |  |  |  | no |  |  |  |  |  |  |  |  |  |  |  |  |
| Dorsal, ventral or circumferential stenosis |  |  |  |  | no |  |  |  |  |  |  |  |  |  |  |  |  |

Table S7: Strength of the overall body of evidence

|  |  |  |  |
| --- | --- | --- | --- |
| **Baseline strength** | **Downgrade if** | **Upgrade if** | **Final strength** |
| Class I or II | **Risk of bias (study quality)**  -1: serious study limitation in protecting against bias  -2: very serious study limitation in protecting against bias  **Consistency**  -1: either large differences in the magnitude of effect or few studies report a different direction of effect for a particular outcome  -2: either very large differences in the magnitude of effect or many studies report a different direction of effect for a particular outcome  **Directness**  -1: some uncertainty whether predictor is related to outcome of interest  -2: major uncertainty whether predictor is related to outcome of interest  **Precision**  -1: data seriously imprecise so that no clinically useful conclusion can be drawn  -2: data very seriously imprecise so that no clinically useful conclusion can be drawn  **Publication bias**  -1: likely that studies may have been published selectively with regards to the extent to which relevant empirical findings have not been published or are unavailable  -2: very likely that studies may have been published selectively with regards to the extent to which relevant empirical findings have not been published or are unavailable | **Magnitude of effect**  +1: large, i.e. strong association, no plausible confounders  +2: very large, i.e. strong association, no plausible confounders  +1: evidence of a dose response gradient  **All plausible confounding**  +1: would reduce a demonstrated effect  *or*  +1: would suggest a non-genuine effect when results show no effect | **High**  *High confidence that the evidence reflects the true effect. Further research is quite unlikely to change our confidence in the estimate of effect* |
|  | **Moderate**  *Moderate confidence that the evidence reflects the true effect. Further research may change the estimate and our confidence in the estimate of effect* |
| Class III or IV | **Low**  *Low confidence that the evidence reflects the true effect. Further research is likely to change the estimate of the effect and our confidence in the estimate of effect* |
|  | **Very low**  *Either (1) Very low confidence that the evidence reflects the true effect and the true effect is likely to be markedly different from the estimated effect or (2) there is no evidence or it is impossible to estimate an effect* |

Based on Balshem H, Helfand M, Schunemann HJ, Oxman AD, Kunz R, Brozek J, et al. GRADE guidelines: 3. Rating the quality of evidence. J Clin Epidemiol. 2011 Apr;64(4):401-6.