International Journal of Research in Medical Sciences
Dasari R et al. Int J Res Med Sci. 2017 Apr;5(4):1230-1240
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20170951

Original Research Article

Case series of clinical study and surgical management of atlanto axial dislocation our institute experience

Ravi Dasari*, K. Satyavara Prasad, B. Sandeep, B. V. S. Raman

Department of Neurosurgery, Andhra Medical College, Visakhapatnam, Andhra Pradesh, India

Received: 28 January 2017
Revised: 06 February 2017
Accepted: 20 February 2017

***Correspondence:**
Dr. Ravi Dasari,
E-mail: sandy3494@gmail.com

ABSTRACT

Background: Atlantoaxial dislocation refers to a loss of stability between the atlas and axis (C1-C2), resulting in loss of normal articulation. Cervical spine C1-C2 motion segment is the most technically challenging.
Methods: This is a prospective and retrospective Study which included 34 patients admitted in King George hospital, Andhra medical college, Visakhapatnam over the past two years (January 2014- January 2016) with AAD.
Results: The age of the patients ranged from 3 to 60 years with mean age being 37.67 years. Commonest presenting sign is local tenderness at the back of upper cervical region in 91.17%. Most common procedure done was single sitting trans oral odontoid decompression with posterior occipito cervical fusion with occipital plate and C2, C4 polyaxial screws and lateral mass rods in 18 cases out of 34. The next common procedure performed was C1 lateral mass and C2 pars screw fixation 8 out of 34.
Conclusions: Trans oral odentoidectomy and posterior ocipito cervical fusion is ideal and still holds good for irreducible AAD with ventral compressive pathology.

Keywords: Atlanto axial dislocation, Cervico medullary junction, Odentoid

INTRODUCTION

Atlantoaxial dislocation refers to a loss of stability between the atlas and axis (C1-C2), resulting in loss of normal articulation. The osseous articulations and their supporting ligaments must resist forces in all axes of motion. Various pathologies like traumatic, inflammatory, idiopathic, or congenital abnormalities can destabilize this junction.[1] The first case who had subluxations of the upper cervical spine described by Sir Charles Bell in 1824.[2] Trauma and rheumatoid arthritis are most common causes but conditions can result from congenital defects tumours, infections and iatrogenic.[3] Significant atlantoaxial instability is a potentially serious progressive condition that, if untreated, may result in local pain, myelopathy, or ultimately death. Cervical spine C1-C2 motion segment is the most technically challenging. Subluxations may remain clinically silent, but in some patients with a subluxation may have bizarre neuronal manifestations.

A primary anterior decompression followed by stable posterior CVJ fixation is preferred by many authors with ventral neuronal compression. Posterior occipitocervical or atlantoaxial arthrodesis is indicated in cases of instability to reduce deformity, to provide pain relief, and to minimize the risk of potential neural damage. The benefits of internal fixation include rigid stabilization, maintenance of alignment, minimal postoperative immobilization, and enhanced fusion rates.

However, given recent advances in diagnostics and surgical techniques, our approach to the management of atlantoaxial dislocation became evidence base. With

improved visualisation and experience more and more may be amenable to surgical correction.

METHODS

All the patients who were operated for Atlantoaxial stabilization in the department of neurosurgery between January 2014- January 2016 formed the study group.

Inclusion criteria

- Patients with post traumatic atlantoaxial instability.
- Patients with atlantoaxial instability secondary to rheumatoid arthritis.
- Radiological evidence of atlanto dental interval of >3mm in adults and >5mm in children was considered mandatory for inclusion in the study.

Exclusion criteria

- Barrel chest deformity.
- Concomitant thoracic kyphosis.
- Patients not fit for surgical stabilization.
- Patients who are not on regular post-operative follow up.

The Demographic data of the patients along with detailed history of the symptoms and other morbidities were recorded. All patients underwent a detailed systemic and neurological assessment data was entered in the proforma to assess the possible etiology.

Routine haematological and biochemical parameters were assessed. Dynamic x-ray of cervical spine centring CVJ lateral neutral, flexion and extension view and anteroposterior trans-oral open mouth view, CT scan craniovertebral junction, CT angiogram of the vertebral artery for MRI C- spine with CVJ were used.

The anatomic characteristics of cervicovertebral junction, presence and extent of Atlantoaxial stability with or without neuronal compression (ventral or dorsal compression) are assessed. In case of irreducible atlanto axial dislocation, cervical skull traction is placed in neutral position with weights starting from 2.5 kg to a maximum of 10% of patient's body weight is applied maximally for one week with regular CVJ X ray to check the reducibility. In case of irreducible AAD cases with ventral compression on CVJ neuronal structures, trans oral decompression of odontoid, soft tissues are removed and in the same single sitting, posterior occipitocervical fusion is performed. Irreducible cases with dorsal compression are dealt with posterior decompression of the posterior rim of foramen magnum or posterior arch of the C1 with subsequent occipitocervical or C1, C2 fusion is performed (Figure 1). Patient's head was held in neutral position to minimise head and neck movement. Endotracheal intubation (Figure 2) was performed using video fiberoptic laryngoscopy. In all cases, autologous tricorticate iliac bone graft was used for bony fusion. All post-operative events neurological deficits, infections or metabolic dysfunctions were recorded. Patients are kept on hard cervical collar for a period of 3 months after which the bony fusion and stability are assessed radiologically in the follow up.

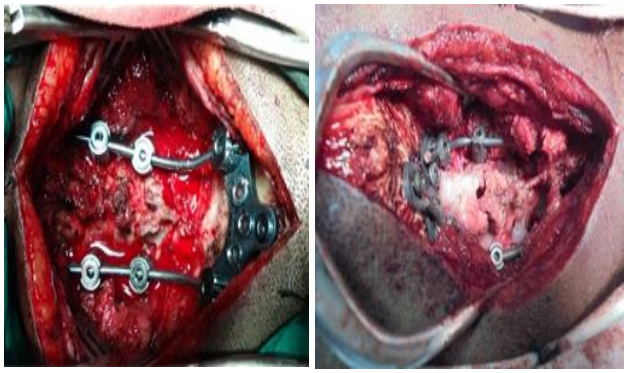

Figure 1: Posterior occiputo cervical plate and rods costruct autologous bone graft placed between occiput and C2 spinous cranial surface.

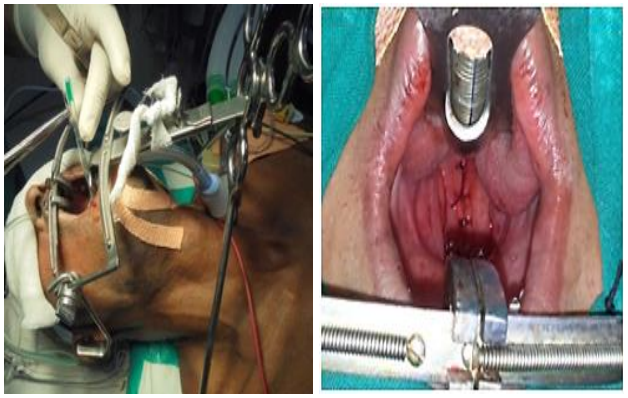

Figure 2: position of the patient for transoral procedue (left). Pharyngial mucosa in midline for incision (right).

Each patient at the time of admission and discharge was assessed by

- Nurick's classification for myelopathy on the basis of gait abnormalities.
- Frankel classification grading system in trauma cases.

The follow-up was done at 1month, 3 months, 6 months and 1 year. At each follow-up, each patient was evaluated as per the Grob et al classification and nurick's grade

Grob et al classification of outcome of surgery.

Objective rating

- Good (no pain, solid fusion).
- Fair (Moderate pain, solid fusion).

- Bad (severe pain, non-union).

Subject rating

- Good (no serious pain, no restriction of activity).
- Fair (periods of pain, working capacity reduced).
- Bad (permanent severe pain, disability).

The fusion rates were assessed from 3rd month of the follow up period.

RESULTS

In the present study period of 25 months from January 2014 to January 2016 at King George hospital, Visakhapatnam, Andhra Pradesh, India, all together 36 cases of atlantoaxial instability were surgically operated. Two cases were excluded from this study due to lack of follow up. 34 cases were analysed. The age of the patients ranged from 3 to 60 years with mean age being 37.67 years.

Table 1: Age distribution.

Range	Number	Percentage
0-10	2	05.88%
11-20	4	11.76%
21-30	7	20.58%
31-40	8	23.52%
41-50	4	11.76%
51-60	9	26.47%
Total	34	100%

Maximum number of patients were seen in age group of 31-40 followed by 21-30 years constituting 8 (23.52%) and 7 (20.58%) of patients respectively (Table 1). Majority of the patients were males (79.41%) with male to female ratio being 3.85:1 (Figure 3).

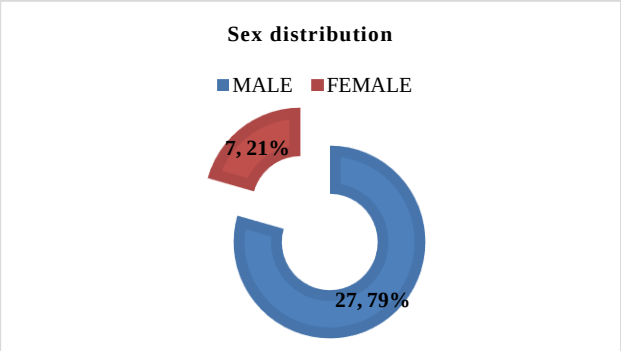

Figure 3: Sex distribution.

The median time duration between onset of the symptoms and presentation to the hospital ranged from 1 day to 3 years with median duration of 3 weeks. Neck pain and posterior occipital headache is the most common symptom at the time of admission (97%) of the cases (Figure 4). It is followed by motor weakness, restricted neck movements and the sensory deficits in the descending order of 82.35%, 61.76 % and 50% respectively. The other symptoms of vestibulobasillar insufficiency were also present in few cases.

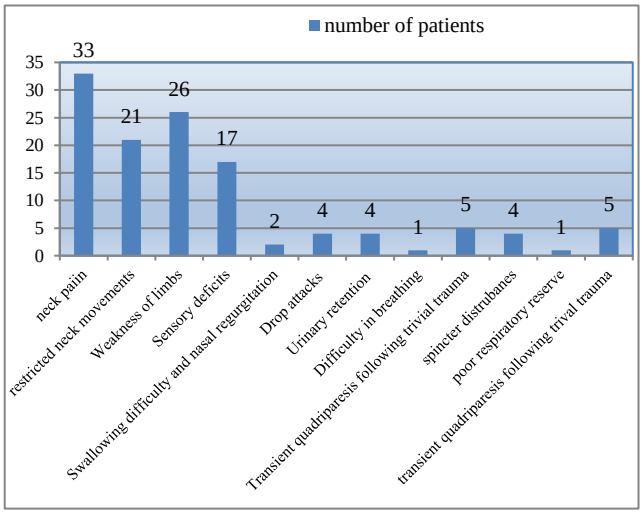

Figure 4: Presenting symptoms.

Commonest presenting sign is local tenderness at the back of upper cervical region in 91.17% followed by motor weakness either in the form of quadriparesis hemiparesis (crossed or cruciate), paraperisis, monoparesis or simply distal hand muscle weakness to about 82.35%. Then are the sensory signs either posterior column and or spinothalamic tracts in 61.76%. stigma of CVJ in the form of low set ears, low hair line, down beat nystagmus, mirror movements are seen in 8.83% (Table 2).

Table 2: Presenting signs.

Signs	No. of patients	%
Tenderness	31	91.17
Motor weakness and spasticity	28	82.35
Posterolateral sensory deficits	21	61.76
Cerebellar signs	3	8.82
Stigma of CVJ	3	8.82
Torticollis	2	5.88
Bladder incontinence	4	11.76
Lower cranial nerve palsy	2	5.88
Poor respiratory reserve	1	2.94

Traumatic atlanto axial dislocation is the leading cause for the atlanto axial instability in our case series constituting to 70.58% of cases followed by the congenital deformities (Table 3). Among 24 cases of trauma cases, mode of injury was road traffic accident (RTA) in 13 cases and 11 cases are due to fall. RTA cases had fractures in 9 (69.2%) out of 13 cases where as only 2 cases (18%) out of 11 in falls.

Table 3: Type of abnormality diagnosed.

Diagnosis	No. of patients	%
Traumatic atlantoaxial instability	24	70.58
Os odontoidium with atlanto axial instability	2	5.88
Basilar invagination with atlantoaxial instability	2	5.88
Basilar invagination with atlantoaxial instability+klippel fiels anormaly	2	5.88
klippel fiels anormaly + with atlantoaxial instability	2	5.88
Rheumatoid atlanto axial disclocation	2	5.88
Total	34	

70.8% (17/24) trauma cases had a Frankel grade of D, suggesting preserved motor function. 2 cases had grade C and 5 cases had grade E (Table 4).

Table 4: Frankel classification grading system at admission (n=24).

Grading at the time of admission	No. of patients	%
Gr. A	0	0
Gr. B	0	0
Gr. C	2	8.3
Gr. D	17	70.8
Gr. E	5	20.8

Figure 5: Klipelifiel anomaly with aad and post op ocipito cervical fusion.

The patients are classified into two classes. Reducible AAD and Irreducible AAD. 19 (55.88%) cases out of 34 were irreducible AAD and 14 (44.12%) out of 34 traumatic AAD cases are reducible and among the rest 10 cases of no traumatic etiologies, one case was reducible (klippelfiel anomaly Figure 5). The mean anterior atlanto dense interval in our case series was 8.1mm.

Most common procedure done was single sitting trans oral odontoid decompression with posterior occipito cervical fusion with occipital plate and C2 pars, C4 lateral mass screws (Figure 1 and 2) in 18 (Table 6), except one case which was done in two sittings. The next common procedure performed was C1 lateral mass and C2 pars screw fixation in 8 cases (Figure 6).

Figure 6: case of reduccible atlanto axial dislocation with dynamic lateral x-rays of cvj and neck (above left). Post-operative x-ray image of cvj–ap and lateral view (above right).

None of the cases had vertebral artery injury intraoperative. One case had encountered CSF leak from the C4/5 interlaminar space when sub laminar wiring (Figure 7) was being done in a 12-year-old boy with os odontoidium for occipitocervical fusion with contour rod. Intraoperative muscle patch was placed and dural sutured with vicry 3 along with tight fascial closure, but in 5th postoperative period, he developed CSF leak from surgical site which we had dealt with skin reinforcement suturing and lumbar CSF drain and he was discharged with improved Nurick's grade from III to II.

Figure 7: Postoperative CVJ AP and lateral view x-rays of trans oral odontoidectomy and posterior occipito cervical fusion with contour rods and sublaminar wiring.

Post operatively (Figure 8) two patients had injury to the spinal cord and roots. Both cases decreased by one level of Nurick's grade in immediate post-operative period, one patient has improved to preoperative status at 6th month follow up where as in other case died on 28th postoperative period. Two patients developed sub occipital numbness, both had c1 lateral mass and C2 pars screw fixation probably affecting C2 nerve root or ganglion intraoperatively. Four patients developed surgical site wound infection, who were treated appropriate antibiotics and regular dressings. One case developed bone deep ulcer in sub-occipital site requiring a rotation musculocutaneous flap.

Graft nonunion occurred probably due to cranial settling of occipitocervical rod secondary to infection. Redo procedure was done. Third case had trans oral wound infected and or regular oral antibiotic gurgling and nasogastric feeds, wound healed by secondary intention. Lastly, fourth case had infection at iliac bone graft harvesting site following a hematoma. It was evacuated and secondary suturing done.

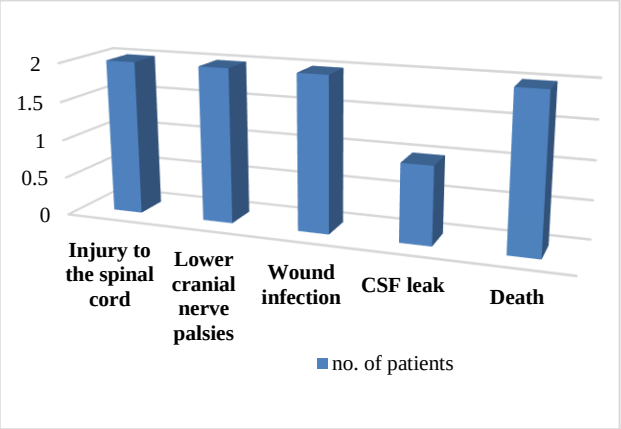

Figure 8: Postoperative complications.

Table 5: Types of procedures performed.

Procedure	Indication	No. of patients
C1 lateral mass and C2 pars screw fixation with occiputo C2 midline iliac bone graft	Traumatic reducible atlantoaxial instability	8
Odontoid lag screws	Traumatic reducible AAD	3
Trans oral odontoidectomy + occipitocervical fusion with occipital plate and C2 pars, C4 lateral mass polyaxial screws and rods with Occipito C2 iliac bone graft +/-C1 posterior arch excision	Basilar invagination (BI)	1
	BI + klippel fiel anomaly.	2
	Klippel fiel anomaly +IAAD	1
	Traumatic IAAD with ventral compression.	10
	Os odontoidium + IAAD.	2
	Rheumatoid arthritis + IAAD.	2
Occipitocervical fusion with occipital plate and C2 pars, C4 lateral mass polyaxial screws and rods with Occipito C2 iliac bone graft +/-C1 posterior arch excision	Reducible AAD	3
C1-C2 spacers with C2 pars screw and C3 lateral mass screws and rods	Basilar invagination	1

Table 6: Nurick's classification system at the time of admission (n=34).

Grade	No. of patients	Percentage
O	5	14.7
I	0	0%
II	2	5.8%
III	20	58.8%
IV	6	9.3 %
V	1	2.9%

Minimum follow up period was 1 month and maximum was 25 months. We observed improvements in myelopathy symptoms to 42.85% and 45.45% by the end of 3rd month and 6th month follow up using the Nurick score (Table 6).

Of all the 32 patients (excluding the 2 cases who encountered death in early postoperative days), bony fusion (Figure 9) has occurred in 92.42% at 3rd month follow up and 95.45% by 6th month follow up and 100% at 1 year follow up. Out of 2 cases of graft nonunion seen at 3rd month, one has fused at 6th month but the other case had a surgical site infection postoperatively had also occipitocervical rod cranial migration with subcutaneous pressure impending to breach the skin near subocciptal region. Second case we reoperated and readjusted the rods and also a new bone graft placed between the sub occiput and C2 spinous process superior surface.

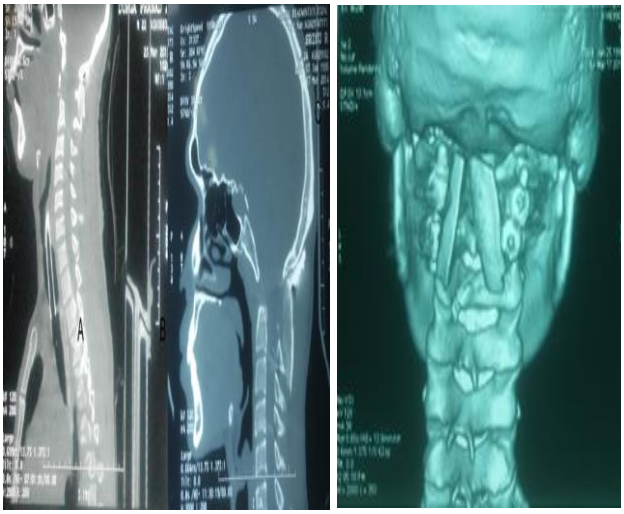

Figure 9: Bony fusion in CT scan and VR images of graft placement.

Residual pain (Table 7, Figure 10).

In each patient, the residual pain was evaluated at each follow up, as no pain (N), moderate pain (M), significant pain (S), as described by the patient

At 1 month (n=32): N-8 (25%)
S-20 (62.5%)
M-4 (1.25%)

At 3 months (n=28): N-13 (46.4%)
S-11 (39.28%)
M-3 (10.7%)

At 6 months (n=22): N-13 (59.1%)
S-8 (36.36%)
M-1 (0.16%)

At 1 year (n=10): N-10 (90%)
S-1 (10%)
M-0 (0%)

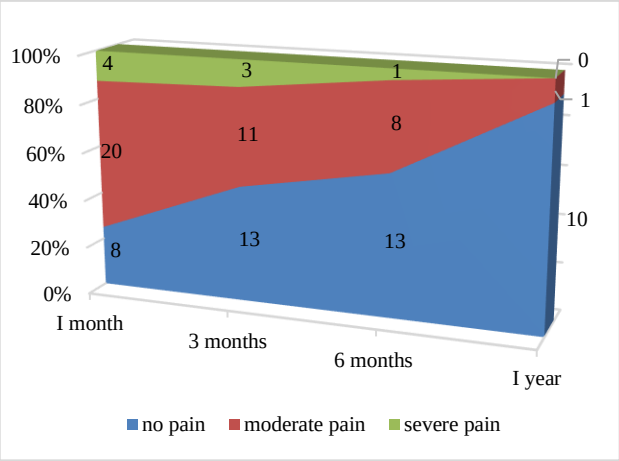

Figure 10: Pain scale.

Table 7: Surgical outcome in follow up period.

Surgical outcome	Follow up duration			
	1 month	**3 months**	**6 months**	**1 year**
Total	32	28	22	10
Pain scale				
No pain	8	13	13	9
Moderate pain	20	11	8	1
Severe pain	4	3	1	_
Nurick's grading				
No myelopathy	5	5	3	2
Improved	9 (28.12%)	12 (42.85%)	10 (45.45%)	4 (40%)
Same	16 (50%)	11 (39.28%)	9 (40.90%)	4 (40%)
Deteriorated	2 (6.25%)	_	_	_
Fusion rate	_	26 (92.42%)	21(91.45%)	10(100%)

Activity as per Grob et al classification

The results were evaluated based on subjective (residual pain, level of activity) and objective (residual pain, fusion) criteria. The subjective results (n=32) at final follow up were noted to be good in 23 (71.85%) and fair 9 (28.12%) (Figure 11). The objective results (n=32) at final follow up were noted to be good in 25 (78.12%) and fair 7 (21.87%) (Figure 12).

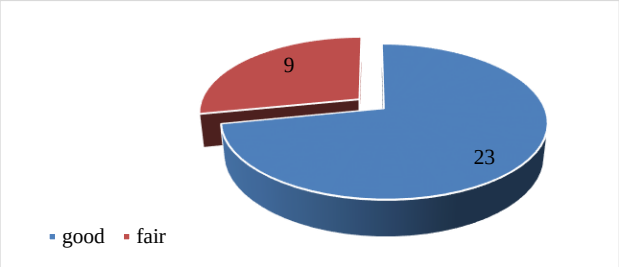

Figure 11: Subjective results.

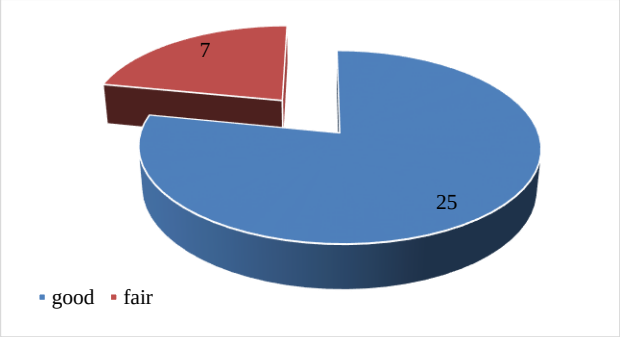

Figure 12: Objective results.

There was two mortality:

First case is an elderly lady with basilar invagination having Nurick's grade 5 with poor respiratory reserve. She underwent Trans oral odontoid decompression and posterior occipito cervical fusion intraoperative was uneventful. Post operatively she had same neurological status as before and became ventilator dependent and had tracheostomy. She developed pneumonia and expired on 28th pod. Second case was elderly male patient with basilar invagination having Nurick's grade IV. He had underwent posterior C1.C2 facet joint distraction with spacers along with occipito cervical fusion (occipital plate and C2 pars, C4 lateral mass polyaxial screws and rods) and was uneventful intraoperative. Patient was extubated with Nurick's grade same as preoperative. He had faced a fatal myocardial infarction on 4th POD being a patient on antiplatelet with previous history of angina.

Age distribution

The mean age of the patients included in the study was 37.67 years, ranging from 3 to 60 years. Bohlman studied 69 cases of the atlantoaxial joint out of 300 patients who were hospitalized for acute cervical injuries. The age of patients included ranged from birth to 88 years with mean average age of 47 years.[4] Haid RW, Subach in 75 case series of AAD, mean age of 44 years ranging 8 to 76 years.[5] Majority of patients were seen in age group of 31-40 followed by 21-30 years constituting 8 (23.52%) and 7 (20.58%) of patients respectively. Bohlman had more than half (161 patients) were 21 to 55yr old.[4]

Sex distribution

Majority of the patients 27 (79.41%) were males and the rest 7 (20.58%) were females. The male to female ratio was 3.85 :1 (Figure 4).

Clinical features

Neck pain and posterior occipital headache is the most common presenting symptom at the time of admission (97%) of the cases. It is followed by motor weakness, restricted neck movements and the sensory deficits in the descending order of 76.47%, 61.76% and 50% respectively.

Additional symptoms included subjective cervical crepitus in 13, weakness of upper extremities in 5, clumsiness in 1, progressive muscular weakness in 2, feeling of impending doom in 2, radicular pain in 8, stiff neck and limited range of in 3, severe spasms in neck in 1, paraesthesias of upper extremity in 8, transient quadriparesis in 1, weakness of lower extremity in 1, and dysphagia in 1.[6]

Xu JJ et al in 2015 studied 107 cases of atlanto axial dislocations. Motor weakness or spasticity was seen in 19 cases, Distal upper-limb wasting in 13, spinothalamic tract involvement in 47, cerebellovestibular dysfunction in 13, Vertigo in 6, sphincteric dysfunction in 6, Poor respiratory reserve in 5, transient loss of consciousness in 11, Neck pain in 73, stigmata of craniovertebral anomaly in 32, neck movement restriction in 69, torticollis in 11, transient quadriparesis after minor trauma in 43 cases.[7]

In present series 5 out of 10 congenital and rheumatic AAD cases presented with a history of acute trauma, though it's a trivial trauma. Yeom JS et al had 9 of 15 patients who presented after acute trauma with congenital atlantoaxial dislocation presented with quadriplegia.[17] He suggested that patients with a congenital yet asymptomatic unstable atlantoaxial joint may have an acute presentation after minor acute trauma. The symptoms may also present as relapsing and remitting episodes due to the motion of day-to-day life.

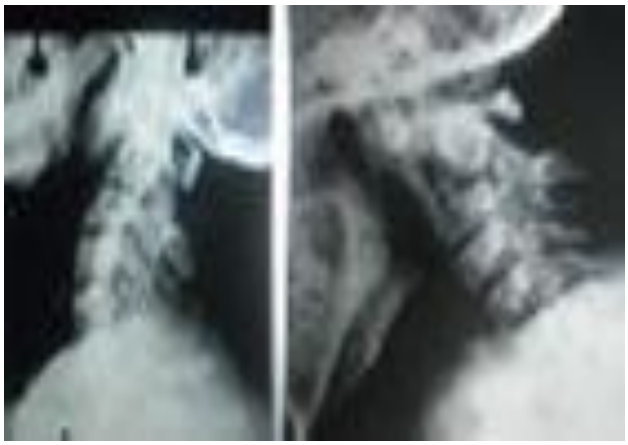

Figure 13: Dynamic X ray flexion and extension.

Dynamic x-rays (Figure 13) of neck were done in all cases to screen the atlantoaxial instability followed by MRI CVJ (Figure 14) to have a clear soft tissue pathology. CT CVJ and CT angiogram of neck vessels was also performed to see the bony element pathology and see vertebral artery anomalies. Swinkels RA and Oostendorp RA in 1996 concluded that conventional X-rays fail to give adequate information about atlantoaxial instability however CT scan and MRI scan can visualize

much more information but neither is an absolute standard. They also concluded that there is no correlation between the measure of hypermobility and the presence of clinical symptoms.[8]

Figure 14: MRI of CVJ with compression.

In present study 29 patients had anterior displacement of the atlas on the axis averaging 8.1 mm; one had posterior displacement 8.7 mm and 4 cases with no displacement. In a study by Fielding JW at the department of orthopaedic surgery, St. Luke's hospital and medical Centre New York, out of the fifty-seven patients that operated forty-two patients had anterior displacement of the atlas on the axis averaging 9.6 mm, ten had posterior displacement averaging 9.2 mm, and five had no displacement.[9] Reddy AM et al had twelve patients had anterior displacement of the atlas on the axis averaging 9.6 mm. Five had posterior displacement averaging 9.2 mm.[10]

Cause of atlantoaxial instability

The cause of the atlanto-axial instability among the patients included in the study was one of the following:

- Traumatic atlantoaxial instability: 24 (70.5 %)
- Os odontoideum: 2 (5.9 %)
- Basilar invagination: 2 (5.9 %)
- Basilar invagination with klippelfiel anomaly: 2 (5.9 %)
- klippelfiel anomaly: 2 (5.9 %)

Management

In present study, only operative cases (34) have been included excluding the conservatively managed ones during the study period. Amongst the irreducible cases we had applied skeletal cervical traction preoperatively but not under general anesthesia. 19 cases of irreducible AAD after applying Gardner Wells traction for a maximum of one tenth of patient's body weight, but none had complete reduction of the instability. Several studies report successful reduction of irreducible atlantoaxial dislocation up to 80% with traction.[11]

Most common procedure done was single sitting trans oral odontoid decompression with posterior occipito cervical fusion with occipital plate and C2, C4 polyaxial screws and lateral mass rods in 18 cases out of 34, except one case which was done in two sittings. The next common procedure performed was C1 lateral mass and C2 pars screw fixation 8 out of 34. This single stage had the advantages over two stages being one can eliminate the unstable CVJ between two stages which can lead to neurological deterioration if the external orthosis is lax at any point either in ward or during transportation to operation table. In the present series, 18 cases had Trans oral odontoid decompression done with no much complication except in a single case who had wound infection and gaping. Dickman et al reported an overall complication rate of 9.4% during trans oral surgery, even in experienced hands including cerebrospinal fluid leakage, wound dehiscence, wound infection, pneumonia, and death.[12]

In all the three cases of type II odontoid fracture operated with odontoid screw having presented early (less than a week of injury), showed fusion rate to be 100% at 6th month follow up. Apfelbaum et al reported the results of 147 patients who underwent anterior odontoid screw fixation (AOSF) for recent (≤6 months post injury, n=129) or late odontoid fractures (≥18 months post injury, n=18) with a mean follow-up duration was 18.2 months. In recent fractures, the overall union rate was 88%, compared with 25% in late injuries ($p \leq 0.05$). Bone union was independent ($p \geq 0.05$) of other factors, such as age, sex, number of screws placed (1 or 2), and the degree or the direction of odontoid displacement. They concluded that, although AOSF was effective and safe for early odontoid fractures, this technique should be reserved for early fractures. In patients who had remote injuries (≥18 months post injury), AOSF may not be the preferred procedure.[13]

C1 lateral mass and C2 pars screw fixation is the second most common procedure done in the present series. Occipitocervical fusion with contour rods and sub laminar wiring, occipitocervical fusion with polyaxial screw and occipital plate instrumentation had 100 percent fusion rate. Eshra MA et al in 2014 had evaluated the efficacy and the safety of craniocervical and upper cervical stabilization by using C2 pars/pedicle screw fixations in twenty-two cases and had concluded this techniques to be a very effective, sound, safe and easy to use surgical modality.[14] In cases of high-riding VA or medially positioned VA, Eshra has suggested usage of 16 mm pars screws are used (not reaching the pedicle) or laminar screws are employed.[14] In present study, two patients had root injury and none had vertebral artery injury. Harms and Melcher in 2001 reported 100% fusion

rates with no incidence of vertebral artery injury or dural laceration using pars screw and rod fixation. There were no instances of implant failure in their study.[15]

In the present series, we encountered one case of occipital screw loosening following surgical site infection in the post-operative period and needed a subsequent redo procedure. Occipitocervical fusion was done in 22 patients. There was 100% fusion rate at 1 year follow up. None of the patients had any complications. There was improvement in myelopathy symptoms in more than 40% cases at more than 3 months follow up. Out of 22 cases 18 cases were done subsequent to preceding trans oral decompression and 3 cases of reducible AAD and one case of basilar invagination where following a spacer of C1, C2 was done. In 21 cases, occipitocervical plates and screws were used and occipitocervical contour rod in one case.

Kalra et al has concluded that, from his study on occipitocervical fusion with contour rods, contour rod stabilization technique is still one of the most economical and versatile method especially in certain conditions like asymmetrically disposed or diseased face joints and lateral masses though it is an old fashioned and several newer fusion techniques are emerging.[16]

One case had CSF leak in 12-year child while placing contour rod and sub laminar wiring. Two cases had mortality in postoperative period, one with non-operative cause of myocardial infarction and other with poor respiratory reserve volume same as preoperative state and died due to pulmonary complications (Figure 15).

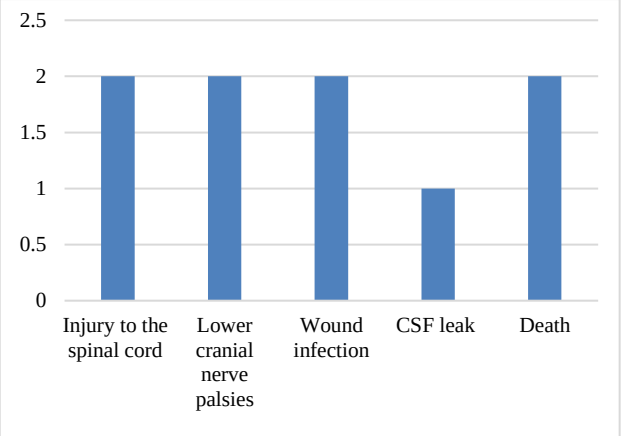

Figure 15: Postoperative complications.

DISCUSSION

The present study was conducted in the department of Neurosurgery at Andhra medical college, Visakhapatnam on patients undergoing Atlantoaxial fixation for atlantoaxial instability. A total of 34 patients with an age of ranged from 3 to 60 years were included in the study. 27 of the patients were males while 7 were females. Each patient was evaluated pre-operatively using cervical spine dynamic X-rays lateral view and open mouth view, followed by MRI and CT CVJ and CT Angiogram of neck vessels. In the post-operative period, patients were assessed clinically by Grob et al. subjective and objective criteria and radiologically. Differences in the neurological status were documented using Nurick's and Frankel grading.

Table 8: Comparative studies of post-surgical fusion.

Study	patients	Follow up (months)	Root injury	Fusion rate	Construct failures
Anderson, J spine [19]	30	17.8		100	3 cases increase kyphosis
Jeanneret et al, J spine[20]	51	12-54		100	0
Naxarian,et al, J spine[21]	23	12-24		100	-
Levine et al, J spine [22]	24	19	6 (25%)	100	6 increase kyphosis
Fehlings et al, JNS[23]	44	46		93	3 failures
Ebraheim et al, JSpDs[24]	36	17		100	1 failure
Heller et al, J spine [25]	78	24	7 (9%)	98	6 hardware, Increase kyphosis
Wellman, J spine[26]	43	23		97	1 hardware failure
Horgan et al, JNS [27]	9	9		100	0
Kalra et al, NI[16]	46	17.7		83.8	-
Bin Ni et al, ESJ [28]	13	25		100	-
Katonis et al, JSpDs[29]	225	18	5 (2.2%)	97.5	3 screw pullout
Liu et al, JSpDs [30]	37	28		100	-
Present study	34	1-24	2	95.45*	1 screw pullout

The most common presenting symptoms in the patients included is the study was neck pain and followed by motor weakness and stiffness. The duration of symptoms before the time of presentation to hospital averaged 3 months. The most common cause of atlantoaxial instability was traumatic cause (70.58% of the patients) with C2 type II fractures present in 15 (62.5%), rest had ligamentous injuries. At the first follow-up at 3 months, 46% of patients had no residual pain. At the end of 1 year, 90% patients had no pain and 10% had only moderate pain. Patients operated for single stage trans oral decompression and posterior occipitocervical fusion with titanium plates and screw constructs in 55.8 % cases followed by C1 lateral mass and C2 pars screw fixation in 23.5%.

The fusion rate was 95.45% at 6 months and 100 % at 1 year follow up. It is same As compaired to Goel A, Laheri V.[18] At follow-up, 71.85% patients had subjectively good results and 28.12% patients had subjectively fair results. When assessed as per the objective criteria, 78.12% patients had good results and fair in 21.87%. We observed improvements in myelopathy symptoms in more than 40% of cases with more than 3 months follow up in our study series. Comparison of present series with other studies in Table 8. Though technically challenging, with proper decompression and stabilization, improvement in myelopathy symptoms are achieved in nearly half of the cases with good bony fusion. We recommend single stage anterior decompression and posterior fixation than two staged procedure. Use of instrumentation of plates and screws construct is best for stabilization, in unaffordable cases, OCF with contour rods is also effective and economical. We recommend usage of posterior stabilization with occipital plate, C2 pars and C4 lateral mass construct with autologous bone graft is a very effective and sound technique with a good outcome.

CONCLUSION

The surgical stabilization techniques at cervicomedullary junction is challenging and there is no single best method for occipitocervical fusion, and the method of surgery should be based on the type of instability, the integrity of posterior cervical elements, the extension of decompression, comorbidities, individual anatomic variation, and the surgeon's learning curve and familiarity with the techniques.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Subin B, Liu JF, Marshall GJ, Huang HY, Ou JH, Xu GZ. Transoral anterior decompression and fusion of chronic irreducible atlantoaxial dislocation with spinal cord compression. Spine (Phila Pa 1976).1995;20(11):1233-40.
2. Beyazal MS, Demirok D, Çapkın E, Usul H, Tosun M, Sarı A. Grisel's syndrome: a case report. Turkish J Rheumatol. 2011;26(3):243-7.
3. Kökse T, Dilek I, Ciklatekerlioclu O, Beoük A, Acka G, Türkan H. One stage transoral odontoidectomy and posterior fixation in odontoid fracture; technical note. Turkish Neurosurgery. 1996;6:111.
4. Boden SD, Dodge LD, Bohlman HH, Rechtine GR. Rheumatoid arthritis of the cervical spine. A long-term analysis with predictors of paralysis and recovery. J Bone Joint Surg Am. 1993;75(9):1282-97.
5. Haid RW Jr, Subach BR, McLaughlin MR, Rodts GE Jr, Wahlig JB Jr. C1-C2 transarticular screw fixation for atlantoaxial instability: a 6-year experience. Neurosurgery. 2001;49(1):65-8.
6. Clark CR, Goetz DD, Menezes AH: Arthrodesis of the cervical spine in rheumatoid arthritis. J Bone Joint Surg Am. 1989;71:381-92.
7. Xu JJ, Yin QS, Xia H, Wu Z, Ma XY, Zhang K, et al. New clinical classification system for atlantoaxial dislocation. Orthopedics. 2013;36(1):95-100.
8. Swinkels RA, Oostendop RA. Upper cervical instability: fact or fiction? J Manipulative Physio Ther.1996;19(3):185-94.
9. Fielding JW, Hawkins RJ. Atlanto-axial rotatory fixation. (Fixed rotatory subluxation of the atlanto-axial joint). J Bone Joint Surg Am. 1977;59(1):37-44.
10. Reddy AM, Faisal GM, Jyothi SM. A study of indications and assessment of fusion rates for atlantoaxial subluxation. Int Surg J. (2016);3(1):211-6.
11. Tuite GF, Veres R, Crockard HA, Sell D. Pediatric transoral surgery: indications, complications, and long-term outcome. J Neurosurg. 1996;84(4):573-83.
12. Dickman CA, Locantro J, Fessler RG. The influence of transoral odontoid resection on stability of the craniovertebral junction. J Neurosurg. 1992;77(4):525-30.
13. Apfelbaum RI, Lonser RR, Veres R, Casey A. Direct anterior screw fixation for recent and remote odontoid fractures. J Neurosurg. 2000;93(2):227-36.
14. Eshra MA. C2 Pars/Pedicle screws in management of craniocervical and upper cervical instability. Asian Spine J. 2014;8(2):156-60.
15. Harms J, Melcher RP. Posterior C1-C2 fusion with polyaxial screw and rod fixation. Spine (Phila Pa 1976). 2001;26(22):2467-71. 109.
16. Kalra SK, Jain VK, Jaiswal AK, Behari S. Occipitocervical contoured rod sta: bilization: does it still have a role admist the modern stabilization techniques? Neurol India. 2007;55(4):363-8.
17. Yeom JS, Buchowski JM, Kim HJ, Chang BS, Lee CK, Riew KD. Risk of vertebral artery injury: comparison between C1-C2 transarticular and C2 pedicle screws. Spine J. 2013;13(7):775-85.
18. Goel A, Desai K, Mazumdar D. Atlantoaxial fixation using plate and screw method: a report of 160 treated patients. Neurosurg. 2002;51:1351-6.
19. Anderson PA, Henley MB, Grady MS, Montesano PX, Winn HR. Posterior cervical arthrodesis with AO reconstruction plates and bone graft. Spine. 1991;16:S72-9.

20. Jeanneret B, Magerl F, Ward EH, Ward JC. Posterior stabilization of the cervical spine with hook plates. Spine. 1991;16:S56-63.
21. Nazarian SM, Louis RP. Posterior internal fixation with screw plates in traumatic lesions of the cervical spine. Spine. 1991;16:S64-71.
22. Levine AM, Mazel C, Roy-Camille R. Management of fracture separations of the articular mass using posterior cervical plating. Spine 1992;17:S447-54.
23. Fehlings MG, Cooper PR, Errico TJ. Posterior plates in the management of cervical instability: long-term results in 44 patients. J Neurosurg. 1994;81:341-9.
24. Ebraheim NA, Rupp RE, Savolaine ER, Brown JA. Posterior plating of the cervical spine. J Spinal Disorders. 1995;8:111-5.
25. Heller JG, Silcox DH III, Sutterlin CE III. Complications of posterior cervical plating. Spine. 1995;20:2442-8.
26. Wellman BJ, Follett KA, Traynelis VC. Complications of posterior articular mass plate fixation of the subaxial cervical spine in 43 consecutive patients. Spine. 1998;23:193-200.
27. Horgan MA, Kellogg JX, Chesnut RM. Posterior cervical arthrodesis and stabilization: an early report using a novel lateral mass screw and rod technique. Neurosurgery. 1999;44:1267-71; discussion 71-2.
28. Ni B, Zhu Z, Zhou F. Bilateral C1 laminar hooks combined with C2 pedicle screws fixation for treatment of C1-C2 instability not suitable for placement of transarticular screws. European Spine J. 2010;19(8):1378-82.
29. Katonis P, Papadakis SA, Galanakos S. Lateral mass screw complications: analysis of 1662 screws. J Spinal Disorders Tech. 2011;24:415-20.
30. Liu H, Ploumis A, Schwender JD, Garvey TA. Posterior cervical lateral mass screw fixation and fusion to treat pseudarthrosis of anterior cervical fusion. J Spinal Disorders Tech. 2012;25:138-41.

Cite this article as: Dasari R, Prasad KS, Sandeep B, Raman BVS. Case series of clinical study and surgical management of atlanto axial dislocation our institute experience. Int J Res Med Sci 2017;5:1230-40.