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Original Article

Surgery of atlantoaxial dislocation by Posterior Decompression Fusion & Fixation at Lateral Mass Screw of C1 & Pedicle Screw & Rod by C2: A Study of 30 Cases

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Abstract:

Background: *Atlantoaxial dislocation (AAD) is a potentially fatal disturbance to the normal occipital-cervical anatomy that affects some populations disproportionately, which may cause permanent neurologic deficits or sagittal deformity if not treated in a timely and appropriate manner.*

Methods: *This was a cross sectional study, which was carried out at the Department of Neurosurgery, Bangabandhu Sheikh Mujib Medical University from July 2010 to June 2017. We have studied 30 patients of atlantoaxial subluxation. After collecting patient admission data a brief history and clinical examinations were done. We have conducted a retrospective analysis of the outcomes of 30 consecutive spinal surgeries performed for AAS patients, by posterior decompression, fusion & fixation at lateral mass screw of C1 & pedicle screw & rod by C2 in all cases. We have compared our findings with a previous study. We also examined the factors related to poor outcomes.*

Result: *From a surgical method perspective, the patients underwent post decompression, fusion & fixation at lateral mass screw of C1 & pedicle screw & rod by C2. After surgery, closed follow up was done. The highest age group was 21-40 years 40%. Most of the sufferer were male 80%. The commonest cause was road traffic accident 26.66%. The commonest clinical finding was quadriparesis 14(46.67%). The majority of the patients 24(80%) improved after surgery. In our present study after surgery neurological improvement rate is 83.33%, the rate of SSI was indeed high 10.00%, total death rate was 3.33%, the hardware failure rate was 3.33% and the reoperation rate reached 6.66%.*

Conclusion: *The results of this study showed that the C1/2 fixation technique exhibited effectiveness in terms of neurological recovery.*

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Introduction:

Atlantoaxial dislocation refers to a loss of stability between the atlas and axis (C1–C2), resulting in loss of normal articulation. The atlantoaxial joints can lose stable articulation from traumatic, inflammatory, idiopathic, or congenital abnormalities.[1] The mechanism of injury typically remains unidentified with several theories proposed in the literature.[2] Although it occurs in all age groups, atlantoaxial dislocation is most often seen in adolescents.

Atlantoaxial dislocations have been previously studied extensively and reported in the literature with subsequent treatment recommendations published using older, less relevant classification systems. The

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atlantoaxial joint allows complex movements of the cervical spine while providing sufficient mechanical strength to stabilize the head. About 50% of total cervical spine flexion and extension occurs at the occiput–C1 articulation.[2]

Flexibility is provided by the dens (odontoid process) of C2 (the axis), which articulates with the C1 (atlas) and transverse ligaments, accounting for over 50% of all cervical spine rotation.[2] To provide this flexibility, the synovial joints at these segments do not have the same osseous and intervertebral disk-related stability mechanisms as the rest of the spinal column, relying more on ligamentous stabilizers.[3]

The region is unique in that the occiput–C1 articulation and the C1–C2 articulation are the only vertebral segments without intervertebral disks, and the vertebral bodies do not directly bear the load distribution from the occiput. The occipital condyles transfer the load at the articulation with the C1 lateral masses, which transfers the load onto the C2 lateral masses.[2]

Atlantoaxial dislocation can be broadly categorized into separate traumatic, congenital, or inflammatory etiologies, although the cause is commonly multifactorial. A purely traumatic atlantoaxial dislocation in the absence of another predisposing risk factor is extremely rare.[1] A literature review by Venkatesan et al in 2012 found only 12 adult case reports.

Traumatic atlantoaxial dislocation is due to forced displacement of the neck resulting in disruption of the transverse ligament.[4] Certain congenital conditions are associated with craniocervical region abnormalities that predispose these populations to developing atlantoaxial dislocation.

One particularly well-studied condition is Down syndrome. Down syndrome (trisomy 21) is the most common inherited chromosomal disorder. Predisposing sequela include hypermobility and instability caused by ligamentous laxity and osseous abnormalities,[1] resulting in an increased incidence of atlantoaxial dislocation (15 to 20%). Another notable population that is disproportionately affected by atlantoaxial dislocation is chronic rheumatoid arthritis patients, particularly adults.

The atlantoaxial joint is frequently affected in rheumatoid arthritis with studies showing incidence rates ranging from 23 to 86% of patients with rheumatoid arthritis. The presentation of atlantoaxial dislocation may range from minor axial neck pain to death. Approximately 50% of patients present with neck pain and/or neck movement restriction, 70% with weakness and/or numbness, and 90% with pyramidal signs.[7]

Other preoperative clinical presentations include sphincter disturbances, lower cranial nerve dysfunction, and respiratory distress. Other serious sequelae include myelopathy, respiratory failure, vertebral artery dissection, neurologic compromise, and rarely quadriplegia or death if left untreated.[8,9] The differential diagnosis of atlantoaxial dislocation includes torticollis, atlantoaxial rotary fixation, and odontoid fractures without atlantoaxial dislocation. There are several different approaches to diagnosing atlantoaxial dislocation; however, no consensus exists.

Atlantoaxial dislocation can be defined with radiographic measurements of atlantoaxial joint articulation using the atlantodental interval (ADI). The ADI is a small slit like space between the posterior aspect of the anterior atlas ring and the anterior aspect of the odontoid process. Flexion and extension radiographs of the neck allow for the measurement of the ADI and to determine whether the atlantoaxial joint reduces itself in these positions.

Objectives:

Atlantoaxial dislocation (AAD) is a potentially fatal disturbance to the normal occipital-cervical anatomy that affects some populations disproportionately, which may cause permanent neurologic deficits or sagittal deformity if not treated in a timely and appropriate manner. The objective of this review is to provide a comprehensive review of the literature to identify timely and effective diagnostic techniques and treatment modalities of AAD.

Result:

Table-I

Distribution of patients by age (n=30)

Age in years	Number	Percentage
1-20	6	20.0
21-40	12	40.0
41-60	8	26.6
>60	4	13.33

Table I shows the highest age groups were 21-40 years (40%)

Table-II

Sex distribution of patients (n=30)

Age in years	Number	Percentage
Male	18	60.0
Female	12	40.0

Table II shows among the patients 18(60%) were male and 12(40%) were female.

Table-III

Distribution of patients by occupation (n=30)

Occupation	Number	Percentage
Day laborer	15	50.0
Service holder	2	6.66
Farmer	8	26.66
Professional	1	3.33
House wife	2	6.66
Others	2	6.66

Table III shows the commonest occupational group was day laborer

Table-IV

Distribution of patients by causes of spinal cord compression (n=30)

Cause	Number	Percentage
Road traffic accident	8	26.66
Fall from height	6	20.0
Fall of heavy object on the neck	4	13.33
Rheumatic arthritis	3	10.00
Akkylosis spoondylithis	2	6.66
Chiari malformation	3	10.00
Occipitalization	2	6.66
Infection	2	6.66

Table-V

Distribution of patients by type of clinical significant (n=30)

Clinical features	Number	Percentage
Hempiaresis	6	20.00
Lower cranial palsy	4	13.33
Quadriparesis	15	50.00
Quadriplegia	5	16.6

Table shows that the most of the suffers had quadriparesis (50%).

Table-VI

Distribution of patients by outcome after surgery

Outcome of patients after surgery	Number	Percentage
Partially improved	10	33.33
Completely cured	15	50.0
Same as before (no improvement)	4	13.33
Died	1	3.33
Re Operation	02	6.66

Table VI shows 83.33% of the patients either cured or improved after surgery.

Table-VII

Distribution of the patients by complication after surgery (n=30)

Complication	Number	Percentage
SSI	3	10.00
Screw and rod dislocation	1	3.33
Died	1	3.33

Table shows 10% of patients had wound infection and 3.33% of patients had screw and plate dislocation.

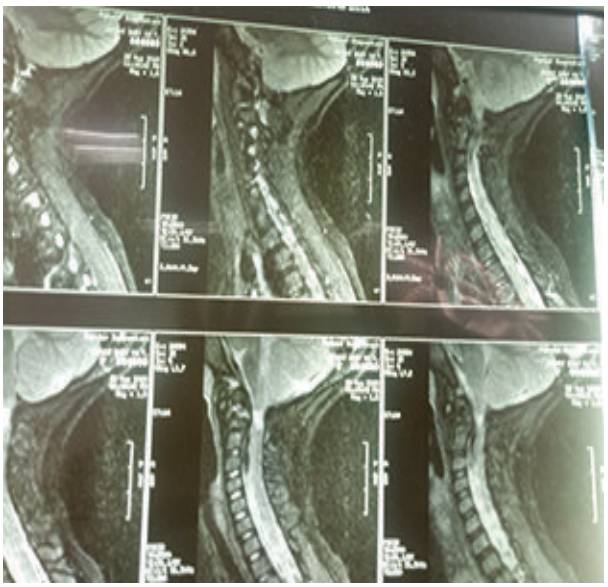

Fig.-1: *MRI of cervical spine showed atlantoaxial dislocation with cord compression*

Fig.-2: *CT scan upper cervical spine showed fracture odontoid tip*

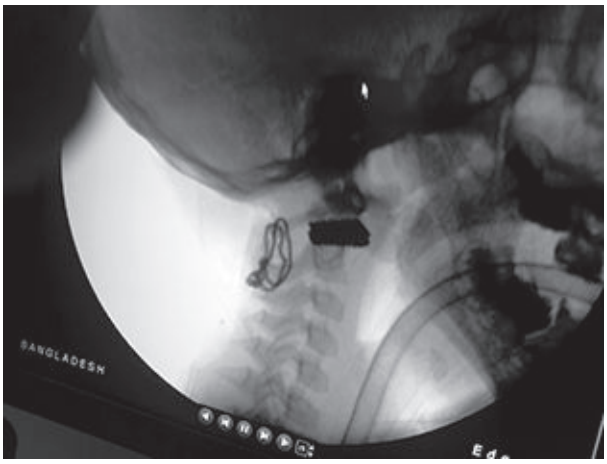

Fig.-3: *Showed posterior fusion & fixation by wiring, case & autologous bone*

Fig.-4: *Postoperative patients*

Fig.-5: *Postoperative after fixation*

Fig.-6: *Postoperative patients*

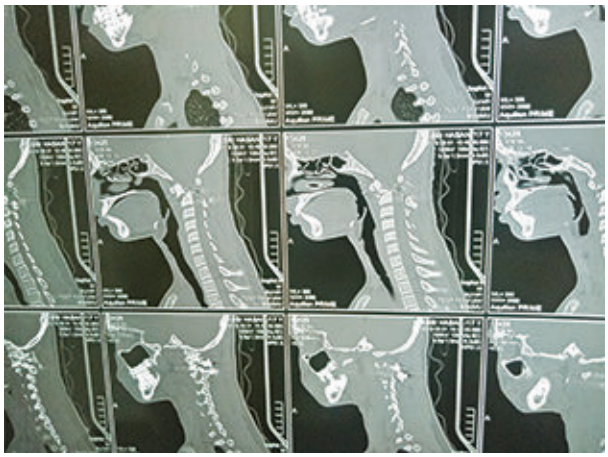

Fig.-7: *CT scan of cervical spine with OS odontoidium*

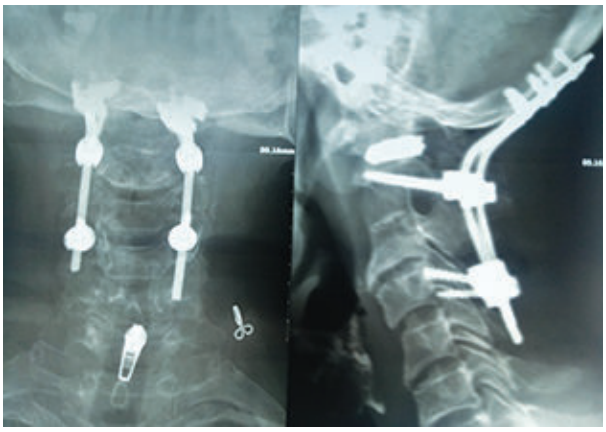

Fig.-8: *Postoperative x-ray after occipito cervical fixation*

Fig.-9: *Postoperative patient*

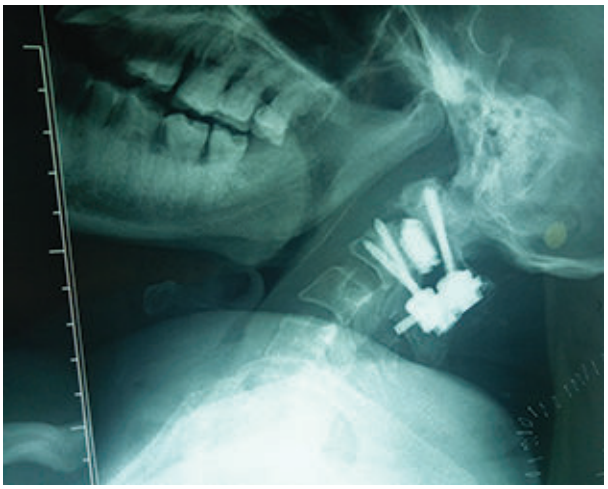

Fig.-10: *Postoperative x-ray after fixation*

Fig.-11: *Pre-operative x-ray with atlantoaxial dislocation*

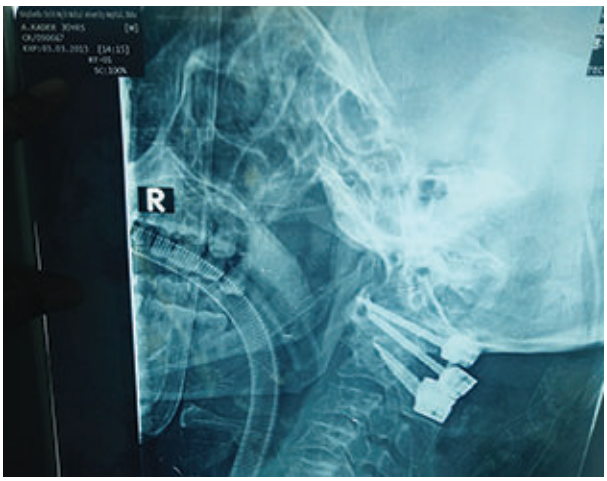

Fig.-12: *Per-operative x-ray after fixation*

Discussion:

The invasion to upper cervical lesions itself may contribute to this kyphotic alignment change because the semispinalis cervical muscle needs to be partially removed during surgery. In Atlanto axial sublaxtion surgery, great care should be taken regarding the C1/2 angle and the invasion of the muscles attached to C2. In addition, postoperative therapy to prevent kyphotic changes is considered important.

In patients who received C1/2 fixation, higher preoperative ADI and good reduction of ADI were related to good surgical outcomes in high-ADI patients, anterior subluxation of C1, and instability at C1/2 are

considered the main factors for neurological problems. Thus, a good reduction of the ADI is directly associated with decompression of the spinal cord and neurological recovery. However, in patients with a small ADI, other pathogens, such as periodontoid synovitis, may also cause the neurological impairment and thus the neurological recovery may not be as good as that in patients with a high preoperative ADI.

Spinal surgery in Atlanto axial sublaxtion patients has been considered challenging because most patients are elderly and have multiple medical problems.

A high incidence of surgical site infections is also an issue in spinal operations for Atlanto axial sublaxtion patients. The Atlanto axial sublaxtion patients in this study included a large number of patients who had a high risk of developing SSI, including patients with diabetes mellitus and collagen diseases such as RA and patients taking other immunosuppressants. In addition, risk for skin contamination is high in the upper cervical region.[18]

In this study, the rate of SSI was indeed high (10.00%). In a previous study SSI rate was 6.66%[10]. These results indicate that patients with Atlanto axial sublaxtion need a more careful risk assessment and risk management, especially those who undergo fixation surgery.

In present study after surgery neurological improvement rate is 83.33%. But in a previous series following C1/2 fixation was 72.00%.[10]

In our series total death rate was 3.33%. It was due to instrument failure. But in a previous history death rate was 00. [10]

The hardware failure rate was 1 (3.33%) in the Atlanto axial sublaxtion patients in our series. In a previous series there was no instrument failure. [10]

The reoperation rate reached 2 (6.66%) in the Atlanto axial sublaxtion patients in our series. One for hematoma & another one for instrument failure. In a previous series re-operation rate was the same. [10]

Conclusion:

In our case series of surgically treated Atlanto axial sublaxtion, the C1/2 fixation technique exhibited effectiveness in terms of neurological recovery. For patients with high preoperative ADI, C1/2 fixation with reduction is generally recommended.

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