Comparison of C1 Expansive Open-door Laminoplasty and C1 Laminectomy with Occipito-cervical Fusion in Cervical Myelopathy with Lordotic Alignment: Sagittal Balance and Clinical Outcomes

HOWARD CHEN[1234], KT YEH[1235], CM CHANG[123], IH CHEN[13], TC YU[13], WT WU[1234]
1 ORTHOPEDIC DEPARTMENT OF HUALIEN TZU CHI HOSPITAL
2 TAIWAN SPINE SOCIETY
3 INSTITUTE OF MEDICAL SCIENCE, TZU CHI UNIVERSITY
4 TZU CHI MEDICAL RECONSTRUCTION CENTER OF SPINAL CORD INJURY
5 GRADUATE INSTITUTE OF PHARMACY

Introduction: For patients with cervical myelopathy and lordotic alignment, subaxial laminoplasty is a well-established decompression method. However, the optimal surgical approach at the craniocervical junction remains controversial. C1 expansive open-door laminoplasty (C1-LP) preserves mobility but may affect sagittal balance, whereas C1 laminectomy with concomitant occipito-cervical fusion (C1-LE OCF) provides stability at the cost of range of motion. This study compares cervical sagittal balance and clinical outcomes between these two surgical techniques.

Methods: This retrospective study included patients with cervical myelopathy and lordotic alignment who underwent either C1 laminoplasty (C1-LP) or C1 laminectomy with occipito-cervical fusion (C1-LE OCF) between January 2016 and December 2021. Patients with idiopathic or traumatic atlantoaxial subluxation were excluded. Radiographic parameters—including C0-2 Cobb angle (CA), C2-7 CA, C0-2 range of motion (ROM), C2-7 ROM, cervical sagittal vertical axis (CSVA), and chin-brow vertical angle (CBVA)—were measured preoperatively, postoperatively, and at 6 months, 1 year, and 3 years. Functional outcomes were assessed at the same time points using the Japanese Orthopaedic Association (JOA) score, Visual Analogue Scale (VAS), and Neck Disability Index (NDI).

Results: A total of 36 patients were included and divided into two groups: C1-LP (n=18) and C1-LE OCF (n=18). Preoperatively, no significant differences were observed between the groups in terms of age, gender, radiographic parameters (C0-2 CA, C2-7 CA, C0-2 ROM, C2-7 ROM, CSVA, and CBVA), and functional outcomes (JOA, VAS, and NDI). Postoperatively, the C1-LP group retained significantly greater C0-2 ROM ($p<0.001$), while C2-7 ROM remained similar between groups. Both groups demonstrated significant JOA and NDI improvements at 6 months, 1 year, and 3 years. However, the C1-LE OCF group had persistently higher VAS scores at each postoperative time point, indicating greater residual neck pain (6 months: 2.9±0.3 vs. 4.8±0.6, $p=0.029$; 1 year: 2.5±0.3 vs. 4.2±0.6, $p=0.036$; 3 years: 1.9±0.2 vs. 3.9±0.5, $p=0.036$). Additionally, the C1-LE OCF group exhibited higher NDI scores, suggesting worse long-term functional outcomes (6 months: 16.8±2.2 vs. 14.5±2.5, $p=0.152$; 1 year: 17.6±2.0 vs. 13.5±1.5, $p=0.027$; 3 years: 17.0±1.9 vs. 10.9±1.1, $p=0.009$).

Conclusion: Both C1 laminoplasty and C1 laminectomy with OC fusion effectively improve clinical outcomes for cervical myelopathy with lordotic alignment. However, C1 laminoplasty preserves C0-2 mobility and is associated with lower postoperative neck pain and better long-term functional outcomes, while C1 laminectomy with OC fusion results in greater postoperative pain and higher long-term disability, despite ensuring better craniocervical stability.