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Case Series

Adult Atlantoaxial Subluxation in Post COVID-19 Recovery: A Case Series

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Abstract

Background: Non-traumatic atlantoaxial subluxation in adults is a rare condition usually common in patients with rheumatoid arthritis, and infection of the upper respiratory tract is also considered to be a trigger of inflammation and laxity of ligaments and further subluxation. to date there have been some reported cases of atlantoaxial as complication of COVID-19. Diagnosis and management of atlantoaxial subluxation is currently based on x-ray with special views. Therefore, it is important to early diagnosis and treating adult patients suffering from neck pain and stiffness as a suspected case of nontraumatic atlantoaxial subluxation.

Case Reports: In this case series, we reported 17 healthy elderly patients (11 male and 6 female) who had atlantoaxial subluxation after a mild (8 patients 4 male and 4 female) and 9 moderate cases (6 males with 3 females) of COVID-19. The patients had neck pain (pain score ranged 6 to9 wit mean 7,5), occipital headache (7 patient with severe and moderate occipital headache with only 3 with mild), and stiffness with different levels of limitation of cervical movements after recovering from Covid-19 in varying periods between 3 and 7 months. Conservative treatment included antibiotics; non-steroid anti-inflammatory agents, short course of corticosteroids, and immobilization with soft cervical collar followed by physiotherapy after pain subsided was done for the patients, and the clinical recovery observed within 8-10 weeks with good results in 10 patients with relieving pain and restoring the cervical motion to the normal, and 7 patients with acceptable result of treatment with slight limitation of cervical movements.

Conclusion: As atlantoaxial subluxation in adult patients may be a late complication of COVID-19, more research is needed to determine the specific association between COVID-19 and atlantoaxial subluxation in adults.

***Keywords:** COVID-19; subluxation; atlantoaxial; neck pain; adult.*

Introduction

The most mobile joint in the body is atlantoaxial joint, allowing stability and mobility of the cervical spine. This joint is made up of several different structural elements that work together to provide stability, including ligaments and synovial joints. These synovial joints include the medial joint and the two atlantoaxial lateral joints. The medial joint consists of the dentate point of the C1 vertebra and two specific ligaments: the bony annulus of the atlas and the transverse ligament. The two lateral atlantoaxial joints, called sliding joints, are located on either side of the uppermost region of the cervical spine, specifically in the atlas (C1) and axis (C2). In the adults, the most common cause of non-traumatic atlantoaxial subluxation is rheumatoid arthritis.[1] However, numerous instances of upper respiratory infection have been documented that lead to the atlantoaxial joint to be displaced. [2;3]. The earliest theorists hypothesized that the acute inflammation of the pharyngeal region extends to the parapharyngeal space and then to the transverse ligament of the atlas, and the inflammation weakens the transverse ligament, causing subluxation. In the second, the infection spread to the atlantoaxial region shared via a hematogenous route [4;5].

Like many other upper respiratory infections (URIs), infection with SARS-CoV-2, the virus that causes COVID-19 disease, can manifest with a variety of symptoms, including fevers, chills, arthralgia, myalgia, cough, nasal congestion, abdominal pain, nausea, and vomiting [6]. The pathophysiology of COVID-19 appears to be like other known infectious causes of atlantoaxial subluxation, further supporting the idea that COVID-19 may be a possible trigger for this condition. However, a significant number of patients have persistent symptoms after resolution of the acute phase of the infection. Despite the association of COVID-19 with severe inflammation and a pathway that leads to the bloodstream, some of research of atlantoaxial subluxation due to COVID-19 have been documented.[7] In this case series, we reported 17 healthy elderly patients who had atlantoaxial subluxation in a period of 3 to 7 months after a mild and moderate case of COVID-19. The patients improved after initial conservative therapy.

Method

The center selected and enrolled a total of 17 patients who exhibited symptoms of neck pain, varying degrees of restricted movement in the cervical spine, and occipital headaches. Each patient's symptomatology was thoroughly documented and analyzed using the Statistical Package for Social Sciences (SPSS) version 24.0. The exclusion criteria encompassed patients with a history of prior cervical trauma, surgical intervention, as well as congenital and autoimmune disorders.

Case Reports

There are 11 males and 6 females in total of 17 patients with age range ages ranged from 46 and 69 years old. All patients had mild 8 patients (4 female and 4 male); and moderate 9 (6male with 3 female) infections of COVID-19 and treated by isolation at home without hospitalization and needs of oxygen, showed symptoms of neck pain, occipital headache (3 with mild headache all female; 7 moderate: 5 ale and 2 female: and 6 patients with severe 5 male and 1 female), and limitation of cervical movements after recovering from Covid-19 in varying periods between 3 and 7 months with mean 4,8 months. 8 of the patients have an arterial hypertension (6 male and 2 female), and five of them have type 2 diabetic mellitus (3 male and 2 female) with 2 males have both arterial hypertension and diabetic mellitus, all patients under regular treatment. [Table 1]

Table 1: Summary of patient data and result of treatment.

S. no	Age	Sex	Start of Symptoms after recovery from COVID-19 (months)	Severity of COVID-19	Neck Pain Score	Occipital Headache	Chronic Disease	Lab. Studies before Treatment						Treatment	
								W.B.C	Hb	R.F.	C.R.P.	E.S.R.	Anti CCP Abs	Duration (weeks)	Follow up after 1 year
1	62	M	5	Mild	7	Moderate	D.M. + A.H	6.5	12.5	Negative	Negative	13	<0-5U/ml	7	Good
2	66	M	6	Mild	7	Moderate	A.H	5.3	11.7	Negative	Negative	14	<0-5U/ml	8	Good
3	69	M	3	Moderate	9	Severe	A.H.	8.3	10.7	8	6	19	<0-5U/ml	13	Acceptable
4	57	F	3	Moderate	8	Moderate	A.H.	6.3	11.6	Negative	Negative	17	<0-5U/ml	11	Acceptable
5	53	F	6	Mild	7	Moderate	-	7.2	11.2	Negative	Negative	20	<0-5U/ml	9	Good
6	56	F	7	Mild	6	Mild	A.H.	5.7	10.3	Negative	Negative	11	<0-5U/ml	8	Good
7	63	M	4	Moderate	8	Moderate	A.H.	4.9	13.2	Negative	Negative	13	<0-5U/ml	11	Acceptable
8	61	M	3	Moderate	9	Severe	D.M.	7.2	10.1	8	6	16	<0-5U/ml	12	Acceptable
9	59	M	6	Mild	7	Moderate		6.6	13.1	Negative	Negative	19	<0-5U/ml	9	Good
10	46	F	4	Moderate	8	Severe	D.M.	5.7	12.8	Negative	Negative	21	<0-5U/ml	10	Good
11	65	M	4	Moderate	8	Severe	D.M.+A.H.	6.8	10.6	Negative	Negative	16	<0-5U/ml	11	Acceptable
12	51	F	6	Mild	6	Mild	-	7.2	10.4	Negative	Negative	18	<0-5U/ml	6	Good
13	53	M	7	Mild	8	Severe	-	6.1	11.2	Negative	Negative	17	<0-5U/ml	10	Good
14	57	M	3	Moderate	9	Severe	A.H.	7.1	13.5	8	6	20	<0-5U/ml	12	Acceptable
15	58	F	3	Moderate	8	severe	D.M	6.3	10.8	Negative	Negative	19	<0-5U/ml	11	Acceptable
16	49	F	6	Mild	6	Mild	-	5.9	9.6	Negative	Negative	11	<0-5U/ml	6	Good
17	52	M	7	Moderate	7	Moderate	-	6.2	12.3	Negative	Negative	15	<0-5U/ml	8	Good
								Normal value							
								4.0-10.5× 10-3/mL	14-18 g/dL	<14 IU/ml	<10 mg/L	0-22 mm/h	0-5 U/ml		

All patients had an MRI, but it was taken for the cervical vertebrae without focusing on the C1-C2, so the x-rays were adopted in special views: anterior-posterior cervical radiography with open mouth demonstrates rotation of the atlas on the axis (asymmetry of the articular spaces between the dens and the lateral masses of C1 on the body of C2) , [Figure 2;3] lateral dynamic views to exclude any anterior or posterior displacement of atlas, and the distance between the turn and niches was inside regular characteristics for age (ADI<3-4 mm).

Conservative treatment includes oral antibiotics for 7-10 days; non-steroid anti-inflammatory agents, short course of corticosteroids (prednisolone)and antibiotic, and immobilization with soft cervical collar followed by physiotherapy after pain subsided (more than50% at initial pain score) was done for the patients, and the clinical recovery observed within 6-13 weeks mean is 9.5; The short treatment period of 6-8 weeks is associated with a low pain score and a late onset period of symptoms, while the long treatment period is in patients with high pain score with an early onset of symptoms, and this also indicates the final treatment result. Good results in terms of relieving pain and restoring the cervical motion to the normal. This is observed in 10 patients whose treatment period extended from 6 to 10 weeks, while the result of treatment was acceptable in 7 patients (with 2-4 pain score remained with a slight limitation of lateral rotation and extension), this is also related to the early appearance of symptoms, with a high pain score before starting the treatment program and is also related to the severity of the occipital headache. [Figures 4;5;6]

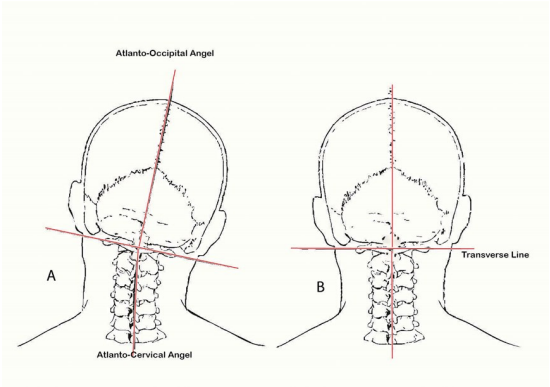

Figure 1: *A Schematic illustration of a case of atlantoaxial subluxation with changes in the atlanto-occipital and atlanto-cervical angels relative to the transverse line of the skull base B normal patient.*

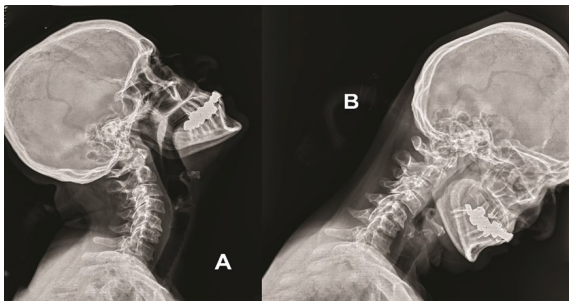

Figure 3*: Lateral Dynamic X-ray in extension A and flexion B flexion showing no anterior/posterior subluxation of the C1.*

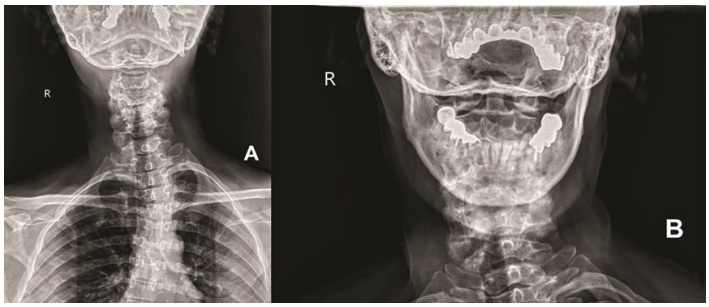

Figure 2*: A-AP view of cervical spine show deviation to right side due to muscles spasm with atlantoaxial subluxation. B-anterior-posterior open mouth view show atlas rotation to the right relative to the dens, consistent with a Type 1 anterior/ posterior subluxation.*

Discussions

In this case series, the patients had considerable neck pain, occipital headache, and stiffness with different levels of limitation of movements after recent cases of COVID-19, succeeding cervical X-rays confirmed the diagnosis of rotatory atlantoaxial subluxation. The intact patients presented with a previously unreported cause of atlantoaxial subluxation and very difficult to definitively attribute COVID-19 as the cause of atlantoaxial subluxation because there are other known causes that must first be ruled out. The primary differential diagnosis for causes of atlantoaxial subluxation in adults includes traumatic, infectious, inflammatory, and congenital causes [8].

***Figure 4**: **(A)** Image of the patient (No 17 in Table 1) before treatment, showing the head's right-sided deviation with torticollis. **(B)** Images of the same patient after treatment, showing normalization of head tilt.*

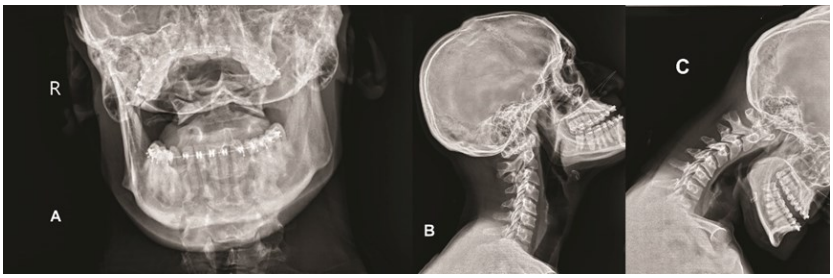

***Figure 5**: **A** Open-mouth X-ray before treatment shows atlas rotation to the right relative to the dens, consistent with a Type 1 anterior/posterior subluxation. **B** Lateral X-ray before treatment in extension showing no anterior/posterior subluxation of the C1. **C** Lateral X-ray before treatment in flexion showing no anterior/posterior subluxation of the C1. Same patient in figure 3.*

***Figure 6**: A Open-mouth X-ray of the same patient in figures 3 and 4 after treatment shows significant improvement in atlas rotation relative to the dens. B Lateral X-ray of the patient after treatment in flexion and C in extension showing no anterior/ posterior subluxation of the C1.*

These patients did not have an attributable history of neck trauma or congenital disease to implicate as the cause of his atlantoaxial subluxation. An inflammatory condition, such as rheumatoid arthritis, is also an improbable etiology, as the patients did not have peripheral joint symptoms or elevated serum markers. Many bacterial and viral upper respiratory tract infections have been identified as triggers for atlantoaxial subluxation, either through a contiguous inflammatory process or by hematogenous spread [9]. However, there have been some documented cases describing COVID-19 as a possible source of atlantoaxial subluxation. [7;10;11] In theory, COVID-19 may be a possible trigger since its pathophysiology is similar to other known infectious causes of atlantoaxial subluxation. Unless there is evidence of neurovascular compromise, severe cervical instability, or unremitting pain, atlantoaxial sub-luxation is treated non-surgically [5]. In our cases, the 15 patients had a Type 1 Fielding and Hawkins subluxation only two have subluxation type 2 and all of them without neurovascular symptoms. [12.13] A subsequent trial of conservative therapy improves their symptoms. Conservative treatment including rest, a cervical collar, analgesics, anti-inflammatory medications, short course of corticosteroids [14;15]. Barcelos et al. has recommended the use of a soft cervical collar moulded to the height of the neck at acute phase due to cervical posture which prevents the use of a rigid cervical collar. [16-18] Early management- consisting of cervical immobilization, medical treatment, and physiotherapy- was considered satisfactory till recently. [19;20] Inappropriately handled cases may result in a fixed and painful neck deformity that may even require surgical intervention. [21]

Conclusion

As we continue to learn more about the long-term effects of COVID-19, it is crucial to explore the incidence and factors associated with atlantoaxial subluxation among adults in post-COVID-19 recovery, to better understand the potential complications and provide appropriate management for these individuals. Further research is needed to confirm and elucidate the relationship between COVID-19 and atlantoaxial subluxation, as well as to identify any additional risk factors or mechanisms involved in the development of this condition.

Conflict of Interest

The authors declare no conflict of interest.

Acknowledgement

None

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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