A novel classification and algorithmic-based management of craniovertebral junction osteoarthrosis

Luis Eduardo Carelli Texeira da Silva 1,2, Ahsan Ali Khan 1,2, Alderico Girão Campos de Barros 1, Fernando Miguel Krywinski 1,2, Fabio Antonio Cabral de Araujo Fagundes 1, Felipe Gomes de Souza e Silva 2

1. Department of Spine Surgery, National Institute of Traumatology and Orthopedics (INTO), Rio de Janeiro, Brazil.
2. Department of Complex and Minimal Invasive Spine Surgery, Spine Institute of Rio de Janeiro (INCOL), Rio de Janeiro, Brazil.

ABSTRACT

Introduction: The objective of this study is to propose a novel classification and algorithmic-based management plan for craniovertebral junction osteoarthrosis (CVJOA). Materials and Methods: A retrospective study was done based on prospective database of radiological studies and clinical history. Twenty symptomatic patients (12 females and 8 males) with a mean age of 54.8 years were identified with CVJOA. These patients underwent either nonsurgical treatment only or surgical intervention and had follow-up of at least 14 months. Classification of CVJOA is based on coronal deformity, rigidity, stability, and two modifiers. The main surgical procedures done in the surgical arm of these patients included C1–C2 fusion, C1–C2 facet distraction and fusion, and unilateral subaxial facet distraction, and posterior column osteotomy. Results: All the twenty patients included in this study complained of either sub-occipital or upper neck pain and had radiological evidence of CVJOA. Seven patients improved with nonsurgical management and 13 underwent surgical intervention. Surgical recommendations for each type of CVJOA have been described with case examples, and algorithm for the management of CVJOA has been developed based on this study. Interobserver agreement on CVJOA classification was measured using kappa value statistics which showed moderate strength of agreement (0.467). Conclusion: This study describes a novel classification and management of CVJOA based on algorithm and current surgical recommendations for each type of CVJOA.

Keywords: C1-C2 fusion, cervical pain, craniovertebral junction, facet distraction, osteoarthrosis
REFERENCES

1. Zapletal J, de Valois JC. Radiologic prevalence of advanced lateral C1-C2 osteoarthritis. Spine (Phila Pa 1976) 1997;22:2511-3.

2. Buraimoh MA, Massie LW, Montgomery DM. Lateral atlantoaxial osteoarthritis: A narrative literature review. Clin Spine Surg 2017;30:433-8.

3. Elliott RE, Tanweer O, Smith ML, Frempong-Boadu A. Outcomes of fusion for lateral atlantoaxial osteoarthritis: Meta-analysis and review of literature. World Neurosurg 2013;80:e337-46.

4. Schaeren S, Jeanneret B. Atlantoaxial osteoarthritis: Case series and review of the literature. Eur Spine J 2005;14:501-6.

5. Goel A, Laheri V. Plate and screw fixation for atlanto-axial subluxation. Acta Neurochir (Wien) 1994;129:47-53.

6. Harms J, Melcher RP. Posterior C1-C2 fusion with polyaxial screw and rod fixation. Spine (Phila Pa 1976) 2001;26:2467-71.

7. Goel A. Treatment of basilar invagination by atlantoaxial joint distraction and direct lateral mass fixation. J Neurosurg Spine 2004;1:281-6.

8. Carelli Teixeira da Silva LE, Borges Laurindo de Azevedo G, Chaves BJM. Fixed atlantoaxial dislocation with cord compression: Treatment with C1-C2 distraction: A case presentation. In: Gupta MC, Vaccaro AR, Gupta S, editors. Complex Spine Cases: A Collection of Current Techniques. New Delhi; Jaypee Brothers: 2015. p. 238-44.

9. Silva LE, Barros AG, Castro CJ, Souza RT, Azevedo GB, Casado PL. Results of the use of peek cages in the treatment of basilar invagination by Goel technique. Coluna/Columna 2016;15:61-4.

10. Carelli Teixeira da Silva LE, Krywinski FM. Osteoartritis atlantoaxial. In: Mezzadri JJ, Jalón P, editors. Cirugía de la Espondiloartritis Cervical. Ciudad Autónoma de Buenos Aires: Journal; 2021. p. 57-73.

11. Goel A, Shah A. Facetal distraction as treatment for single- and multilevel cervical spondylotic radiculopathy and myelopathy: A preliminary report. J Neurosurg Spine 2011;14:689-96.

12. Ames CP, Smith JS, Scheer JK, Shaffrey CI, Lafage V, Deviren V, et al. A standardized nomenclature for cervical spine soft-tissue release and osteotomy for deformity correction. J Neurosurg 2013;19:269-78.

13. Goel A, Shah A, Gupta SR. Craniovertebral instability due to degenerative osteoarthritis of the atlantoaxial joints: Analysis of the management of 108 cases. J Neurosurg Spine 2010;12:592-601.

14. Grob D, Luca A, Mannion AF. An observational study of patient-rated outcome after atlantoaxial fusion in patients with rheumatoid arthritis and osteoarthritis. Clin Orthop Relat Res 2011;469:702-7.
15. Ehrat C, Grob D, Dvorak J. Post-traumatic atlanto-axial arthrosis. Orthopade 1996;25:542-5.

16. Park J, ScheerJK, Lim TJ, Deviren V, Ames CP. Biomechanical analysis of Goel technique for C1-2 fusion. J Neurosurg Spine 2011;14:639-46.

17. Kang DG, Lehman RA Jr., Wagner SC, Peters C, Riew KD. Outcomes following arthrodesis for atlanto-axial osteoarthritis. Spine (Phila Pa 1976) 2017;42:E294-E303.

18. Finn M, Fassett DR, Apfelbaum RI. Surgical treatment of nonrheumatoid atlantoaxial degenerative arthritis producing pain and myelopathy. Spine (Phila Pa 1976) 2007;32:3067-73.

19. Voronov LI, Siemionow KB, Havey RM, Carandang G, PatwardhanAG. Biomechanical evaluation of DTRAX® posterior cervical cage stabilization with and without lateral mass fixation. Med Devices(Auckl) 2016;9:285-90.