Newer Surgical Adjuncts in the Management of Complex Cranio-Vertebral Junction Anomalies

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Introduction

Surgical management of complex cranio-vertebral junction anomalies requires careful attention to the complex anatomy of the region. Routine use of operating microscope and navigation have helped in making the surgery safer. Newer adjuncts like 3D Printed Models, Vertebral Artery Doppler and Intra-Operative Neuro-Monitoring have potential to improve surgical safety.

Methods

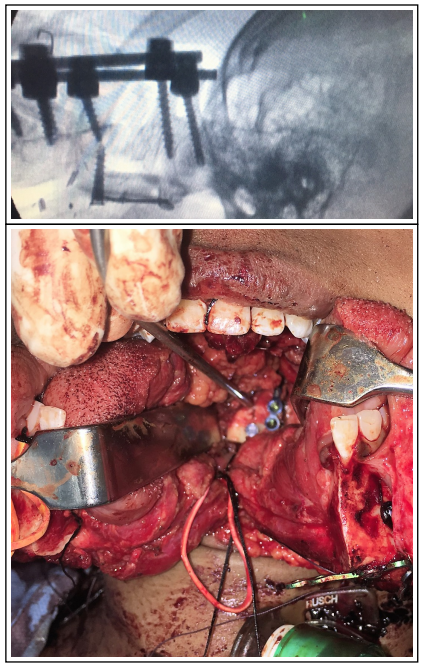
Authors describe their case series of complex cranio-vertebral junction anomalies where surgical adjuncts helped in improving the safety of surgery.

Results

3D Printed Model

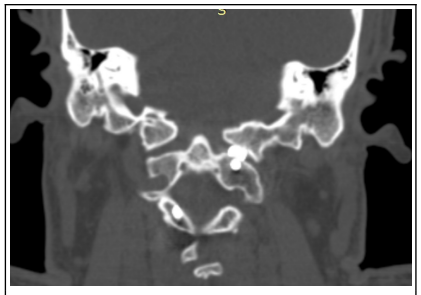
3D printed models help in planning the optimal surgical exposure.

This 14 year old patient with C2 vertebral body epithelioid sarcoma underwent posterior C1-C3-4 stabilisation and decompression of lesion in posterior elements of C2 as first stage. After analysing the 3D model, she was planned for midline mandibulotomy and glossotomy approach ensuring optimal exposure of ventral lesion in C2 body. The model helped in achieving safe maximal resection of the lesion. It also facilitated accurate fashioning of vascularized fibula graft to snuggly secure in between C1 anterior arch and C3 body.



Vertebral Doppler

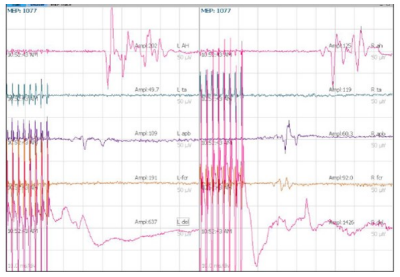
Vertebral Doppler helps in identifying the course of vertebral arteries. In cases where C1-C2 distraction and spacers are required, checking for flow in horizontal portion of V3 segment of vertebral artery avoids its inadvertent occlusion due to excessive distraction.



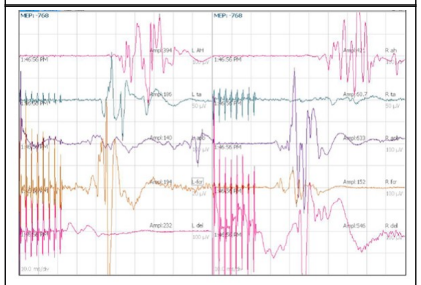
In this patient with basilar invagination, placing of spacer on the right side caused dampening of flow in distal vertebral artery. So, the right spacer was removed and placed only unilaterally on opposite side

Movie

Intra-Operative Neuro-Physiological Monitoring



Baseline



Improvement in amplitude after cranio-vertebral decompression

Intra-Operative Neuro-Monitoring using Sensory Evoked Potential (SEP) and Motor Evoked Potentials (MEP) help in predicting neurological deterioration. An unchanged or improved MEP amplitude suggested good decompression and confirmed safety of the cord. Of the sixteen patients analysed, eight (50%) showed improvement in trans-cranial motor evoked potentials (MEP), five showed no change in MEP and one showed reduction in amplitude. None of them had significant neurological deterioration.

Conclusions

Use of 3D printed models ascertains precise anatomy of cranio-vertebral junction and helps in surgical planning. Bio-mechanical analysis of cervical spine using pre-operative model helps in optimal usage of implants. Use of Doppler helps to delineate the course of vertebral artery and also to ascertain its patency after C1-C2 distraction. Intra-operative neurophysiological monitoring is very useful in preventing neurological deficits. Surgery for complex cranio-vertebral junction anomalies is technically challenging. Newer surgical adjuncts studied make the complex surgery safer.

References

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