ORIGINAL RESEARCH PAPER

Volume-7 | Issue-12 | December-2018 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

POSTERIOR FIXATION FOR OCCIPITO-CERVICAL INSTABILITY

Orthopaedics

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ABSTRACT

Occipito-cervical instability and compression at the cervico-medullary junction provides a big surgical challenge. We present 5 cases of cervico-medullary compression operated with posterior decompression and fixation along with bone grafting taken from iliac crest. Three cases had occipto-cervical congenital anomalies associated with atlanto-axial instability, one was associated with dens erosion with rheumatoid arthritis and one had odontoid fracture. Four of them showed significant canal compromise associated with neurological deficit. In 3 cases we used hartshill-ramsford loop and sub-laminar wires, in one cortical bone graft with sub-laminar wires and in one screws with contoured rods was used. All the cases showed post-operative neurological improvement and 3 patients were able to walk without support. No instance of construct failure, broken wire or laminar fracture was seen.

KEYWORDS

INTRODUCTION

In the early 1900s occipitocervical instability and lesions located at the occipitocervical junction were considered inoperable and terminal. Occipitocervical (0-Cl) and atlantoaxial (C1-C2) instability is an unusual problem but, when encountered, stabilization is a formidable undertaking (Menezes1991-2)1.

Planned occipitocervical fusion was first reported in 1927 by Foerster2 who inserted a cortical graft from fibula between the occiput and C7 to stabilise a progressive atlantoaxial dislocation after fracture of the dens. A year later, an unsuccessful attempt to fuse an atlantoaxial dislocation with a tibia graft was reported (Juvara and Dimitriu1928) 3. The first operation using an iliac crest graft was performed by Kahn and Yglesias 4 in 1935. These early techniques used simple onlay grafts and external orthoses (Foerster 1927; Newman and Sweetnam 19695), and in some centres this method remains popular (Elia, Mazzara and Fielding6 1992).

Subsequent reports, however, have described the use of wires to secure the bone grafts (Cone and Turner7 1937; Robinson and Southwick8 1960; Hamblen9 1967; Grantham et al 101969; Wertheim and Bohlman 111987). To avoid the complications of prolonged external immobilisation, internal fixation devices such as Luque rods (Itoh 12 et al 1988) or rectangles (Nakano et al 131978; Dove1986; Sakou et al 1989) were secured by wires to the occiput and laminae.

Methyl-methacrylate bone cement with wires was also a popular method of fixation (Brattstrom and Granholm 14 1976).

Specially designed but technically demanding posterior plates fixed by screws to the occiput and laminae have proved effective in highly skilled hands (Roy-Camille et al15 1983; grob et al 1990).
Occipitocervical instability can result from a myriad of disorders, including congenital cranial settling, trauma, rheumatoid arthritis and other inflammatory arthropathies, neoplasm, infection, or iatrogenic response to surgical decompression.

Atlanto-occipital dislocation, or traumatic dislocation of the occipital condyle and C1 lateral mass (O-C1 joint), is the most common acute presentation of instability at the occipitocervical junction. Rheumatoid disease is the most commonly seen inflammatory arthropathy affecting the high cervical spine, although the region can also be affected by Reiter syndrome, psoriatic arthritis, inflammatory bowel disease-associated arthritis, and calcium pyrophosphate deposition disease.

Various congenital and developmental defects may be seen at the occipitocervical junction and may lead to instability. Occipitocervical instability is commonly seen in patients with Down syndrome and may require fusion at a young age. Additionally, because of the complex embryology of the area, numerous developmental anomalies may necessitate fusion owing to instability or neural compression.

Patients may present with progressive myelopathy, pain, lower cranial nerve dysfunction, or deformities of the craniocervical region.

MATERIALS AND METHODS

We present our experience of five cases of occipito-cervical instability and associated cervico-medullary compression operated at our institute in the past 2 years.

White & Panjabi's criteria for instability of the C0-C1-C2 complex was used to define the occipito-cervical instability.

>8°	Axial rotation C0-C1 to one side
>1 mm	C0-C1 translation
>7mm	Overhang C1-C2 (total right and left)
>45°	Axial rotation C1-C2 to one side
>4 mm	C1-C2 translation
<13 mm	Posterior body C2-posterior ring C1
	Avulsed transverse ligament
	Neurological involvement

The first case had rheumatoid disease associated with dens erosion and occipito-cervical instability. Symptomatically she complained of occipital headache with neck pain and had normal neurology. One case was associated with 6 month old Type II odontoid fracture with non-union, associated with severe canal compromise and spastic quadriparesis. Three cases had congenital occipito-cervical anomalies associated with occipito-cervical instability. All of them showed significant canal compromise with space available for cord <10mm. These three cases showed varying grades of spasticity and neurological deficit. Two of them were non-ambulatory while one could walk with support.

Posterior midline approach was used in all cases. Pre-operative cervical tong traction was given for 24 hours in the four cases with neurological involvement and canal compromise. In all the patients pre-operative 3D CT scan was done after 24 hours of tong traction to evaluate residual subluxation. In all the cases, posterior decompression was done at C1 and/or C2 level. The posterior margin of foramen magnum was also removed in two cases where severe cord compression and basilar invagination was evident.

We used three types of implants for posterior fixation. In one case associated with rheumatoid arthritis we used screw-and-rod fixation (O-C fixation system,Synthes) with lateral mass screws in C3 and pedicle screws in C2 screws, using Roy-Camille technique.

In three cases we used Hartshill-Ransford loop along with sub-laminar wires. The loop was fixed at the level just below the occipital protuberance using wires passed through burr holes made in occiput. The vertical arm was fixed using sub-laminar wires passed through C2 lamina. In one case C3 lamina was also spanned for better stabilization.

In one case of congenital instability of C1-C2 which was irreducible pre-operatively by tong traction, evident on CT scan, was fixed by sub-laminar wires passed through C1 and C2. Sub-luxation was reduced with the help of these wires and beneath these wires tricortical graft was kept.

In all cases cancellous bone graft from iliac crest was used. In all the patients immediate post-operative dynamic CT scan in flexion and extension were obtained.

Post-operative mobilization protocol was decided upon based on quality of bone, age and physical activity of the patient, stability of fixation achieved on the operation table and incorporation of graft evident on follow-up X-rays. In the patient operated with C2-C3 screws and rods, immediate post-operative mobilization was permitted and the patient could walk freely from second post-operative day. In two cases, during post-operative period immobilization was done using the Sterno Occipito Mandibular Immobilization (SOMI) brace for six weeks. The patients were allowed sitting and walking after fusion was evident on lateral X-rays.

The patients were assessed for neurological status using the ASIA-MIS scores pre- and post-operatively. Radiological evaluation was done at regular follow-ups and union evaluated using plain, flexion and extension lateral radiographs.

RESULTS AND DISCUSSION

This is a case series of 5 patients operated for posterior occipito-cervical fusion, over a period of 3 months to two years.

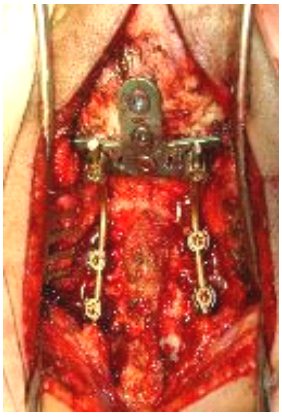
All the cases with neurological deficit showed significant improvement in motor power. The ASIA-MIS scores for these patients improved from a pre-operative average of 49 to post-operative average of 76. The patient with normal neurology remained so post-operatively. Three patients were able to walk post-operatively without support.

This improved neurological status can be attributed to the good decompression achieved by the posterior approach. Suboccipital craniectomy and C1 laminectomy could afford a 30-50% increment in anteroposterior diameter of the neural canal and effective decompression of the lower part of medulla and upper part of spinal cord.

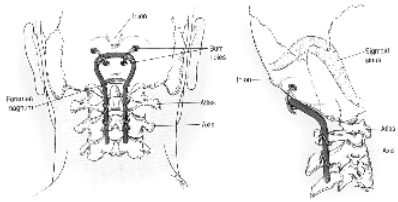
H-J Chen, M-H Cheng and Y-C Lau 16 in their study on one-stage posterior decompression and fusion using Luque rod for occipito-cervical instability and neural compression, have achieved similar results in terms of improvement in neurology after C1 laminectomy.

Fusion as evident on lateral flexion and extension radiographs was achieved in three patients. The remaining two had shorter follow-up of 3-4 months.

Screw-and-rod fixation is a very stable construct and provides the best biomechanical stability. It helps in early mobilization of the patient. These systems are easy to contour and provide rigid fixation. Abumi and colleagues have also described occipitocervical reconstruction in which pedicle screws and occipitocervical rod systems are used. These systems provide high fusion rates and a significant correction of malalignment.



Hartshill-Ransford loop has also shown to provide good stability. Part of the success of the system is due to the close conformity of the loop to the shape of the craniocervical junction and the wide distribution of the load through multiple levels of fixation. The flare at C2 level helps to prevent translocation. No instance of construct failure, broken wire or laminar fracture was seen.

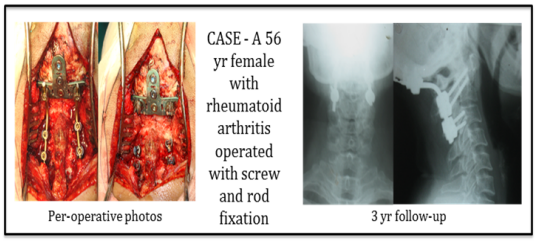


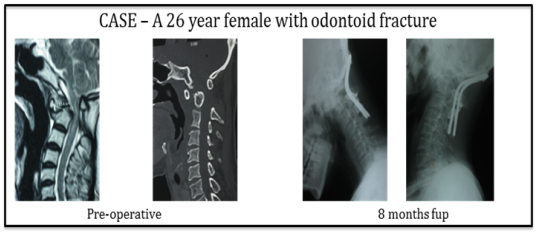
In their series of 43 patients operated for various non-rheumatoid conditions causing occipito-cervical instability, using internal fixation with the Hartshill-Ransford loop, G.P. Malcolm, A.O. Ransford and H.A. Crockard 17 have obtained good to excellent results. The best results were obtained in patients with tumors or bone-softening conditions. Neck stiffness was the major complication causing half the patients to change their lifestyle.

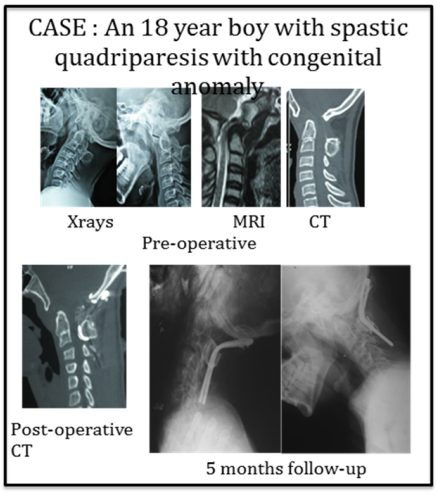
It provides an excellent alternative in cases where anatomy of cervical vertebrae is disturbed or destroyed and it is difficult to insert posterior screws. The cost-effectiveness and the stability provided by the implant, make it an attractive option for posterior occipito-cervical fusion in our setup.

As duration of follow-up and total number of cases increases, it would further enable us to evaluate our results more critically and help in the standardization of treatment protocol.

FIGURES :-







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