



C1 C2 FUSION BY GOEL TECHNIQUE - A REVIEW OF CASES IN OUR INSTITUTE.

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ABSTRACT

Objective: we have reviewed clinically and radiologically results of C1C2 fusion in 15 cases with C1C2 instability.

Method: We have operated on 15 patients in our institute from 2016 to 2020. All had undergone C1C2 fusion by Goel technique after proper pre and post operative evaluation both clinically and radiologically.

Result: Out of 15 patients one died due to neurological deterioration. All other patients had definite benefit from surgery, they have been followed up to maximum of 18 months.

Conclusion: There are various ways to treat CVJ junction instability. The Goel technique has revolutionized this dark area of neurosurgery. It was a difficult learning slope, but it's not invincible. One of our patient died, it was in our early phase of learning, all other patients had better quality of life. It should be treated early to avoid permanent neurodeficit.

KEYWORDS : Atlanto-axial dislocation, Goel technique¹, C1C2 fusion, Nurick grade².

INTRODUCTION:

Surgical treatment of cervical Vertebral Junction (CVJ) instability is a complex and challenging procedure. Many of the old teachings like classification of CVJ anomaly into reducible, irreducible, congenital are obsolete now. Even various surgical procedure like anterior approach which includes odontoidectomy and fusion of C1C2, posterior approach like long segment fusion i.e occiput to cervical fusion, foramen magnum decompression etc are historical.

Prof Atul Goel the pioneer of atlanto-axial fixation(C1&C2 fixation by posterior approach)introduced a revolutionary concept which has replaced most of the old procedure. C1 &C2 fixation a complete restoration of normal alignment can be achieved.

Objective: We have reviewed clinically and radiologically results of C1C2 fusion in 15 cases with C1C2 instability.

MATERIAL AND METHODS:

Inclusion criteria of study population were patients with CVJ instability due to any pathology like trauma, congenital anomaly and tumor. 15 patients of CVJ lesions (nine male and six female) were treated in our department in 5 years. Instability resulted from trauma in eleven, congenital malformation in three and one with a large neurofibroma in the region. Outcome (mean follow-up period, 18 months) was based on clinical and radiological review. All patients were managed surgically with Goel technique.

Study design : a retrospective observational study.

Clinical features and evaluation:

Clinical assessment as per Nurick grading system(fig1.a) pre and post operative period.

Grade	Description
0	signs or symptoms of root involvement without myelopathy
1	myelopathy, but no difficulty in walking
2	slight difficulty in walking, able to work
3	difficulty in walking but not needing assistance, unable to work full-time
4	able to walk only with assistance or walker
5	chairbound or bedridden

Fig.1aNurick grading system

Investigations:

Preoperatively a dynamic cervical spine antero-posterior and lateral view X-ray, Magnetic resonance imaging MRI of CVJ, computed tomography CT of CVJ region with sagittal and coronal reconstruction. CT angiogram with 3D reconstruction to derive information on anomalous course of vertebral artery and its side of dominance, lateral masses of C1 and pedicles of C2 and its measurement for implant use. During post-operative period follow up done by simple dynamic x-rays and computed tomography CT of CVJ region if needed.

Surgical planning:

After proper pre anaesthetic check up and detailed consent from patient and relative, all patients underwent C1C2 fusion by Goel technique.

Surgical technique :

The most important step is positioning patient in supine posture under skull traction and the head is floating¹ (Fig1.b). The head end is slightly raised to make traction effective and it also helps in joint reduction. Linear midline incision to open C1C2 region. The dissection carried in subperiosteal plane from mid line to laterally. C1C2 joint identified anterior to C2 ganglion. The capsule of C1C2 incised posteriorly and opened. The cartilage lining scraped, drilled by diamond bur to make the joints completely free and mobile. We had incised C2 ganglion in all except in one case. The sectioning of ganglion makes the procedure easier. The posterior joint space is properly grinded for proper fitting of implants. The appropriate size of screw, plates and spacer are selected by preoperative radiograph picture and confirmed by C-Arm images during surgery. Wound closed in layers, postoperatively patient advised to wear Philadelphia collar for 3months.

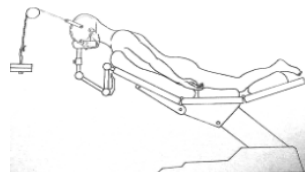


Figure 1.b: Line drawing showing the patient position. The patient is placed under cervical traction and the head end of the table is elevated

DISCUSSION:

Surgical technique for CVJ anomaly correction has evolved over the years, with advent of better imaging modality and introduction of novel techniques specially by Goel et al¹. Currently the entire focus has shifted from anterior approach with posterior fixation to direct posterior approach and C1C2 joint alignment. Chandra et al¹¹ introduced a technique to reduce Basilar invagination (BI) and AAD atlanto axial dislocation by single stage posterior approach, DCER technique in which reduction of AAD and BI was achieved by distraction and spacer placement followed by compression and extension. In this procedure spacer is used not only for distraction but also as pivot for extension to reduce AAD. In this method they deal with C1C2 joints in same way as Goel but they include occiput in fusion. In our experience Goel technique is adequate to achieve desired results. The Goel technique have made anterior transoral decompression⁵ almost obsolete and ushered a new era of surgical procedures.

Goel et al technique advocates C1C2 screw placement and opening of joint by chisel and manipulating it to place spacer or strut bone graft to achieve alignment at C1C2 joint. All the myths of CV junction instability have been addressed in Goel technique. C1C2 joints are the most mobile joint and the sole cause of instability so there is no need to address other joints. Atlanto-occipital joint is the most stable joint therefore there is no need to manipulate them. There is no narrowing of foramen magnum or any posterior fossa volume compromise so the need to enhance it is unnecessary^{4, 6,7,8,9,10}. Syrinx is a sign of C1C2 instability so once it is addressed it will resolve with time, there is no extra treatment needed for it. Earlier this pathology was classified as reducible, irreducible or congenital or acquired. Here is the figure which gives summary of classification and management fig 2. All these are obsolete as after C1C2 joints are opened and manipulated in surgery they all will get reduced and there is proper alignment of this complex anatomy. The odontoid takes its normal position, there is no need to do additional anterior decompression.

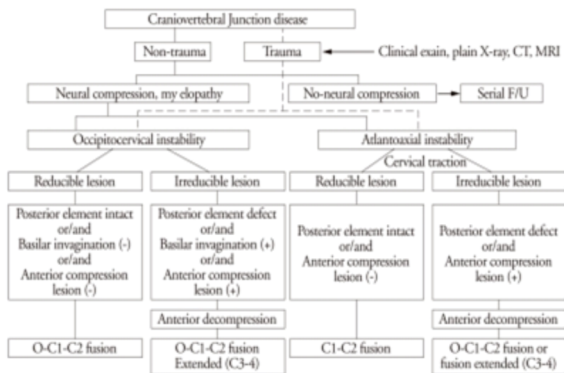


Fig. 2 : Algorithm for classification and treatment of craniocervical junction disease.

Sl no	Age	Sex	Nurick grade preoperative	Nurick grade at discharge	Nurick grade in follow up.	Cause of c1c2 instability	Complication Apart from headache and residual neurodeficit.
1	49	M	3	2	0	traumatic	C2neuralgia
2	40	M	3	3	0	traumatic	Needed one unit blood transfusion
3	42	M	2	2	0	traumatic	
4	39	F	4	Expired		traumatic	
5	35	F	3	2	0	Acme	
6	25	M	4	3	0	traumatic	
7	26	M	3	2	1	Acme	
8	28	M	4	3	1	traumatic	C2 neuralgia
9	31	F	3	2	1	Acme	
10	21	M	3	2	0	Traumatic	

Thus we see that this is a novel answer to the complex problem, though the learning curve is very arduous and risky as a slight error can lead to patient mortality. But it not invincible as with proper training and dedication one can learn to change the course of this crippling disease.

RESULTS:

Fourteen patients improved in their nurick grade. One patient died in immediate post operative period, she was completely quadriplegic and on ventilator support and was the fourth patient. Her cord was severely compromised and probably she deteriorated because of cord injury during joint manipulation. As we matured in this surgery our timing reduced from 8hours to 4 hours, blood loss reduced as well. Only one patient was transfused one unit packed cell volume. Two patients had severe post operative C2 neuralgia. Figure 3, 4,5 shows pre and post operative scan plates. All 14 had some degree of post operative neck pain and headache which gradually improved over the time. All surviving patient had better quality of life after surgery. Over the 18 month follow up no patient developed evidence of new, recurrent, or progressive instability. Here is the chart to summarize patient's details.



Fig 3 pre op MRI plate



Fig 4 pre op CT plate



Fig 5 post op CT Plate

11	28	M	3	2	0	Traumatic	
12	42	F	3	2	1	Traumatic	
13	30	F	3	3	0	C2neurofibroma	
14	25	F	3	3	0	Traumatic	
15	21	M	3	2	0	traumatic	

Acm : Arnold chiary malformation.

CONCLUSION:

No patient in our study needed any additional procedure like anterior or posterior decompression as discussed before. No long segment fusion was required, only the fusion of C1C2 is required. The Goel technique has replaced all other procedures. Thus the authors conclude that early C1C2 fusion to be recommended in all cases C1C2 instability.

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