

Posterior C1-2 fixation in basilar invagination with atlantoaxial dislocation: challenges, techniques and innovations

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Aims: To establish a standardized surgical protocol for C1 lateral mass screw placement, to explore the feasibility, safety and clinical effectiveness of C2 medial pedicle screw placement and to assess the feasibility and accuracy of C3 pedicle screw placement in congenital C2-3 fusion in patients with basilar invagination and atlantoaxial dislocation.

Methods: A surgical protocol for C1 lateral mass screw placement was established, and the accuracy of screw placement and the related complications were reviewed. A novel C2 fixation technique, the “C2 medial pedicle screw” fixation technique was proposed. Its safety and clinical effectiveness were evaluated. C3 pedicle screw placement was carried out using the “medial sliding technique” in patients with C2-3 fusion, and its screw accuracy was evaluated. The long-term clinical efficacy of C3 pedicle screw fixation was investigated

Results: The “protocol for C1 lateral mass screw placement” can be divided into 8 independent steps, with 96.5% of the screws safely inserted without lethal complications. C2 medial pedicle screws were successfully placed in patients with narrow C2 pedicle. Reduction of basilar invagination and atlantoaxial invagination was achieved in all patients and no serious complications were founded. C3 pedicle screws were placed in patients using the medial sliding technique and 96.7% of the screws were considered safe with no severe complication.

Discussion: The present study established a standardized surgical protocol for C1 lateral mass screw placement in atlas assimilation, which is beneficial to ensure safety placement of C1 lateral mass screws. The C2 medial pedicle screw technique was feasible, safe and effective and can be used as an ideal alternative for C2 fixation in patients with C2 narrow pedicle. The C3 pedicle screw could be a reasonable and feasible fixation technique for patients with congenital C2-3 fusion.

Conclusion: Posterior C1-2 fixation is a reliable reduction and fixation technique in basilar invagination and atlantoaxial dislocation with satisfied successful rates. However, C1-2 fixation still faces challenges due to complexity of congenital malformations. Technical innovations of C1 and C2 screw placement will significantly increase its safety, stability and efficiency.

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