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Anterior bone loss after two-level cervical disc arthroplasty with artificial discs

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Recently, cervical disc arthroplasty (CDA) has been applied to multiple-level degenerative disc disease. A significant concern is anterior bone loss (ABL), defined as non-progressive early peri-prosthetic vertebral bone loss. Despite existing classification systems for ABL, there is limited literature focused on ABL following 2-level CDA.

This study aimed to assess the incidence of ABL after 2-level CDA and explore biomechanical effects through a retrospective chart review. We analyzed data from 108 patients who underwent two-level CDA between February 2016 and September 2020 at a spine surgery center, managed by a single neurosurgeon to reduce variability. Hybrid cases were also studied to determine if adjacent segment fusion contributes to ABL, leading to the evaluation of 216 artificial discs.

Radiological measurements were collected pre-operatively and six months post-operation, with ABL assessed at 1, 3, 6, and 12 months post-surgery. A grading system for ABL was used: Grade 0 (no remodeling), Grade 1 (spur disappearance or mild contour change), and Grade 2 (obvious bone regression with implant exposure).

Results showed that all 108 patients had at least Grade 1 ABL in one or both segments. Of the 216 segments analyzed, 56 exhibited Grade 2 ABL, 151 had Grade 1, and only 9 had no bone loss. Significant findings showed that segments with Grade 2 ABL were linked to larger preoperative segmental alignment angles and larger postoperative global alignment angles during extension.

In conclusion, ABL is common among patients undergoing 2-level CDA, more pronounced than in single-level cases. Larger alignment angles may increase the risk of extensive bone loss. Understanding the mechanisms of ABL is crucial, as they may reflect adaptive responses to alignment changes post-arthroplasty. Future CDA procedures and artificial disc designs should consider the implications of ABL.