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TECHNICAL NOTE

A New Technique of Craniovertebral Fixation

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ABSTRACT

Craniovertebral instability is usually treated by posterior occipitocervical fixation using occipital plate and bilateral atlas lateral mass and axis pars/pedicle fixation with screw rod construct. A patient with unfavorable anatomy of the lateral masses of the atlas and superior facet of the axis due to previous surgical wound infection had developed craniocervical instability. A new technique using a customized plate rod construct fixed anteriorly to the midcervical vertebrae (by a standard midcervical exposure) with the rods contoured to reach posteriorly through the safe paraspinal corridor and connected with dominos to occipital plate rods fixed on either side of midline by additional posterior exposure avoiding the midline scar was planned and executed successfully. The technique seems to be safe and easy, but will need further evaluation.

Keywords: Craniovertebral fixation, Occipitocervical fixation.

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INTRODUCTION

An adult male presented with complaints of severe neck pain and weakness of all four limbs. 4 months ago, he had been operated for basilar invagination with myelopathy. Transoral odontoid excision was performed and also a posterior occipitocervical fixation, which had become complicated with infection of both surgical sites and needed removal of the posterior implant. The transoral surgery wound had also gaped with infection and had healed by secondary intention.

He had severe neck pain, spasticity of all limbs, exaggerated tendon jerks, and positive bilateral Babinski reflex. He had a discharging sinus in the lower aspect of the previous neck surgery wound. The cervical paraspinal muscles revealed wasting, diastasis, and a thin wide midline scar. Some drops of purulent fluid could be expressed from the sinus on pressure.

The computed tomography (CT) scanning and magnetic resonance imaging (MRI) of craniovertebral junction revealed residual odontoid compression of the cervicomedullary junction (incomplete odontoidectomy), altered signal, and sclerosis of residual odontoid, axis body, small deformed lateral masses of the atlas, and unfavorable distorted anatomy of the axis pars/pedicles bilaterally (Fig. 1). After nutritional replacement and medical fitness, he underwent repeat transoral surgery for the residual odontoid.

A new stabilization to avoid the lower aspect of the neck wound and the atlas/axis was planned (Fig. 2).

Following a careful fiberoptic awake intubation and general anesthesia, a standard right-sided anterior incision exposed 3rd, 4th, and 5th vertebral bodies.

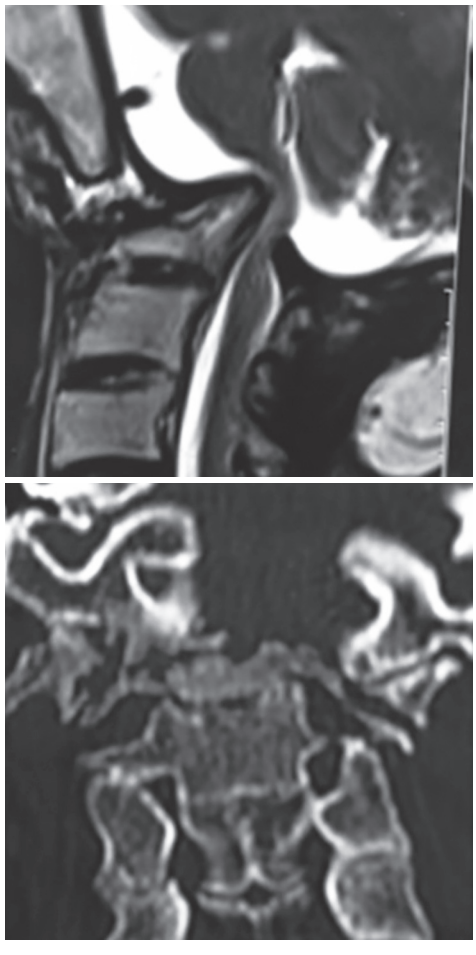

Fig. 1: Preoperative, MRI and CT scan revealing incomplete odontoid excison with poor bone quality and volume in lateral masses of atlas and axis

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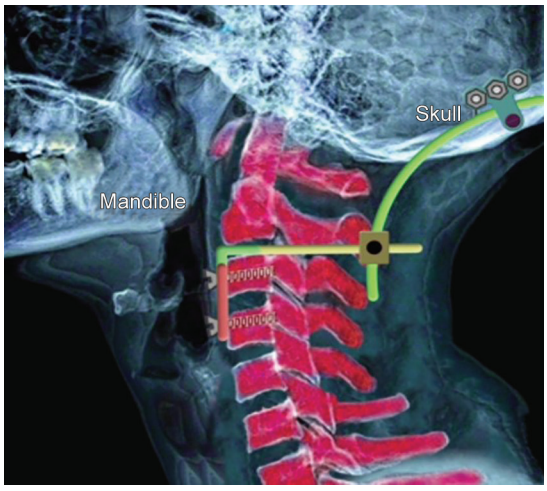

Fig. 2: New construct to fix cranium to vertebral bodies along the natural line of weight transmission

Fig. 3: Customized contoured titanium plate rod construct

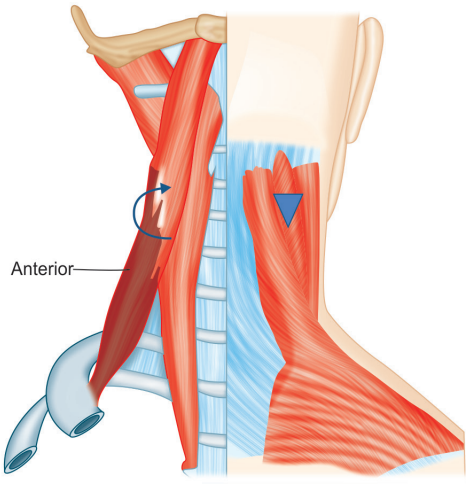

Fig. 4: Safe intermuscular route for the rods, lateral to the transverse process to reach the posterior paraspinal region. Safe intermuscular corridor lateral to transverse process of 3rd cervical vertebra

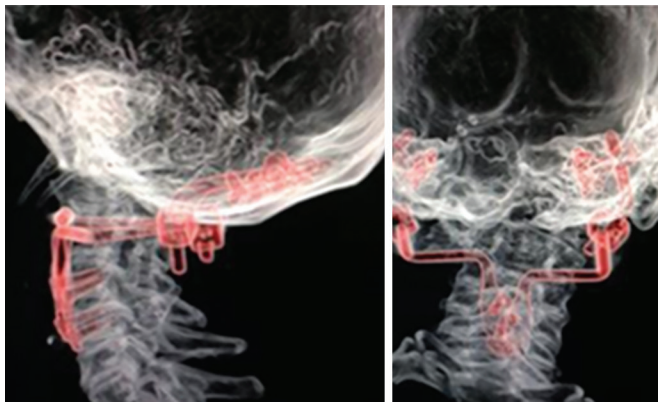

Fig. 5: Final construct

Dissection was performed far laterally over the longus colli muscles on both sides to reach the lateral aspect of the transverse processes of the 3rd cervical vertebra, which was confirmed by palpation and using "C" arm imaging. A customized titanium plate with rod (4-mm diameter implant) (Fig. 3) was contoured and inserted so that the plate rested on the vertebral bodies of the 4th and 5th vertebra and the rod was negotiated by blunt dissection paraspinally lateral to the transverse process to reach the posterior paraspinal region under the occiput on either side (Fig. 4). The plates were fixed to the vertebral bodies with screws. After closing the neck wound, the patient was turned prone with all anesthesia precautions for tube position, and maintaining neck in neutral position, the head was positioned on a "U" rest protecting the eyes. The occiput and the projecting rods' tips were exposed with an inverted "U" incision. Two separate rods were fixed to the occiput using plates with three screws with bicortical purchase and connected to the projecting rod ends at 90° with customized connectors. Patient was made to sit up next day with a cervical rigid collar in mild extension. Immediate postoperative CT scan and X-rays were satisfactory (Fig. 5).

The neck pain disappeared on the first postoperative day. Wound healed uneventfully. He made a small objective progress in neurological status and felt satisfied. We planned reexploration of the lower aspect of the previous cervical wound for searching for any residual foreign body once patient was better.

Three months follow-up showed a rigid implant on dynamic X-rays and the discharge from the previous posterior neck wound was minimal, but patient was unwilling for additional surgery at present.

DISCUSSION

The technique of craniovertebral fixation has evolved over the years, to a rigid construct of a midline occipital plate fixed to posterior elements of the cervical vertebrae with polyaxial screws and rods.[1] Technical difficulty of cervical pedicle screws in subaxial vertebrae resulted

in the lateral masses being used for fixation.[2] Posterior screw fixation of the atlas and axis is not without risks (vertebral artery, venous plexus, and C2 root ganglion), and literature is abundant with methods to reduce those risks.[3,4]

Postoperative infection in the posterior implant site (previous surgery) and poor bone quality in the atlas and unfavorable pars/pedicle anatomy of the axis may need a different implant fixation site to transfer the weight of the cranium to the cervical spine with rigid fixation.[5]

Normally, weight of the skull is transmitted by the occipital condyles to the vertebral bodies of the subaxial spine.[6] Anterior plate screw fixation of the cervical vertebrae is a standard, safe, and biomechanically tested procedure.[7,8] By remaining lateral to the cervical transverse process, the vertebral artery and the exiting nerve root can be avoided easily.[9] After turning the patient prone, the occipital bone and the rods can be exposed with minimal tissue dissection and preserving the posterior tension band.

Though the technique needs two surgical exposures, both are familiar, easy, and safe. More cases need to be done to evaluate the potential of this technique; until then, it can be considered as a salvage option when the standard technique is not possible.

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