Basilar invagination case series

2022

Zhou et al. in a study of a total of 410 patients (205 consecutive patients with BI and 205 matched patients without BI) and 820 unilateral laminae of the axis were included at a 1:1 ratio. Comparisons with regard to insertion parameters (laminar length, thickness, angle, and height) for C2 translaminar screw placement and Hounsfield unit (HU) values for the assessment of the appropriate bone mineral density of C2 laminae between BI and control groups were performed. Besides, the subgroup analyses based on the Goel A and B classification of BI, HRVA, atlas occipitalization, and C2/3 assimilation were also carried out. Furthermore, the factors that might affect the insertion parameters and HU values were explored through multiple linear regression analyses.

The BI group showed a significantly smaller laminar length, thickness, height, and HU value than the control group, whereas no significant difference was observed regarding the laminar angle. By contrast, the control group showed significantly higher rates of acceptability for unilateral and bilateral translaminar screw fixations than the BI group. Subgroup analyses showed that the classification of Goel A and B, HRVA, atlas occipitalization, and C2/3 assimilation affected the insertion parameters except the HU values. Multiple linear regression indicated that the laminar length was significantly associated with the male gender ($B = 0.190$, $p < 0.001$), diagnoses of HRVA ($B = -0.109$, $p < 0.001$), Goel A ($B = -0.167$, $p < 0.001$), and C2/3 assimilation ($B = -0.079$, $p = 0.029$); the laminar thickness was significantly associated with the male gender ($B = 0.353$, $p < 0.001$), diagnoses of HRVA ($B = -0.430$, $p < 0.001$), Goel B ($B = -0.249$, $p = 0.026$), and distance from the top of odontoid to the Chamberlain line ($B = -0.025$, $p = 0.003$); laminar HU values were significantly associated with age ($B = -2.517$, $p < 0.001$), Goel A ($B = -44.205$, $p < 0.001$), Goel B ($B = -25.704$, $p = 0.014$), and laminar thickness ($B = -11.706$, $p = 0.001$).

Patients with BI had narrower and smaller laminae with lower HU values and lower unilateral and bilateral acceptability for translaminar screws than patients without BI. Preoperative 3-dimensional computed tomography (CT) and CT angiography were needed for BI patients [1)].

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From 2008 to 2018, eleven patients with atlantoaxial dislocation (AAD) and basilar invagination underwent surgical reduction using C1/C2 the joint reduction technique with a fibular graft/peek cage placement followed by C1 lateral mass/C2 pedicle screw fixation. In two cases that we originally planned to perform C1/C2 joint reduction, occiput-C2 pedicle screw fixation was performed instead due to intraoperative challenges.

A total of 13 patients, with an average age of 30.46 ± 13.23 years (range 12-57), were operated. In one patient, iatrogenic vertebral artery injury occurred without any neurological complication. JOA score improved from 10.45 ± 1.128 to 15.0 ± 1.949 ($p < 0.0001$, paired t-test). All radiological indices were improved (p at least < 0.001). No construct failure was seen in any of the patients with C1-2 facet joint distraction technique during follow-up, and no additional anterior decompression surgery was required.

C1/C2 joint reduction technique with fibular graft/cervical PEEK cage of BI patients together with AAD

seems to be an effective and safe surgical method of treatment [2].

Du et al. reviewed 32 patients with basilar invagination and atlantoaxial dislocation who were misdiagnosed as a simple Chiari malformation and received a suboccipital decompression surgery before admission. All patients underwent atlantoaxial facet joint reduction, fixation and atlantoaxial fusion (AFRF) as revision surgery. The separating, fusing, opacifying and false-coloring-volume rendering (SFOF-VR) technique was used to identify the course of the vertebral artery. Clinical and radiological outcomes were assessed after revision surgeries.

Clinical symptoms improved in all patients. The postoperative atlantodens interval, Wackenheim line and clivus-canal angle significantly improved (all $P < 0.01$). Intraoperative dural tear and Cerebrospinal fluid fistula occurred in 3 patients and were managed by suture repair and lumbar drainage. Abnormal VA was identified in 7 patients and no VA injury occurred with the aid of SFOF-VR technique. The average follow-up was 19.1 months and atlantoaxial bone fusion was confirmed in 31 patients.

For BI and AAD patients with failed suboccipital decompression, revision surgery is challenging. Occipitocervical fixation and posterior midline bone grafting are rather difficult due to the large occipital bone defect. The current study demonstrated that the posterior AFRF is a simple, safe and highly effective technique in revision surgery for such cases. For VA variations, the SFOF-VR technique is an effective tool to delineate the course VA [3].

A study included all patients with atlantoaxial dislocation and basilar invagination (BI) with occipitalized C1 arch. Study techniques included Nurick grading, computed tomography scan to study atlanto-dental interval, BI, hyper-lordosis, and neck tilt. Sagittal inclination (SI), coronal inclination (CI), cranio-cervical tilt, presence of pseudo-joints, and anomalous vertebral artery were also noted. Patients underwent DCER with/without joint remodeling or extra-articular distraction (EAD) based on the SI being <100°, 100°-160°, or >160° respectively. In cases with pseudo-joints, joint remodeling was performed in type I and EAD in type II. Customized 'bullet shaped' PSC spacers (n=124) and prototype of the universal craniovertebral junction reducer (UCVJR, n=36) were useful.

A total of 148 patients with average age 27.25±17.43 years, ranging from 3 to 71 years (87 males) were operated. Nurick's grading improved from 3.14±1.872 to 1.22±1.17 ($p<0.0001$). Fifty-two percent of total joints (n=154/296 joints) were either type I (19%)/type II (33%) pseudo-j oints. All traditional indices such as Chamberlein line, McRae line, atlanto-dental interval, and Ranawat line improved (p<at least 0.001). BI, SI, and CI values correlated with type of pseudo-joints ($p<0.0001$). Side of neck tilt correlated with the type of pseudo-joint ($p<0.0001$). Cervical hyperlordosis improved significantly ($p<0.0001$).

Occipito-C2 pseudo-joints are important in determining the severity of BI. Asymmetrical pseudo-joint causes coronal/neck tilt. Type of pseudo-joint can strategize by DCER. Customized instruments and implants make technique safe, effective and easier [4].

1)
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2)

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3)

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4)

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